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Birds of Prey by Alphabetical Order

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[Red-tailed Hawk - Western light](#)

[Red-tailed Hawk - Western rufous](#)

[Roadside Hawk](#)

[Rough-legged Hawk](#)

[Rough-legged Hawk dark](#)

[Rough-legged Hawk light](#)

[Sharp-shinned Hawk](#)

[Short-tailed Hawk](#)

[Short-tailed Hawk - dark](#)

[Short-tailed Hawk - light](#)

[Snail Kite](#)

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Black Vulture

Coragyps atratus

GENERAL DESCRIPTION

The Black Vulture, primarily a southern species in North America, is a large, dark raptor, that is widely distributed throughout tropical and southern temperate regions. Its plumage is black all over. It is a stout, bulky-looking vulture with prominent white patches on its wingtips. Its head and throat are featherless, except for some down and a few bristles. The head appears small, but a short neck is apparent, unlike the Turkey Vulture. Its head, throat, and beak are dark gray and its eye is dark brown. Sexes are similar in size and appearance.

The Black Vulture is not a graceful flier. When taking off from the ground it usually runs along, then hops two or three times before getting airborne. It flaps its wings much more than the Turkey Vulture, in characteristic bursts of three to five jerky flaps followed by gliding. It can also lift off directly from tree perches, cliffs, or when surprised on the ground. Because its wings are shorter and stouter than the Turkey Vulture, and its tail is short, it requires strong thermals to soar efficiently. It tends to soar at higher altitudes than the Turkey Vulture. When gliding it holds its wings level or in slight, shallow dihedral. In flight its toes may protrude beyond the tail.

SIZE

The Black Vulture is slightly smaller, but heavier, than the Turkey Vulture, and about half the size of an eagle. Males and females are similar in size. Body lengths average 25 inches (65 centimeters). Wingspans average 59 inches (151 centimeters). Weights average 4.4 pounds (2 kilograms). Large birds can reach weights of 6 pounds (2.7 kilograms).

MORPHS

There is no individual variation in plumage although partial and nearly full albinos have been reported. In the field, all birds appear identical.

SPECIFIC DESCRIPTION

Adult - Perched

- small, featherless, dark gray head with wrinkles
- all dark (black) body; backs usually blacker but with noticeable purplish sheen close up
- tip of beak is white
- legs whitish

Immature - Perched

- like adult, but head and neck black without wrinkles
- all dusky or dark beak
- body lacks sheen or iridescence of adults
- brownish neck feathers

Adult - Flight

- shorter, broader wings than Turkey Vulture
- feet reach tip of short, black tail
- white patch at the tips of each wing in primaries are diagnostic except for regions

inhabited by the Crested Caracara

- holds wings in flat or in a shallow "V" or dihedral position
- wing beats are quick and choppy followed by a short glide

Immature - Flight

- similar to adult in shape, size, and movement
- darker head and neck than adult close-up
- white patch in primary feathers

SIMILAR SPECIES

The Black Vulture can be confused with other large, dark raptors that soar. The similar Turkey Vulture has a red, rather than black head (although juvenile Turkey Vultures have dark heads). In flight, the Turkey Vulture has longer wings, with silvery flight feathers contrasting with a black body and front of the wing compared to the Black Vulture's shorter wings, stouter profile, and white flight feathers at the wingtip only. Also the Black Vulture does not rock in flight like the Turkey Vulture. In flight, it can be confused with eagles because it holds its wings fairly straight, but it is only half their size, has a very stubby tail, and flaps its wings with choppy, almost frantic wingbeats rather than steady powerful strokes. It can be separated from hawks, eagles, and ravens by the shallow dihedral (V-shape) position of the wings, and the lack of sustained and strong wingbeats.

OTHER NAMES

Often referred to as buzzard.

ETYMOLOGY

The Genus *Coragyps* comes from the Greek word *korax*, the raven; and *gyps*, the vulture. The Latin species name *atratus* translates into "a vulture clothed in black as for mourning"; a very descriptive name.

MYTHOLOGY

In the southeastern United States, several stories involving vultures are part of local folklore. If you see a vulture's shadow, but do not see the bird, then an unexpected visitor will arrive. If a vulture flies over your house at noon, then a member of your family will die at four in the afternoon. Other people believed that if a vulture flew over your house you would get a letter or hear good news. If you saw a vulture on the ground you should make a wish, if it flapped its wings the wish would come true, if it did not then the wish would not come true. Wearing a vulture feather behind the ear is thought to prevent rheumatism.

RANGE

This species is primarily non-migratory in southern parts of its range and is the most common vulture in the southeastern United States. It reaches its center of abundance in Florida. It is resident from southeastern Pennsylvania and New Jersey south to Florida and west along the Gulf Coast to western Texas. A small population is also resident in southern Arizona. The summer range extends north into southern and eastern Oklahoma, northern Arkansas, southeastern Missouri, and southern Illinois, Indiana, and Ohio. The range is expanding in the northeast.

BEHAVIOR

The Black Vulture is a poor flier compared to other vultures. It can remain aloft easily only when strong thermals occur during the heat of the day. After sunning to warm up, it leaves its night roost and flies off to previously discovered food, or to search for new food. It returns to roost before dusk. Roosts are often traditional, used for as long as birds are present and from year to year, and are often shared with Turkey Vultures when their ranges overlap.

The Black Vulture scavenges carrion, mainly preferring fresh rather than rotten meat. Large numbers of birds (dozens) can occur at one carcass and consequently it overwhelms competitors like the Turkey Vulture. It tends to gorge when feeding then perches in nearby trees. When hunting, the Black Vulture soars at higher altitudes than Turkey Vultures. It watches for signs of food by watching the behavior of other vultures. Once food is sighted, the Black Vulture drops rapidly to the ground, and this action often alerts other birds to the presence of food. The Black Vulture often takes advantage of food found by other species. This vulture will also attack live animals, usually newborn domestic stock or medium-sized mammals like opossums and skunks. Information about food sources is transferred at communal roosts so that many birds can benefit from the discovery of food by a few.

Courtship displays include aerial chasing flights and "dancing" on the ground. The dance involves the male strutting in front of a female with wings drooped and head lowered. The male loosens its skin along the neck and hisses as it hops around. The female can also dance by running in circles with quivering wings. Pair bonds are thought to last for life as Black Vultures are often seen in pairs during winter. Mutual preening occurs between mates while roosting.

The Black Vulture is generally nonmigratory throughout most of its tropical ranges, but individuals wander or move considerable distances at times. Northern populations in the United States withdraw southward for the winter.

Young in the nest are aggressive towards humans. They hiss and snarl, may lunge suddenly toward an observer, and scatter foul-smelling dust and air with flapping wings. They also regurgitate and defecate when hard-pressed by an intruder.

ADAPTATIONS

The Black Vulture conserves energy at night by reducing its body temperatures. As the sun rises in the morning it warms up by spreading its wings and raising its feathers. During hot weather it excretes on the legs, called urohydrolysis, for evaporative cooling, and also pants in order to cool down.

HABITAT

The Black Vulture frequents open and forested habitats, from lowland to mountainous areas, in temperate and tropical zones. It is more abundant in lowland areas, including deserts, grasslands, shrublands, wetlands, and even riparian environments, and avoids dense forest. The Black Vulture commonly inhabits urban and rural areas, unlike the Turkey Vulture, almost acting like domestic animals at times where they use buildings as roosting and nesting sites and scavenging along village and town streets. Breeding areas must contain dense thickets of low vegetation or large trees with cavities or cliffs with crevices and boulder screens. Roosts are usually located in groves of mature trees, free from disturbance.

VOICE

The Black Vulture is usually silent. Its sounds are mainly wheezes, hisses, grunts, and

grunts like dogs barking or snuffling hogs. Adults tending chicks give a low creaking coo. Nestlings hiss and bark.

FOODS

The Black Vulture feeds mainly on carrion, and will feed on virtually any small to large, dead mammal, bird, fish, reptile, or amphibian. Larger carcasses are preferred even though it may have a difficult time penetrating tough hides with its weak bill. It will also take live food such as newborn livestock, turtles and their eggs, bird eggs and nestlings, and even fish. It tends to target colonial-nesting birds such as cormorants, herons, and ibises when hunting for eggs and nestlings. It has also been observed around farmlands feeding on afterbirth and still born calves. Cultivated crops such as sweet potatoes and coconuts are also eaten. Like all vultures, it has very weak feet and beak, so it cannot kill prey efficiently. Young in the nest are fed regurgitated food.

PELLETS

Pellets are medium-sized, cylindrical balls of hair, feathers, scales, vegetation, and rarely bone. They average nearly two inches (five centimeters) long by 1.1 inches (three centimeters) wide.

NESTING

The Black Vulture nests mainly on the ground in tangles of dense vegetation such as palmettos, but will also lay its eggs in stumps, in deserted buildings and crevices and holes in cliffs. It prefers dark, protected areas. The Black Vulture tends to nest colonially, with many pairs nesting near abundant sources of food. Eggs are laid on whatever litter is present. Sometimes nearby vegetation and pebbles appear to be arranged in some loose order. All nest sites are smelly!

Egg-laying can begin as early as late January in the southern United States and late April in the northeastern United States. The eggs are elliptical or long-oval in shape and the shell is smooth, or finely granulated, without a glossy appearance. The background color varies from a dull white to a creamy white. Large spots of dark brown are often set in larger blotches of lavender or pale chocolate which is scattered over the entire egg but often accumulates at the larger end to form a wreath-like pattern. Occasionally some eggs have few spots and blotches. The average egg size is 2.81 inches (71.3 mm) x 2.00 inches (50.9 mm). Clutch size ranges from one to three eggs, but is usually two. Eggs are grayish-green or pale blue colored. The incubation period ranges from 37 to 41 days, and males and females share incubation duties with shifts lasting about one day. Eggs can hatch up to three days apart. Replacement clutches are laid three to four weeks after the loss of the first clutch. Over 60% of nests lose one or more eggs during incubation due to predation, flooding, or adults accidentally kicking eggs out of sight into brush. Young are brooded constantly for the first two weeks and remain in the nest for about 10 to 11 weeks, before beginning to fly. Young gradually move away from the nest site after beginning to fly. Some family groups may remain together up to six months after young leave the nest, with parents continuing to feed their young.

CONSERVATION

Throughout most of its range, the Black Vulture is an ubiquitous species and populations appear to be stable although locally, logging practices may be responsible for loss of nest sites. In tropical regions, the Black Vulture provides valuable services by disposing of garbage. In many jungle towns and villages this vulture walks the streets and alleys looking for scraps, and can become quite tame, almost like domestic fowl. It may cause health

problems for some people, especially when excrement seeps or is washed into drinking water.

In some areas, the loss of suitable tree cavities for nesting due to fire control and timber harvesting may cause local declines. Eggshell thinning, which causes reduced reproductive success, due to pesticide intake is a widespread problem for this vulture. Feeding on road-killed animals also makes the Black Vulture vulnerable to collision from cars and trucks.

The Black Vulture is a long-lived species, with wild birds living up to 25 years.

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Turkey Vulture

Cathartes aura

GENERAL DESCRIPTION

The Turkey Vulture is a large and widely distributed raptor that feeds almost entirely on carrion. It spends much of each day soaring. Its plumage is very dark brown overall. It has relatively long and broad wings and long, rounded tail. In flight, it holds its wings in a strong "V" or dihedral position. From below, the silvery flight feathers contrast noticeably with the darker body and forewing plumage. Its head is featherless, except for a few bristles, and appears very small and "neckless" relative to the body. The head, legs, and feet are reddish-colored on adults. The Turkey Vulture is usually seen soaring above forest or open areas in long straight glides. It is a graceful flier and rarely flaps its wings, except during takeoffs and landings. Its body and wings teeters gently in response to slight changes in winds. During migration it can form into large flocks, known as "kettles", of hundreds or thousands of birds, which circle together in thermal updrafts.

SIZE

The Turkey Vulture is a relatively large, but light raptor. It is smaller than Golden and Bald eagles but larger than all buteo hawks. Males and females are similar in size. Body lengths average 26 inches (67 centimeters). Wingspans average 67 inches (171 centimeters). Weights average four pounds (1.8 kilograms). Large birds can have wingspans of six feet (183 centimeters) and weigh over five pounds (2.3 kilograms).

MORPHS

Once attaining adult plumage there is no individual variation in plumage. In the field, all adult birds appear the same.

SPECIFIC DESCRIPTION

Adult - Perched

- small, featherless, red head with wrinkles or warts
- all dark (brownish-black) body
- short, stout, dull whitish beak
- legs reddish, sometimes with white from defecation
- ivory-colored beak

Subadult - Perched

- similar to adult but with pinkish head and well defined two-toned beak which is ivory with a dark tip

Immature - Perched

- wing coverts with buffy feather edges
- small, featherless, black, dusky, or gray head without wrinkles or warts
- short, stout, dusky beak, with light base

Adult - Flight

- long, broad wings

- appears "headless" from a distance
- tail about three times longer than head
- all dark body
- two-toned wings with dark leading edge and silvery flight feathers on the trailing edge
- feathers at wing tips are deeply "fingered"
- holds wings in "V" or dihedral position in flight
- tilts back and forth in flight
- red head

Subadult - Flight

- similar to adult

Immature - Flight

- long, broad wings
- appears "headless" from a distance
- tail about three times longer than head
- all dark body
- similar plumage patterns to adult, but underwing less silvery
- feathers at wingtips are deeply "fingered"
- holds wings in "V" or dihedral position in flight
- tilts back and forth in flight
- gray head

SIMILAR SPECIES

The Turkey Vulture can be confused with other large, dark raptors that soar. The similar Black Vulture has a black, rather than red head (although juvenile Turkey Vultures have dark heads). In flight the Turkey Vulture has longer wings, with silvery flight feathers contrasting with a black body and front of the wing compared to the Black Vulture's shorter wings, stouter profile, and white, rather than silvery, flight feathers at the wingtip only. In flight it can be separated from hawks and eagles by the strong dihedral (V-shaped) position of the wings, and the lack of sustained and strong wingbeats. Other species that hold their wings in a shallow dihedral include the Golden Eagle, Northern Harrier, Rough-legged Hawk, Ferruginous Hawk, Red-tailed Hawk, Swainson's Hawk, and Zone-tailed Hawk. The latter species is the only other raptor that tilts back and forth when it flies. Dark-morph buteos and Common Ravens may also be confused with this species under certain conditions.

OTHER NAMES

Often referred to as buzzard or turkey buzzard. Adults and immatures are sometimes called "redheads" and "blackheads", respectively.

ETYMOLOGY

Catharus is from the Greek word kathartes which refers to a cleanser or purifier, probably referring to its scavenging activities. The species name aura is from the Latin "gold" which may refer to the color of its head in museum specimens but the word is more likely derived from a Latin American version of "vulture".

MYTHOLOGY

The Cherokee people believed that drinking a vulture's blood, or hanging a dead vulture near a home, gave temporary immunity from all diseases. They also used vulture feathers to

cleanse wounds because vultures were known as birds of purification. Early European settlers believed that Turkey Vulture fat dissolved in oil and rubbed on the body would relieve aches and pains.

RANGE

Breeds from southern British Columbia, including southeastern Vancouver Island, central Alberta and Saskatchewan, southern Manitoba, western Ontario, Michigan, extreme southern Ontario, New York, to southern Maine and south throughout the United States. Winters mainly from southwestern California and Arizona, Texas, and the southeastern United States north along the Atlantic coast to New York and New Jersey. Populations in northern parts of the range are migratory as are most birds in the west. Also found in Middle America and South America.

BEHAVIOR

The Turkey Vulture is a graceful, buoyant flier. It spends much of the day in the air, searching for food, or riding thermal currents. It leaves its night roosts after dawn and flies off to previously discovered food, or to search for new food. It returns to roost before dusk. Roosts are often traditional, used for as long as birds are present, and from year to year, and are often shared with Black Vultures when their ranges overlap. When roosting during daylight hours, the Turkey Vulture preens its feathers, sit at rest or lay along a branch, or sun themselves. When soaring, it rarely flaps its wings, depending more on wind currents and thermals to provide lift. It often glides along close to the ground or treetops, along cliffs and ridgetops, or sifts through open forests, at speeds of up to 35 miles per hour.

The Turkey Vulture scavenges carrion, mainly, preferring fresh rather than rotten meat. Large numbers of birds (dozens) can occur at one carcass. It tends to gorge when feeding then perches in nearby trees. Some authors believe the Turkey Vulture may locate food in the afternoon but return the next day to feed. Information about food sources is transferred at communal roosts so that many birds can benefit from the discovery of food by a few.

While hunting, the Turkey Vulture can smell food, even in areas of dense vegetation. It avoids competition with Black Vultures and Crested Caracaras by often feeding on small, obscure carrion.

Courtship displays include aerial circle flights and "dancing" on the ground. Several birds may gather in a clearing and hop around chasing each other, with wings spread and drooped. Before eggs are laid females lead males on "follow flights" in the vicinity of the nest site. These flights include synchronous flying at close distance and can last several hours. Once paired, pair bonds can last for life. While copulating, each bird may nibble at its mate's head.

Northern and some western populations are migratory whereas southern and tropical populations are mostly resident. Western North American populations winter mainly in Mexico and Central America. Eastern populations move mainly to the southeastern United States. Spring migrants move through Panama in large numbers in late February continuing through early April with February and March being the peak movements in the northeastern United States. Smaller flocks move northwards to breeding areas in the United States and Canada. In the autumn, large flocks can accumulate along migration corridors where the movement may last from late September through November. There are little data on breeding home ranges but individuals likely range over many square miles.

Young in the nest are aggressive towards humans. They hiss and snarl, may lunge suddenly toward an observer, and scattering foul-smelling dust and air with flapping wings.

They also regurgitate and defecate when hard-pressed by an intruder.

ADAPTATIONS

The Turkey Vulture conserves energy at night by reducing its body temperature. As the sun rises in the morning the vulture warms up by spreading its wings and raising its feathers. During hot weather it excretes on its legs (urohydrosis) for evaporative cooling, and also pants in order to cool down.

The Turkey Vulture has a well-developed olfactory sense, and often locates prey in wooded areas by smell. This ability is very rare in birds. Its large, open nostrils permit breathing to continue when feeding with its beak plunged into gore and offal. And its bare head prevents feathers from becoming soiled.

HABITAT

The Turkey Vulture requires habitat for roosting, hunting, and nesting. It frequents open and forested habitats, from lowland to mountainous areas, in temperate and tropical zones. At different times of the year it may visit mountains and canyons, deserts, grasslands, shrublands, forests, wetlands, riparian areas of lakes, agricultural lands, and urban and residential areas. In heavily forested areas, or in dense thickets, it often occurs along open hillsides and cliffs, where thermal currents are more likely found. In southern areas, it is attracted to garbage dumps and landfills. In the tropics, and some areas of North America, it can be found scavenging along village and town streets. Breeding areas must contain large trees with cavities, cliffs, or boulder strewn slides. Recently, many have been found nesting in man-made sites such as buildings.

VOICE

The Turkey Vulture lacks a syrinx and, therefore, has a limited vocal ability. It mainly hisses, snarls, or whines (like a puppy). Young birds begin to hiss, rattle, or buzz like a rattlesnake at about two weeks of age.

FOODS

The Turkey Vulture feeds mainly on carrion, and will feed on virtually any small to large, dead mammal, bird, fish, reptile, or amphibian. In coastal areas, it also feeds occasionally on intertidal invertebrates. The Turkey Vulture has very weak feet and beak, so it cannot kill prey efficiently, but will occasionally feed on incapacitated animals or very young animals. In some areas poultry and farm animals are important components of the bird's diet.

It also eats insects such as beetles and grasshoppers. During tough times it may eat rotting fruit and vegetables left in agricultural fields. One study of pellet analysis showed that plant material, probably herbaceous in nature, was ingested by Turkey Vultures, in autumn, in southwestern Virginia. It will also eat salt from salt blocks. Young in the nest are fed regurgitated food.

PELLETS

Pellets are medium-sized, cylindrical or oblong balls of hair, feathers, scales, vegetation, and rarely bone. Usually they are tapered at one end and have a pungent odor. They average about two inches (five centimeters) long, 1.2 inches (three centimeters) wide, and 0.8 inches (2 centimeters) deep at the thickest part of the pellet.

NESTING

The Turkey Vulture nests in a wide range of cave-like sites including caves or dark recesses in cliffs, among boulders on scree slopes, in cavities in large trees, hollow logs, in lofts of abandoned or seldom-used buildings, and in dense tangles of vines or shrubs. Eastern populations tend to nest more often in tree cavities and tangles of vegetation whereas western populations nest mainly in caves and among boulders. Eggs are usually laid on whatever litter is present, although a few stones, leaves, or wood chips will be gathered around the eggs.

Egg-laying can begin as early as February in the southern United States and late April in Canada. The eggs are elliptical or long-oval in shape and the shell is smooth, or finely granulated, without a glossy appearance. The background color is dull white or creamy white. Bright brown spots or blotches are scattered irregularly over the entire shell. The average egg size is 2.81 inches (71.3 mm) x 1.91 inches (48.6 mm). Clutch size ranges from one to three eggs, but is usually two. The incubation period ranges from 34 to 41 days, and males and females share incubation duties with shifts lasting about one day. Replacement clutches are likely laid routinely if the first clutch is lost. Clutches laid on the ground among thickets have higher mortality than clutches in cliffs or trees.

Young remain in the nest for about nine weeks, before beginning to fly. Young in ground nests begin to venture out into the open after about six weeks. Some family groups may remain together until the beginning of the next nesting season.

CONSERVATION

Populations appear to be stable overall in North America. The Turkey Vulture is a species of concern in some regions and has appeared on various state and provincial "Blue Lists". In other areas it is thought to be increasing rapidly. This species responds to changing food availability by moving in large numbers to areas with high food supply and leaving areas with low food supply. Supplemental food programs called "vulture restaurants" could help restore or maintain populations in local areas.

There has been some concern about vultures spreading pathogens that may enter the human food chain. Studies have indicated that vultures do not spread livestock diseases such as tuberculosis and anthrax.

The Turkey Vulture, like many raptors, is susceptible to organophosphorus and other chemical poisoning when indirectly ingested through eating contaminated livestock.

In some areas of North America traditional banding of vultures with leg bands has been forbidden. Because vultures defecate onto their own legs the excreta can form a solid ball around the aluminum band and cause severe leg ulceration's.

Populations are dependent also on the availability of nest sites. The removal of mature forests and the short harvesting cycle in eastern forests have undoubtedly greatly reduced the availability of nest sites for eastern populations that favor cavities in large trees. Spring floods often destroy many ground nests in the southeastern United States.

The Turkey Vulture competes for food with other scavengers such as Black Vultures, Crested Caracaras, Bald Eagles, foxes, skunks, snakes, mongooses, eagles, and condors.

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California Condor

Gymnogyps californianus

GENERAL DESCRIPTION

The endangered California Condor is an extremely large vulture restricted to a small range in the mountains of southern California. It is one of the rarest birds in the world and may be extirpated in the wild in North America. It feeds entirely on carrion and because of its size it has been mistaken for a small airplane! Its plumage is dark brown overall. In flight a distinctive, large, white triangular patch is visible under each wing. Its head and upper neck is featherless, and is yellow-orange to orange-red colored. A ruff of dark feathers forms a collar around its lower neck. In flight, the head appears relatively small. It is usually seen soaring in slow circles or perched in tall snags. When at rest, its folded wings extend to the tip of the tail or beyond. Sexes are alike in appearance and size.

There is presently an on-going program by state and federal governments in the United States to re-introduce the California Condor into parts of southern California and Arizona.

SIZE

The California Condor is the largest raptor in North America. With the exception of the Trumpeter Swan, which is heavier, it is our largest bird. Males and females are similar in size. Lengths average 46 inches (117 centimeters). Wingspans average 9 feet (2.8 meters). Weights average 23 pounds (10.5 kilograms). Large individuals can attain wingspans of 10 feet (3 meters) and weigh 31 pounds (14 kilograms).

MORPHS

Once attaining adult plumage there is little individual variation in plumage.

SPECIFIC DESCRIPTION

Adult - Perched

- small, featherless, reddish-orange to yellow head
- neck bare, reddish in front and pinkish on sides
- silver-gray or horn-colored beak and reddish-brown eye
- short black feathers between eyes
- erectile ruff of blackish feathers on lower neck
- legs whitish to pinkish
- body and back black
- narrow white bar on folded wings
- tail black and tip is square

Immature - Perched

- similar plumage patterns to adults but do not attain full adult plumage until five to six years of age. Juveniles go through three major plumages going from the "black", or very dark stage, to the "sub-adult" stage where they look similar to adults
- head and neck are grayish or dusky with scattered gray down
- black beak with gray-brown eye
- narrow dusky bar on folded wings

Adult - Flight

- large, broad wings
- large, elongated white triangular patch under wings
- does not rock or tilt back and forth in flight
- does not show strong dihedral wing position of the Turkey Vulture; flatter profile.
- short, black, square tail

Immature - Flight

- triangular underwing patches are dusky and primaries have a light trailing edge; generally more mottled appearance
- tail sometimes appears wedge-shaped

SIMILAR SPECIES

The California Condor could be confused with the other North American vultures, namely the Turkey and Black Vulture, or with Golden and Bald Eagles. Its very large size, however, should leave little doubt about its identification. Turkey and Black Vultures do not have white on the underwing. Immature Golden and Bald Eagles have white patches on the underwing, but also on the tail, which condors do not. Condors soar in larger and slower circles than other raptors. One circle averages about 16 to 17 seconds to complete.

OTHER NAMES

None.

ETYMOLOGY

The Genus *Gymnogyps* translates into "naked vulture" which no doubt refers to its featherless head. The species name *californianus* refers to the range of the condor.

MYTHOLOGY

The California Condor was used in religious-ceremonial activities by Indians in California. Some California native peoples captured condors for use in ceremonies where they were killed. Some native societies impersonated the California Condor in dances. To others the condor represented a person who transformed into a bird. Several cultures even considered the California Condor as a totem, a respect for its supernatural powers. Condor feather quills were also used occasionally by California goldminers as containers for gold dust.

RANGE

At one time the California Condor ranged over nearly the entire continent feeding on ice-age animals. In western North America it was formerly resident along the Pacific coast, and probably inland west of the Cascade-Sierra Nevada Mountain ranges from southern British Columbia south to northern Baja California. By 1940 a small population was restricted to the area surrounding the southern San Joaquin Valley. By 1985 only nine condors remained in the wild and two years later what apparently was the last wild condor was captured to establish breeding programs for re-introduction into the wild. Today, few if any, condors remain in the wild. If still present they may be found in the coastal ranges of California from Monterey and San Benito counties south to Ventura County.

BEHAVIOR

The California Condor is a magnificent bird in flight. It spends much of the day aloft, riding thermals, as it searches for food. It tends to leave the roost three to five hours after sunrise and return two to five hours before sunset. As the first sunlight of the morning reaches them, it holds its wings out to sun and warm up. Sunning bouts usually last several minutes. During cold or wet weather it may not take flight at all because it depends on thermals or wind to provide lift. When soaring it seldom flaps its wings, except when it begins to glide straight ahead, when it takes one or two powerful wingbeats. When flapping, the wings bend below the body, almost touching tips.

The California Condor scavenges carrion and, in former times, many birds could gather at one time. Historical accounts list as many as 28 condors at one carcass. At a carcass, there is dominance hierarchy whereby older birds and birds nearer their nesting territories feed before younger birds. The condor uses other species, such as the Turkey Vulture, Common Raven, and eagles to help them locate food. Like all vultures, the condor gorges itself when food is available. It may go several days between meals. It also occasionally competes for carcasses with the Golden Eagle. Another account reported four condors dragging a small grizzly bear carcass downhill for 200 yards. It does not normally capture live prey, although there are historical accounts of attacks on severely wounded animals. The California Condor is attracted to herds of cattle or ungulates such as deer and circle above looking for sickly individuals.

The Condor bathes and drinks frequently. To bathe it walks into pools, potholes, cattle watering tanks, or lakes. Afterwards, it suns and dries off before taking flight. The condors also cleanses itself after feeding by rubbing its head and neck on the ground or nearby vegetation.

There are no clear migratory patterns but there are seasonal concentrations. Each summer and early fall aggregations occur in the foothills of the southwest San Joaquin Valley. In winter, some birds gather in the Bakersfield area. There are little data on home ranges but individuals likely range over several hundred square miles.

The California Condor is not an aggressive bird and will both defend nesting territories from other condors or allow free passage. It is wary and sensitive to approach by humans when on the ground but can be very bold when on the nest.

Courtship displays prior to nesting are lengthy. Pairs often fly synchronously, turning and twisting as they cruise by their nest and roost sites.

ADAPTATIONS

During hot weather the condor moves to shady roost sites, pants, and inflates air sacs on its head in order to cool down. It also excretes on its legs, a process known as urohydrolysis. During cold weather it may elevate its neck ruff to cover its neck and part of the head.

HABITAT

The California Condor frequents mountainous terrain at low to moderate elevations throughout the year, especially rocky and brushy areas with cliffs available for nest sites. It forages over open rangelands, mountain plateaus, oak savannas, along ridges, and in canyons. Breeding habitat tends to include pine or chaparral-covered mountains.

Roosts are usually in large, tall snags but the California Condor also uses high cliffs.

VOICE

The California Condor is usually silent. When feeding or fighting it grunts, hisses, or snarls hoarsely. Its voice has been described as a "hoarse tin horn toot".

FOODS

The California Condor, like all vultures, feeds on carrion, and will feed on virtually any large, dead animal. Most food is provided by carcasses of deer, elk, and domestic stock, but also bear, cougar, rabbits, hares, and bobcat are eaten. On the coast, it feeds on dead marine mammals such as whales, seals, and sea lions, and will also feed on spawned-out or dying salmon along rivers.

PELLETS

Pellets are large, cylindrical balls of hair and bone.

NESTING

The California Condor nests mainly in high, remote cliffs or in a large cavity in a giant sequoia. In cliffs, nests are situated in caves or large niches. No nest material is added and eggs are laid on whatever litter is present. All pairs have alternative nest sites. Although many sites have a long history of use, the condor nests in different sites during successive breeding attempts. Details of breeding biology are not well known.

Egg-laying can begin as early as late January and young may fledge as late as December, a breeding season lasting almost a full year. The egg is long-oval in shape with a finely granulated shell and no glossy sheen. The background color is dull white or bluish-white with pale brown or lavender spots and blotches with darker brown overlaid. Often these spots form a wreath-like ring at the larger end of the egg. The average egg size is 4.34 inches (110.2 mm) x 2.62 inches (66.7 mm). The condor lays one egg and usually nest only once every second year. If the first egg is lost during incubation a replacement egg may be laid in an alternative nest. Because condors likely do not breed until seven years of age, and because of their small clutch size and infrequent nesting, its reproductive capacity is quite limited. The incubation period ranges from 54 to 61 days. Males and females share incubation, but there are often hostile exchanges between mates during nest exchanges. Each parent spends between two to four days incubating before being replaced by its mate. The condors often sleep while incubating, or preen or gather substrate around egg. Young remain in the nest for five to six months, before they are capable of first flight. It remains a clumsy flier for several months afterwards.

CONSERVATION

The California Condor is hovering on the brink of extinction. After the wild population of condors declined to about 20 birds, a captive breeding program was begun in 1982 at the Condor Research Center in Ventura, California. In 1987, the last remaining apparent wild condor was captured. Happily, the breeding program has proven successful and, in 1993, the first captive-bred condor was returned to the wild. It is hoped that a viable wild population can be re-established.

This species has suffered greatly from loss of habitat. It requires huge tracts of forest and rangelands to provide sufficient food sources. Newly established populations also face old threats such as indiscriminate shooting, poisoning, and collisions with power lines. Condors can be sensitive to disturbance at nests, therefore these sites need to be carefully protected.

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Osprey

Pandion haliaeetus

GENERAL DESCRIPTION

The Osprey, popularly called "Fish Hawk", is one of the most widely distributed birds of prey in the world. It inhabits every continent except Antarctica and is usually found near water. One reason for its success is its highly adapted ability to hunt fish in a manner no other raptor has evolved. Thus it has no direct competitors, and is the lone occupant of an available and productive niche. It is a large raptor with a brown back and white front, a white head and a prominent dark brown eye stripe extending down to the shoulder. It has long, narrow wings, which in flight are bent at the wrists giving them a swept-backed look similar to a gull. Associated with its unique lifestyle, it has evolved a number of unusual adaptations such as a reversible foot and spiny pads for catching and holding fish, and unusual feathers which are water resistant. The Osprey is a top predator in an aquatic food chain and hence is susceptible to biological magnification of certain pesticides. The effects of this accumulation of chemicals in its body was first noticed in the late 1960s when reproductive failure was documented in the Osprey and other raptors. Reproductive failure was the result of egg shell thinning which has been associated with various organochlorines, the most common one being DDT. The banning of DDT and other organochlorines in North America has coincided with an increase in Osprey populations.

SIZE

The Osprey is larger than a buteo yet smaller than eagle. The female is slightly larger than the male. It has a head to tail body length that ranges between 21 and 26 inches (53 to 66 centimetres). Wingspans range between 58 and 70 inches (147 to 178 centimetres). The male averages about 3.2 pounds (1.5 kilograms) and the female averages about 3.9 pounds (1.8 kilograms).

MORPHS

There is very little individual variation in plumage. Juveniles obtain adult plumage after about 18 months, once the distal ends of the feathers have worn away. Other than streaking on the breast, which is sometimes distinguishable on the female, the plumages of the sexes are almost alike.

SPECIFIC DESCRIPTION

Adult Male - Perched

- prominent white head with speckled crown
- brown back and white underparts
- dark brown eye stripe extends to shoulder
- bright yellow eye
- feathering half way down leg
- short tail without terminal band
- underparts white

Adult Female - Perched

- slightly larger body size than male
- similar to male plumage but has light to dark brown streaks or splotches which contrast with white underparts to form a necklace across breast. It should be noted that this plumage

trait may not always be present on every individual.

Immature - Perched

- back is predominantly brown but white to pale edges to the feathers give it a "scaly" appearance
- head is streaked brown and white
- red to orange eye
- white band on tip of tail

Adult Male - Flight

- long, narrow crooked wings
- swept back at the wrist
- prominent dark wrist or carpal patch
- strongly barred tail
- all white underparts, at times very weak brown streaks on upper breast
- upperparts uniformly dark

Adult Female - Flight

- similar to male but with dark streaks or blotches on upper breast that may form a necklace

Immature - Flight

- profile similar to adults
- underparts may show buffy smudges
- "scaly" back appearance due to pale edges of feathers
- wide white band at tip of tail
- underwing has a more scattered pattern of streaking which radiates out to a dark wrist patch.
- tail appears more heavily banded than in adults

SIMILAR SPECIES

The Osprey's large size, white head, and similar habitats will sometimes suggest an adult Bald Eagle. However, a closer look at the diagnostic differences in size, wing shape, eye line, and banded tail will allay any confusion. When soaring at a distance the Osprey looks similar to larger gulls, primarily because of the crooked narrow wings and the predominantly white underside. Gulls have unbanded tails, and lack black wrist patches on the underside of the wings.

OTHER NAMES

The Osprey is often locally known as "Fish Hawk" or "Fish Eagle."

ETYMOLOGY

Osprey is derived from the Latin *ossifraga* meaning "bone-breaker." The Genus *Pandion* is taken from the name of a mythical King of Athens who, along with his two daughters, were transformed into birds. The species name *haliaeetus* is Greek for "salt or sea eagle" an allusion to the eagle that hunts in the sea. In coastal areas the Osprey does forage for perch in the ocean.

MYTHOLOGY

The Osprey is revered for its hunting skills by Bolivian Indians. In one documented case, an Osprey was shot with a bow and arrow, where upon a bone was taken from the hawk and slipped under the skin of the hunter in order to "absorb" hawk-like hunting skills.

RANGE

Most Ospreys in North America are migratory, wintering in Latin America, Caribbean, and northern South America. In North America, it breeds in the boreal forests from northwestern Alaska, northern Yukon, British Columbia (excluding the Queen Charlotte Islands), western and southern Mackenzie, northern Saskatchewan, Manitoba, and Ontario, central Quebec, central Labrador, Newfoundland and extends its range south to Florida and the eastern portion of the Gulf Coast. In the West it ranges into northern California and western Wyoming, with scattered areas to the south in California, Utah, Colorado, Arizona. Elsewhere in the lower 48 United States it is found only locally.

A few Ospreys winter in North America in central and southern California, southern Texas, along the Gulf Coast, and in Florida.

BEHAVIOR

The Osprey is most frequently observed near permanent water bodies which contain significant fish populations. It is a dramatic bird to watch as it flies over water scanning the surface for rising or basking fish. When a potential kill is detected it usually begins to hover. As it hovers it will periodically adjust its height and then plunge down hitting the water surface at its up to 45 miles per hour (70 kilometres per hour). As it enters the water, the wings are folded and swept back behind the tail. The feet are extended out in front of the body. When the fish is caught, the Osprey will unfold its wings, and make a powerful downthrust freeing it from the water. The fish will be adjusted so that the head points in the direction of flight. At times it will skim above the water, similar in method to a Bald Eagle, dragging its legs intermittently in an attempt to startle fish to allow easy capture. The frequency of foraging success appears to be quite high with average adult success from one study at 62% while another study reported 57.5%. The Osprey hunts most often in mid-morning and late afternoon, apparently independent of cloud conditions or wind speed. Yet these factors do impede success, probably because of limited visibility.

The adult Osprey, in autumn, migrates on average about two weeks earlier than do juveniles. The bulk of migration occurs in the middle of September. In eastern North America migration occurs on a broad front from the Appalachian Mountains east to the coastline. In the interior, and the west coast, the timing is similar but pathways are less understood. The Osprey returns to its breeding grounds in North America between early March and mid-May.

The Osprey generally begins mating at three years of age. Typically, a male returns first to an old nest site. He may perform elaborate flight displays such as flying backwards at near stalling speeds, or carrying a stick (or fish) and dangling it in what is thought to signify nest ownership. Nest building or refurbishing commences once the female has returned and she stands in the nest organizing sticks and twigs which are brought by the male. Polygamy has been observed at one study site in Massachusetts in the early 1970s. This is believed to have been the result of too few males or too many females. The unequal sex ratio seems to have been the effect of low productivity because of pesticide poisoning and long distance immigration by females from source populations.

The Osprey defends only the immediate nest site so that in areas with abundant food, local colonies can develop. In these areas nest sites can be as close as 67 feet (20 meters).

In areas relatively poor in food supply, such as at the northern limit of the range in Quebec, nests occur one every 75 square miles (200 square kilometers).

ADAPTATIONS

The Osprey has evolved several novel adaptations which are unique among birds. The foot is remarkable in that it can turn backwards and has accompanying spines on the soles of its toes; both of which contribute to the ability for catching fish. Osprey feathers tightly overlapping in a regular pattern, are compacted, and oily; all three factors contribute to water resistance. The tarsi are short and relatively thick, possibly for resisting impact at high speeds on the water surface and the fish itself. The bill is strong and hooked and the small intestine is relatively long and narrow; thought to be a benefit for digesting scales and bones.

HABITAT

The fundamental life requisites of the Osprey is an open water surface such as seacoasts which include tidal estuaries, coves and bays, lakes, rivers, ponds, or wetlands, which contains a plentiful supply of fish. Nest sites are usually in trees but any elevated site which provides protection from mammalian predators is suitable provided it is within a few miles of a hunting site. In the absence of a suitable nest site the Osprey will make use of many man-made site such as power poles, irrigation towers, beacons, or purposely constructed nest platforms. It is one raptor that is willing to live near human activity.

VOICE

The Osprey has an ascending high pitched plaintive call which rises in quarter tone "chewk-chewk-chewk", with the last notes somewhat slurred. The male has the deeper call. When circling above the nest, either alone or together in a sky dance, it will call "cree-cree-cree" repetitively for up to 15 minutes. Females elicit a softer, more muted call issued in single notes when the male approaches the nest with nest material or prey items.

FOODS

Fish make up 98% of the Osprey's diet. Incidental prey items have included amphibians (mostly frogs), reptiles (mostly turtles and snakes), crustaceans, small mammals, and birds. There does not appear to be any species of fish which is preferred. Rather it takes what is available locally. The fish which are taken tend to be benthic or deep water animals, a seeming contradiction, but it may be that when the fish rises to the surface to bask it is not well equipped with the anti aerial predator behaviors of the Osprey. The average fish size in the diet is about 0.5 pounds (227 grams). Fish about 1.0 pound (454 grams) or greater may be too large for Ospreys to handle.

PELLETS

Osprey pellets, which are not often found, are small for the size of the bird. The pellets are composed of scales and bones and at times grass. The latter is thought to be ingested accidentally.

NESTING

The Osprey is primarily a tree nester, but have been recorded using almost any site, including cliffs and cacti, which allows it security from mammalian predators and close proximity to foraging areas. Most nest sites are associated with marine areas although ospreys can be found nesting along any significant inland river, lake, slough, or marsh.

Where no natural nest site is available artificial nest sites, mostly man-made, have been used successfully. Nests are built with sticks, sod, grass, seaweed, and other available sundry. The male does the majority of the gathering of the material while the female does the actual nest construction.

In northern areas the Osprey lays its eggs within 30 days of arriving in the breeding territory. The eggs are oval, short-oval, elliptical, or long-oval in shape. The background color varies from white to creamy white sometimes with a dusty tan or fawn color. The shell is finely granulated. Pronounced blotches of chestnut, burnt sienna, and deep reds with gray undermarkings make this the most handsome of all hawk's eggs. The average egg size is 2.40 inches (61.0 mm) x 1.79 inches (45.6 mm). Clutch size averages three with a range of two to four. Incubation ranges between 35 and 43 days. The nestling period, with the female in attendance, lasts about 30 days. After about 35 days the female will leave the nest more frequently and watch from nearby perches. At about 52 or 53 days chicks begin to fledge.

Postfledgling dependency, that is parents are still in attendance but rate of prey delivery declines, has been estimated at between 93 to 103 days in Virginia. At higher latitudes it is believed to be shorter because of the shorter breeding season.

During the first year of life the immature stays on its wintering ground during the breeding season. It returns to its breeding range the next summer but does not breed. In the third year the birds may build nests but not actually reproduce although there is some recent evidence of a few individuals actually raising young successfully. Most breed a year later.

CONSERVATION

The fall and subsequent rise of Osprey populations in eastern North America has been well documented and the story can be considered a success of conservation measures. Ospreys began to decline in the late 1960s as a result of organochlorine poisoning. The effect of the pesticide on the bird, a result of bio-accumulation where toxins concentrate as they move up the food chain, caused egg shell thinning and subsequent breeding failures. The recognition of this fact, along with other alarming effects associated with this class of chemicals, resulted in the banning of their use in North America. Osprey populations have been rebuilding ever since the withdrawal of this pesticide from the market.

Another successful conservation measure has been the use of artificial nest platforms adjacent to productive fishing habitats. These platforms have helped by providing sites where no nest sites were prior; establishing sites which are secure from mammalian predators; and they are often superior to natural sites which may be prone to blow down.

In some areas Ospreys are considered pests because they raid fish hatcheries or build their nests on power poles which may result in loss of electricity to towns for short periods of time. But with thought, these problems can be dealt with easily. For example, nets can be used to cover fish stocks in hatcheries and nest platforms can be erected on poles adjacent to where electrical shorting is a problem.

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Hook-billed Kite

Chondrohierax uncinatus

GENERAL DESCRIPTION

The Hook-billed Kite is mainly a species of tropical and subtropical forests whose range includes parts of Cuba and the West Indies and all of Central America and most of South America. In North America it occurs as far north as southern Texas and lives mainly in the thorn-scrub vegetation along the Rio Grande valley.

This medium-sized bird is an odd raptor that is easily distinguished in the field by its unusually large and strongly hooked beak, paddle-shaped wings, and short, stump-like legs. It lacks a bony shield above the eye. Its bill size varies and is related to the size of the prey it eats, which is mostly tree snails. Extremely short yellow-orange legs, glassy-white eyes, a unique greenish patch of skin topped by a yellowish patch between the eye and the bill also help set this species apart from other raptors.

Both sexes are similar in size but have different adult plumages. The plumage of immature birds is similar to that of an adult female and a melanistic plumage also occurs in this species but has not been found in Texas populations.

SIZE

The Hook-billed Kite is medium-sized raptor. Male and female birds are similar in size with an average length of about 18 inches (46 cm). The average wingspan is 36 inches (91 cm) and the average weight is less than one pound, about 10 ounces (277 grams).

MORPHS

Unusual plumages have not been found in this kite. Although dark morphs exist in the world population in adults and juveniles it has not yet been documented in North America. The typical morph found in Texas is "gray-bellied" for the male and "brown-bellied" for the female

SPECIFIC DESCRIPTION

Adult Male - Perched

- blue-gray head with long-hooked bill
- white eyes
- slate gray back
- underparts gray but variable with narrow white bars which at times may be difficult to see
- wide band(s) on dark gray tail which is narrowly white-tipped
- tip of wings reach about mid tail
- cere, gape, and skin around mouth edges a greenish-yellow
- lores (in front of eye) a bright yellow to orange
- legs orange-yellow

Adult Female - Perched

- dark head with blackish crown and nape, rufous collar, and long-hooked bill
- white eyes
- gray-brown to sooty brown back

- underparts creamy buff with rufous or deep brownish-red bars or bands
- wide bands on dark brown tail which is narrowly white-tipped
- tip of wings reach about mid tail
- cere, gape, and skin around mouth edges a greenish-yellow
- lores (in front of eye) a bright yellow to orange

Immature - Perched

- dark head with dark-brown to blackish crown and nape, light or white collar, and long-hooked bill
- pale brown eyes
- dark brown back with buffy to rufous brown edges to feathers
- underparts whitish or creamy with indistinct bars which vary in presence
- dark tail has two or three grayish-brown bands
- facial soft parts paler than in adults
- tip of wings reach about mid tail

Adult Male - Flight

- paddle-like wings, long fan-shaped tail
- dark tail with a single wide band (sometimes two may be seen)
- contrasting underwings with primary feathers boldly barred and secondaries uniform dark in appearance
- slate-gray back with gray underparts lightly barred

Adult Female - Flight

- paddle-like wings, long fan-shaped tail
- underwings with boldly barred primary and secondary feathers; more rufous appearance on inner primaries than in males
- dark tail with two wide bands
- dark brown back with rufous bands on creamy underparts

Immature - Flight

- paddle-like wings, long fan-shaped tail
- dark brown back
- boldly barred primaries and outer secondaries
- whitish underparts with faint buffy brown bars, sometimes unbarred
- tail has three bands of similar width terminated with narrow light tip

SIMILAR SPECIES

The Hook-billed Kite can be confused with at least seven hawks. The adult Gray Hawk has a smaller bill, dark eyes, and has more finely barred underparts than the adult male Hook-billed Kite. Its silhouette shows more pointed and smaller wings. The Red-shouldered, Broad-winged, Sharp-shinned, and Cooper's hawks also lack the large, long-hooked bill of the Hook-billed Kite. They all show rufous or reddish barring on the underparts but all have different silhouettes that are not paddle-like in flight. The Road-side Hawk also lacks the hooked beak but also the rufous collar on its neck. The Common Black Hawk is a larger bird than the adult Hook-billed Kite. In flight it shows much wider wings and a light area at the base of its outer primaries.

OTHER NAMES

In the West Indies the Hook-billed Kite is also called the Mountain Hawk and in Cuba it is known also as the Wilson's Kite.

ETYMOLOGY

The Genus name *Chondrohierax* comes from the Greek word *khondros* meaning "composed of cartilage" and *hierakos* meaning "a falcon or hawk". The species name *uncinatus* is the Latin word for "hooked" or "curved".

RANGE

The Hook-billed Kite ranges mostly from central Mexico south through Middle and South America to northern Argentina. It also occurs in eastern Cuba and Grenada in the West Indies. Recently, it has extended its range northward, from Mexico, into extreme southern Texas where it is present year-round. Here it occurs mainly in the Rio Grande valley of southern Texas between Falcon Dam and Brownsville. Breeding birds are most easily found at the Santa Ana National Wildlife Refuge and Bentsen State Park.

There are three recognized subspecies of the Hook-billed Kite. In Texas, the kites belong to the Mexican race *C. u. aquilonis*.

MIGRATION

The Hook-billed Kite is relatively sedentary although local dispersal takes place within its range in Texas.

BEHAVIOR

Most Hook-billed Kites are seen singly or in small groups of several birds. Only rarely is a flock seen soaring. Its flight has been described as active or rapid wingbeats or flaps followed by a slow tipping glide. Soaring and gliding occurs on bowed wings held just above the tree tops.

The main prey of this species is tree snails which it plucks from trees. Sometimes piles of snail shells found on the ground in the forest indicate favorite feeding sites. Although little foraging information is available, the Hook-billed Kite has been watched inserting its beak into the opening of the snail's shell and progressively breaking apart each whorl until most of the body of the snail has been exposed. Then the snail is swallowed whole.

The social behaviour of the Hook-billed Kite is poorly known. No information is available concerning the courtship or other reproductive behavior of this species.

ADAPTATIONS

The size of the bill of the Hook-billed Kite varies greatly between individuals and has nothing to do with sex or age. Different bill sizes allows birds to select snails of differing sizes thus spreading out the impact of food supplies. Also, the lack of a bony shield over the eye and the bare lores reflect the kite's snail diet.

HABITAT

The Hook-billed Kite's habitat must include an abundance of tree and land snails for its specialized diet. These environments include a preference for lower canopy and understory in lowland forests and shrubby areas, especially in swampy and marshy wetlands as well as riparian habitats.

VOICE

The Hook-billed Kite's repetitive call has been described as an "oriole-like musical whistle". Near its nest it may utter a loud rattling sound that descends in pitch and may sound a bit like that of a Northern Flicker. It also gives a harsh chattering or screaming call when chasing a hawk of another species.

FOODS

Tree and land snails constitute most of the diet of the Hook-billed Kite. Species and sizes of prey vary greatly throughout its range but in Texas it feeds on the tree snail *Rhabdotus alternatus*. Occasionally amphibians such as frogs and salamanders, as well as aquatic insects are taken.

NESTING

Very few nests have been found in North America. The nests are flimsy and frail structures placed in trees and built of dead twigs and branches. In Texas, one nest was found about 22.6 feet (7 meters) above the ground in a willow (*Salix nigra*) tree and a second nest was found in a ebony tree (*Pithecellobium flexicaule*), 21 feet (6.5 meters) above the ground.

The eggs are nearly elliptical in shape and the shell does not have a glossy appearance. The background color is white. The shell is scattered with small to large blotches of dark brown. The average egg size is 2.1 inches (53.6 millimeters) x 1.59 inches (40.5 millimeters).

Clutch size varies from 2 to 3 eggs. Incubation and fledgling periods are unknown for this species. Both adults feed the young up to one snail every six minutes! Once a clutch is lost the Hook-billed Kite does not replace them.

CONSERVATION

Destruction of wetland habitats, mainly due to agricultural activities and urbanization, has placed the survival of the Hook-billed Kite at risk. Currently, there are only 10 to 20 pairs in Texas.

Without the co-ordinated help of conservationists, ornithologists, and naturalists to prevent and control destruction of wetlands, this unique species future looks bleak in North America.

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American Swallow-tailed Kite

Elanoides forficatus

GENERAL DESCRIPTION

The American Swallow-tailed Kite is one of our most elegant and agile raptors. In flight, it is unmatched by any other bird of prey as it gracefully twists and turns or soars on thermals with barely flapping its wings. Its long pointed wings, deeply forked tail, and striking black-and-white plumage are unmistakable. Its tail is more deeply forked than any other raptor. Both sexes look alike but the female is generally larger in size. The plumage of immatures are similar to those of the adult.

Formerly, the range of the American Swallow-tailed Kite in North America extended as far north as Wisconsin and Minnesota but today it occurs mostly in the southeast and along the Gulf Coast where it reaches its highest numbers in the southern swamps of Florida. It visits North America only during the breeding season, arriving mostly in early March and departing for its winter home, in South America, in September.

The Swallow-tailed Kite is a medium-sized raptor that is gregarious throughout the year. It may also nest in loose colonies.

SIZE

The American Swallow-tailed Kite is a medium-sized bird of prey. Both sexes appear very similar in size and weight but the female is slightly larger and heavier. Body lengths range between 19 and 25 inches (48 and 62 centimeters). Wingspans range between 47 and 54 inches (119 and 136 centimeters). Weights vary between 11 and 18 ounces (325 and 500 grams).

MORPHS

There are no morphs or unusual plumages documented for the American Swallow-tailed Kite.

SPECIFIC DESCRIPTION

Adult - Perched

- all-white head, neck, and underparts
- upperparts purplish or black including back, wings, and tail
- forked tail nearly as long as body
- wings cross over tail
- reddish eyes
- black beak with bluish or blue-gray cere
- undertail coverts and leg feathers white but often stained

Immature - Perched

- similar to adult but head and upper breast with fine dark brown streaks or varying amounts of buff on crown, nape, throat, and upper breast
- upperparts dull black or with greenish iridescence on back, wings, and tail
- white tips to wing and tail feathers
- tail not as deeply forked and outer feathers shorter than in adult
- long wings nearly reach to, or extend beyond, tip of tail

- brown eyes

Adult - Flight

- striking black-and-white plumage with deeply forked tail, and long, narrow, pointed wings
- white body and wing linings with black flight feathers and tail
- flight silhouette is flat in appearance
- swallow-like in flight

Immature - Flight

- striking black-and-white plumage of adult but tail not as deeply forked and appears shorter than in adult
- wings long, narrow, and pointed
- swallow-like in flight
- indistinct buffy areas on upper breast, head, and nape

SIMILAR SPECIES

The American Swallow-tailed Kite is often confused with the light morph Swainson's Hawk, the White-tailed Hawk, and the light morph Short-tailed Hawk. All three of these species have the same two-toned pattern to the underwing, relatively dark heads, and lack the distinguishing swallow-shaped tail.

OTHER NAMES

The American Swallow-tailed Kite is often referred to as the "Fork-tailed Kite", "Scissor-tailed Kite", or "Snake Kite".

ETYMOLOGY

The genus name *Elanoides* is derived from the Greek word *elanos* meaning "a kite", and *ideos* meaning "resembling". The specific name *forficatus* is from a Latin term meaning "deeply forked". Therefore, a rough translation would be "a kite resembling (something) deeply forked."

MYTHOLOGY

No known mythology for North America

RANGE

Prior to the 1880s, the breeding range of the American Swallow-tailed Kite included 21 states, ranging from eastern Texas to South Carolina in the south, to Minnesota near the Canada\United States border in the north. Over the next century its range was greatly reduced mostly due to land clearing for agriculture and urbanization. Today it breeds regularly only in the extreme southeastern United States along the Gulf Coast from eastern Louisiana to South Carolina (locally) and south through Florida. Its center of abundance is around the Big Cypress region of Florida.

The kite's breeding range also includes southeastern Mexico south through most of Central and South America. The wintering range includes South America from Columbia and Venezuela southward, but rarely north to Central America.

There are two subspecies of the American Swallow-tailed Kite which are very difficult to separate. The race breeding in North America is known as *E. f. forficatus*.

BEHAVIOR

The boldly patterned American Swallow-tailed Kite is one of the most graceful and agile birds of prey in flight. It spends much of its time riding thermals and soaring low over the tops of trees. It uses its long forked tail as a rudder.

This species is very tolerant of humans and their urban habitats. It is often seen hunting in residential areas and at times appears quite tame. In the mornings it can often be spotted on a perch with its tail outspread and wings drooping, catching the warmth of the sun. During the nesting period, adults often fly over the nest site riding air currents and gently swooping on one another, possibly to reinforce their pair bond.

Unlike many other raptors, the American Swallow-tailed Kite begins its daily activities late in the day. It may visit feeding grounds in the early morning but roosts until the habitat dries a bit and insects become active. It then actively feeds until early afternoon, forms flocks with other kites, and then returns early to its night roost. During cloudy or overcast days it may try to locate food throughout the day.

Hunting and feeding occurs almost entirely on the wing. The kite may hunt like a harrier, and quarter back and forth over fields looking for prey or twist and turn quickly to pluck food from tree branches and trunks. It also takes nestling birds and sometimes in its haste takes the entire bird's nest before prey is actually eaten. It may also chase prey directly, such as dragonflies, or stalk grasshoppers on the ground in fields. It drinks and frequently eats while in flight.

The American Swallow-tailed Kite is gregarious by nature and may be found in flocks of up to 300 birds during migration and near feeding grounds. When a potential predator is near, like a Bald Eagle or Great Horned Owl, kites will flock together to harass and drive away the threat. Even at night kites get together in communal roosts.

Little is known if birds remain paired throughout the year, but recent evidence suggests that some kites arrive back at traditional nest sites already paired. The adults frequently engage in a "swooping" behavior which may be important in maintaining their pair bond.

Spring migrants may arrive in southern Florida during the last week of February but most are seen in early March. In more northern areas, such as coastal Georgia and the Carolinas, they arrive between mid-March and mid-April. Spring migration occurs later along the west side of the Gulf of Mexico. Many of the vagrant occurrences in the United States occur during this period when birds overshoot their destinations. Fall migration may commence in mid-July and last until mid-September. Some departing birds fly south from North America via Cuba and Jamaica, while others migrate south via Texas and Central America.

During the nesting period, foraging territories may range between 1.5 and 27 square miles (388 and 6993 hectares). When out of the nest adults may range over a much larger area, between 27 and 66 square miles (6993 and 17,754 hectares).

ADAPTATIONS

The deeply forked tail of the American Swallow-tailed Kite helps immensely in buoyancy and maneuverability during flight, both in courtship and feeding activities. Nestlings excrete their waste on the edge of the nest, not over it to the branches and ground below. This obviously makes the nest inconspicuous to land predators like raccoons.

HABITAT

The American Swallow-tailed Kite prefers lowland forested regions, especially swampy areas, but also inhabits open woodlands and fields. Many consider it a forest-edge bird. Specific habitats may include hardwood forests, pine woods, cypress and mangrove swamps, floodplain forests and timber belts. It hunts over marshes and wet prairie-like habitats and requires tall trees for nesting. Usually water is nearby.

VOICE

The calls of the male and female may appear similar to the human ear but the male's is lower in pitch. Usually the call consists of a three-syllable, high-pitched or shrill sound that has been described as "peet-peet-peet", "ki-ki-ki", "we-we-we", "wheet-wheet-wheet", or "klee-klee-klee." An "eep" call is uttered between adults when food is being transferred or nest duties are being changed. During the nestling stage young can be heard throughout the day giving their characteristic "cheep" call.

FOODS

Although large and small insects, such as locusts, crickets, beetles, grasshoppers, yellow hornets, dragonflies, flies, lepidopterans, and caterpillars are regularly eaten, other prey may be more important in some years. For example, when tree frogs become scarce during periods of drought, lizards and nestling birds may be utilized more. Of the latter Mourning Dove, Northern Mockingbird, Loggerhead Shrike, Painted Bunting, Clay-colored Robin, and Tropical Kingbird nestlings have been recorded as food items.

NESTING

The American Swallow-tailed Kite is a tree-nester and may breed in loose colonies of a few pairs. Nests are usually built near the forest edge, often in isolated trees but frequently in the tops of trees projecting above the forest canopy. Nest sites have an unobstructed view of the surroundings and offer easy landing and perching situations. Pine, cypress, cottonwood, maple, birch, and hickory trees are most used. Nests may be built from about 55 feet (17.1 meters) up to 130 feet (40.3 meters) and are placed next to the main tree trunk or on horizontal branches.

The nest itself is composed of sticks and twigs with moss, pine needles and lichen interspersed. Feathers and fine plant material line the nests. Nests vary in size, but many may have more than 200 pieces of sticks and twigs in them which the adults gather in flight from dead trees.

The eggs are short-oval or nearly oval in shape. The background color is white or creamy white with dark brown to reddish brown blotches and spots irregularly but heavily scattered over the entire egg. Some eggs may show a "wreath" around the larger end. The shell is smooth, not glossy. The average egg size is 1.85 inches (47.0 centimeters) x 1.48 inches (37.5 centimeters). Clutch size averages 2 eggs. Incubation period is from 21 to 26 days. Full body feathering begins to appear at about two weeks of age and is fully developed at about 40 days. Nestlings may begin to leave the nest at 26 days but most do not fledge until 35 to 42 days.

After fledging both adults feed the young either back in the nest or on tree branches. Family groups may stay together for the summer before migrating to their winter homes.

CONSERVATION

In the short span of about 50 years the American Swallow-tailed Kite lost most of its breeding range in North America. Direct human persecution, such as shooting, and loss of habitat from logging, marsh drainage, and urbanization, as well as changing agricultural practices are the likely reasons for the decline.

In 1985 this kite was a candidate for the "endangered species" list and today it is a "species of concern" which is carefully being watched by government personnel. Habitat destruction must be monitored and closely controlled in order to protect this unique species.

Some of the kite's natural enemies include the Red-shouldered Hawk, Great Egret, Bald Eagle, Peregrine Falcon, Great Horned Owl, Barn Owl, Common Crow, and racoon.

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White-tailed Kite

Elanus leucurus

GENERAL DESCRIPTION

The White-tailed Kite, formerly known as the Black-shouldered Kite, is a medium-sized raptor about the size of a Peregrine Falcon or a small male Northern Harrier. It is a graceful, streamlined bird of open spaces, and from a distance it is so white that it could easily be mistaken for a gull. In shape it superficially resembles a falcon but has a longer, non-tapering tail and a light, more buoyant flight style. While hunting it commonly hovers with legs dangling, like an American Kestrel. It also hunts from perches, including power lines.

The White-tailed Kite, which has a nearly world-wide range, has been undergoing a steady range expansion in North America since the 1960s. Once so endangered that it was considered likely to become extinct in the United States, this species has now re-occupied much of its former California and Texas range, and is beginning to nest once again in Florida for the first time in over a century.

SIZE

Females and males are similar in size. The beak of the female averages slightly longer than the male. Total lengths range between 14 and 16 inches (35.6 and 40.6 centimeters). Wingspans range between 14.2 and 15.7 inches (36 and 40 centimeters). Weights range between 10 and 13 ounces (283.5 and 368.6 grams).

MORPHS

This species has no morphs and in North American and South America no unusual plumages have been reported.

SPECIFIC DESCRIPTION

Adult - Perched

- white head, black-tipped bill, yellow cere, red eye, dark feathers around eye
- body is white
- gray back and upper wing surfaces with black shoulders
- wing tips reach end of tail
- center of tail is gray; outer tail feathers are white; tail is slightly forked
- under surface of tail is white
- yellow legs and feet

Immature - Perched

- juveniles just out of the nest have rusty streaks on the chest
- rest of underparts white
- light brown wash to crown and nape , with thin dark streaks
- medium brown back with pale feather edges
- dark brown-blackish shoulders and generally medium brown upper wing surfaces
- pale tips to flight feathers on upper wing surface
- generally pale gray tail with dusky subterminal band
- yellow legs and feet

Adult - Flight

- underparts white
- white underwings except for gray tips and small black "wrist" patch
- light gray back
- upper surface of wings is medium gray with black shoulders
- upper surface of tail is gray in center with white outer tail feathers
- under surface of tail is white
- tail is long and square tipped or slightly forked

Immature - Flight

- white underparts with rusty streaks on chest
- under wing surface pale with dark gray wing tips and diagnostic black "wrist" patch
- upper wing surface dark with pale feather edges
- dark brown to black shoulders
- upper surface of tail has gray center, whitish outer tail feathers and a gray subterminal band

SIMILAR SPECIES

The species most similar is the related Mississippi Kite which shares the same general size and shape as the White-tailed Kite, but in both adult and juvenile plumages has a dark gray or black tail (black and white banded in the juvenile). Adult Mississippi Kites also have gray, not white, underparts and show pale secondaries that contrast with medium gray shoulders and very dark wing tips.

The Peregrine Falcon shares a superficial similarity in size and shape but is always a generally dark bird, never whitish, and has barred underwings and a broader, shorter tail. The Peregrine lacks the black wrist marks of the underwings. The Gyrfalcon is also similarly shaped with pointed wings, but is streaked below and lacks the black wrist marks. The Prairie Falcon has black wing tips, not black wrist patches.

The Northern Harrier lacks pointed wings and has a banded tail (at least one band) and a conspicuous white upper tail coverts that contrasts with the darker color of the tail and back.

Several gulls are similar in size, shape, and color. None, however, shows the distinctive small black wrist patch of the underwing, or the black shoulders on the upperwing.

OTHER NAMES

The White-tailed Kite has recently reverted (1993) to the common and scientific names it was known by for most of the twentieth century. However, during the 1980s this bird was grouped with several other species of superficially similar kites of the Old World and was then called the Black-shouldered Kite (*Elanus caerulus*). In some parts of its range the White-tailed Kite is called the "White Hawk."

ETYMOLOGY

The scientific name *Elanus leucurus* translates into "kite" (*Elanus* - from Latin) that is "white-tailed" (*leucurus* - from Greek).

MYTHOLOGY

No North American mythology is available for the White-tailed Kite.

RANGE

In the first half of the twentieth century the White-tailed Kite was considered an endangered species in North America. However, since the 1970s, populations have been spreading across areas of former occurrence and also expanding into new areas. The White-tailed Kite is now present throughout the year (but not breeding) from southwest Washington (since 1982) and western Oregon (since 1977) where it breeds only in the southwestern corner of the state, and south along coastal and interior (but not eastern) California to northern Baja. It has become resident (since 1983) in southeastern Arizona and is resident along the Texas and Louisiana coasts (since 1983) south through Mexico (both coasts) to Central America and South America. Recently, isolated breeding has occurred in North Dakota, Oklahoma, New Mexico, Mississippi and Florida. There have been numerous recent sightings in Nevada, southern Idaho, and Utah. The White-tailed Kite appears as a vagrant over many of the eastern States north to the Great Lakes and in the West has been recorded north to southwestern British Columbia. There are two recognized subspecies of the White-tailed Kite. The one which occurs in North America is *E. l. majusculus*.

MIGRATION

The White-tailed Kite in North America is not migratory. However, individuals often wander, in a nomadic fashion, after breeding.

BEHAVIOR

The White-tailed Kite usually cruises at 60 to 200 feet (19 to 62 meters) above the ground, with slow wing beats. The rate and depth of wing beats vary according to aerial conditions. Hunting and courtship flight patterns are described below. When perching into a breeze, an incoming kite approaches gracefully with legs extended. It may make contact, but be blown clear of the perch once or twice before settling as if weightless. During the breeding season, when the male provisions his mate, talon to talon in-flight transfers can take place. The two fly side by side into the wind and the female closes on the male, reaches over and takes the prey from him.

The White-tailed Kite hunts over open ground where winds aid it in hovering and soaring. A typical hovering height is about 90 feet (28 meters). The bird dangles its legs during hovering. Upon spotting prey the bird may drop to about 9 feet (3 meters) and briefly hover again before striking. The kite generally strikes feet first, but sometimes seizes the prey in its beak first. The wings are upheld during the strike. The kite will also perch hunt, which is more energy efficient but generally less successful than hovering. Hunting strategies may vary locally depending upon prey species and density, cover type and perch availability. The kite hunts most frequently in the early morning and in the late afternoon-evening. Hunting success appears to be quite high in American studies, a plausible explanation why White-tailed Kites spend the mid day perching and preening. Even when burdened with feeding females at the nests, males hunted only 12 to 15 percent of their time in one California study. A kite needs to eat roughly three voles a day, or the equivalent in other prey.

It is likely that at least some breeding pairs maintain their pair bond beyond the breeding season. However, most kites usually leave their territories after breeding, hunt alone and roost at night communally. Kites gather at a roost between sunset and dark, and after some aerial activity disappear into the foliage of the grove. Kites depart early in the morning. Roosting sites are often changed one or two times a winter. Numbers build during late fall and decline after mid-January. Territories apparently contain the foraging grounds as well and are defended against other kites. In one study, territory size varied from 7.3 to 21

acres (17.8 to 51 hectares). Two to three pairs of kites may nest fairly close together in areas of high prey density.

The White-tailed Kite commonly soars above, and swoops down, upon buteo hawks, causing them to move on. Apparently, kites do not attack Turkey Vultures but will go after other birds of prey. In California, the American Crow has been seen scavenging and robbing White-tailed Kites of their food. In Arizona, a wide variety of songbirds including Northern Mockingbird, Loggerhead Shrike, Ash-throated Flycatcher, Northern (Bullock's) Oriole, House Sparrow, Cassin's Kingbird, and Western Kingbird will nest in the same grove as a pair of kites. However, the kingbirds will harass and chase the kites persistently.

White-tailed Kites begin to form pairs in January while still roosting communally. The male establishes a territory and performs the "wings-up" display when a female is near. He holds his wings up in a V, and rapidly vibrates as he gives a continuous chattering vocalization. He may fetch a mouse to the perched female. The two birds may fly together, the male dangling the mouse to the female below who snatches it from him. Two birds perched or foraging next to each other means that pair formation is complete. The pair may also High-Soar over their territory. Copulation occurs at the male's perch with both birds calling continuously.

The life span of the White-tailed Kite is poorly known. Based on less than 100 returns from banded birds, it is known that this species lives at least five years and 11 months in the wild. Reasons for mortality are also poorly known, although in the early parts of the twentieth century shooting was responsible for much of the mortality, especially around communal roosts. The species almost disappeared from California where overgrazing virtually eliminated rodent populations which the kite depended upon. Under such circumstances, starvation must have caused the deaths of many birds.

ADAPTATIONS

The White-tailed Kite has shown a remarkable ability to adapt to changes in its habitat as long as a prey base of diurnally active rodents is available.

HABITAT

The White-tailed Kite inhabits open country such as irrigated agricultural lands, orchards, grasslands with water, grassy foothill slopes with oak groves, partially cleared lands, windbreaks, marshes and savannas. It needs ground cover long enough to harbor diurnally active rodents, wind for soaring and hovering, and trees or copses with fairly dense canopies for nesting. It shows a preference for riparian areas.

Heavy grazing can cause prime grassland habitat to deteriorate and no longer support cover for rodents. In areas where there are no trees, kites will perch on rocks, power lines, and on the ground.

VOICE

The White-tailed Kite has a fairly limited vocal repertoire. A common call is a whistle like a distant Osprey. This becomes high pitched when the bird is alarmed. This call may also be the low, rounded whistle or chirp given to announce the presence of a mate. During copulation and food exchanges between mates an "eee-grack" or "whee-grack" call is given. The first syllable is high pitched; the second is low and raspy. A similar "ee-gritch" has been described, uttered by a female as she plucked prey. In flight display a bird will call a chirping or chattering call. The male calls a "chuck" when feeding the female. Nestlings hiss, and fledged young utter begging screams at the appearance of their parents.

FOODS

The White-tailed Kite is a rodent specialist, choosing one or two species as primary and secondary prey. Primary and secondary prey differ regionally. In California, the California Vole is the primary prey, but in southeastern Arizona (where the vole does not occur) the Cotton Rat is the primary prey. So strongly is this kite tied to rodents as prey that in a San Diego County study only 0.9% of prey (from pellet analysis) did not include small mammals.

Across its North American range the White-tailed Kite has taken voles, shrews, house mice (a common prey choice in California), ground squirrels, harvest mice, pocket gophers, wood rats, cotton rats, and young cottontail rabbits. Birds, particularly species of fields and grasslands, are reported as taken although which species is not well reported. The kite also takes snakes, frogs, lizards, and large insects such as beetles, crickets, and grasshoppers.

PELLETS

The pellets are spherical, more owl-like than hawk-like. Length varies from 1 to 1.6 inches (25 to 43 millimeters), with an average of 1.25 inches (32 millimeters), and a breadth of 0.6 to 0.9 inches (15 to 24 millimeters), averaging 0.7 inches (18 millimeters).

NESTING

The stick nest is built atop slender branches in the crown of a tree or rarely a tall bush. It is not supported by main branches or located next to a trunk as with most hawk nests. Tree species include oaks, willows, eucalyptus, cottonwoods and other deciduous trees. The nest site, selected by the female, may be on sloped or flat land, dry or in a marsh. Rarely is the nest built atop an old hawk or crow nest. The male may initiate the nest, and gathers most of the material, but the female does all the building, constructing a nest usually concealed from below but open to the sky above. Skills in nest construction vary but the nest is generally a bulky, well built bowl of slender twigs, lined with Spanish moss, dry grasses, rootlets and forbs. Nest construction can be completed as quickly as seven to 10 days. The typical nest has an outside diameter of 21 inches (53 centimeters), a total depth of eight inches (20 centimeters), a bowl diameter of seven inches (18 centimeters) and a bowl depth of three and one-half inches (9 centimeters). In North America, a new nest is constructed for each clutch (pairs often have two broods). Nests from previous seasons are rarely reused.

Clutch sizes range from three to six eggs but average four to five. The egg is oval and smooth, not glossy. Although the background color is white or cream, it is often obscured by washes or splashes of bright brown and profuse rich brown markings. The average egg size is 1.67 inches (42.5 millimeters) x 1.29 inches (32.8 millimeters). The female does most of the incubating while the male provides food, carrying it to his perch near the nest, often in an adjacent tree. He may call her to be fed. Uneaten or refused food may be cached by the male. The incubation period is estimated at 30 to 32 days but some reports have eggs hatching after 26 days. Larger nestlings are not aggressive toward smaller nestlings. The brood departs the nest in stages, oldest first with others following in one to two days. The young first fly at 30 to 35 days. In some cases adults tolerate and feed the young around the nest tree; in others the young are driven away. There may be some overlap between the two broods with adults copulating or beginning a new nest as their first young are still in the first nest.

This species will lay a replacement clutch if the nest is raided or lost.

CONSERVATION

The White-tailed Kite continues to show an increasing population in most parts of its New World range. The reasons for the increase and spread of the kite are not known but some believe that the White-tailed Kite has directly benefited from the expansion of agriculture and the use of irrigation.

In the first half of the twentieth century, the bird was in serious decline and many expected it to become extinct in the United States. Shooting and egg-collecting (the White-tailed Kite has a particularly attractive egg) had reduced the bird's numbers and overgrazing of native grasslands had seriously damaged kite foraging habitat.

In the 1960s the White-tailed Kite population began to expand, re-occupying parts of its former range and even moving into new areas. Possibly agricultural irrigation was helping to create the kind of riparian habitat favored by kites. Overgrazing had been curbed in places and longer grasses were able to support rodent populations. In places, new rodent species appeared as a prey base. In California, for example, the introduced House Mouse spread throughout grasslands and became an important alternative prey. Large holdings of fallow land held by developers also became important, albeit temporary kite habitat. Vegetational success following fires in interior and coastal chaparral included a grassy stage that also favored both rodents and kites.

The loss of grasslands to urbanization remains the most serious threat to the long-term recovery of the White-tailed Kite in North America. Management must include the preservation of suitable habitat.

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Snail Kite

Rostrhamus sociabilis

GENERAL DESCRIPTION

Over the freshwater marshes of central southern Florida the Snail Kite slowly flies with broad, bowed wings. The male is a deep slate gray-black while the female and young birds are dark brown above and streaked brown below. Both sexes, and all age groups, are instantly recognized by their contrasting white undertail coverts and the white at the base of their tail feathers on both upper and lower surfaces. The remainder of the long, square-tipped tail is dark with a very narrow white or buff terminal band. The Snail Kite flies close to the water's surface, searching for apple snails, its primary food. Snails rise close to the surface on stalks of submerged vegetation. The kite deftly snatches the snail, barely getting its leg wet.

SIZE

The Snail Kite is a medium-sized hawk. Females are slightly larger than males. Lengths of both sexes combined average about 17 inches (43 centimeters). Wingspans are up to 45 inches (115 centimeters) for both sexes. Weights average about 13.8 ounces (390 grams) for females and 12.7 ounces (360 grams) for males.

MORPHS

No morphs have been reported.

SPECIFIC DESCRIPTION

Adult Male - Perched

- a medium-sized, dark black-gray raptor with a thin, sharply hooked beak
- bare facial skin between eye and beak reddish-orange
- reddish eye, cere and corners of mouth
- white undertail coverts
- long square tipped or slightly indented tail
- at rest wing tips project past tail tip
- base of tail feathers white; rest of tail dark black-gray, except for very narrow white or buffy margins on tail tips
- legs reddish-orange

Adult Female - Perched

- a medium-sized brown backed raptor with streaked, or mottled, underparts and a thin, sharply hooked beak
- buffy eyebrow, cheek, and throat contrast with black eye line and yellowish cere
- reddish eye.
- underparts are off-white, streaked broadly with dark brown
- dark brown back and upperwing with rusty edges
- white undertail coverts
- base of tail white; rest of tail slate, except for narrow buffy margins on tail tips.
- orange-yellow legs

Immature - Perched

- very like the female but dark brown eye, streaked crown, yellowish cere
- underparts less heavily streaked than adult female
- yellow legs

Adult Male - Flight

- all dark hawk with white undertail coverts
- base of tail white, rest of tail black-gray, except for narrow buffy margins on tail tips.

Square-ended tail

- wings oddly shaped, narrower close to body, then spreading wider closer to wing tips (often described as paddle-shaped or rounded)
- wings bowed in flapping and gliding flight

Adult Female - Flight

- shares same overall shape of body and wings with male.
- has very similar tail pattern as male.
- underparts are streaked broadly with dark brown
- dark bandings on secondaries and primaries of underwing, as well as a small whitish patch at the base of the four outer primaries
- barred black and rusty-brown wing linings
- wings bowed in flapping and gliding flight

Immature - Flight

- like female but may appear less heavily streaked on the underparts
- secondary feathers darker than primary feathers on underwing

SIMILAR SPECIES

Because of the Snail Kite's restricted North American range and its specialized habitat (freshwater marshes), the only other hawk liable to be confused with it is the Northern Harrier. The Northern Harrier has white upper tail coverts, not white tail base and long slender wings, not wings that are narrower near the body and broader near the flight feathers such as those in a Snail Kite.

OTHER NAMES

The Snail Kite was formerly known in North America as the Florida Everglade Kite, or Everglade Kite. Other old names for this species include Black Kite (not to be confused with *Milvus migrans*, the Black Kite of Eurasia) ; Hook-bill Kite (not to be confused with *Chondrohierax unicinctus*, the Hook-billed Kite); Sociable Marsh Hawk; and Snail Hawk.

ETYMOLOGY

The scientific name *Rostrhamus sociabilis* translates to "hooked beak" [hawk] (rostrum, "beak"; and hamus, "hook" - both Latin) that is sociable or gregarious (sociabilis - Latin).

MYTHOLOGY

No mythology has been found for this species.

RANGE

The Snail Kite formerly occurred as a nomadic resident throughout the lower half of the Florida peninsula and was widespread over the huge expanse of the Everglades. Its present range in Florida is much smaller owing to the containment and draining of parts of the Everglades. It is found from the headwaters of the St. Johns River and the Kissimmee River basin, south through Lake Okeechobee and the Everglades into the northern part of Everglades National Park. It also occurs in wetlands near the east coast of Florida from central Brevard County south to central Palm Beach County and in the eastern part of the Big Cypress region. In times of drought Snail Kites disperse widely over much of the Florida peninsula. It winters throughout these areas.

Three subspecies are recognized in the world. The race found in North America is *R. s. plumbeus*, which is also found in Cuba and the Isla de la Juventud (Isle of Pines).

The Snail Kite also occurs from southern Mexico, locally through Central America south to Ecuador, Uruguay, and northern Argentina.

MIGRATION

In North America the Snail Kite is not migratory. However, it has been suggested that Snail Kites in northern Florida move south down the peninsula to escape cooler winter temperatures. The kite is nomadic, and in times of drought disperses across the Florida peninsula in search of supplies of water snails. Birds also move nomadically at the end of the nesting season. Snail Kites can move long distances each day between feeding areas and their communal roosts.

BEHAVIOR

The flight of the Snail Kite is slow but buoyant, with several deep wingbeats alternating with glides during which the wings are cupped. The wings appear bowed during flight. When foraging, the kite makes tight, graceful turns on its broad, rounded wings. The foraging flight is described below. During midday kites often soar, ascending high enough to be invisible from the ground. The species is social with others of its kind and is tamish around people.

The Snail Kite hunts from an elevated perch, spotting a snail and going after it, or by coursing low over the wetland with more or less constant slow flapping of its bowed wings, scanning the water's surface and below for the presence of a snail. When about to strike, it dangles one or both legs. It seizes an apple snail near the water's surface and gets, at most, only its legs and thighs wet doing so. It may transfer the snail from foot to beak before settling on a perch to extract the snail body from the shell. In Florida, perch hunting is mostly done by young kites. Kites hunt throughout the day. When snails are plentiful kites spend very little time searching for them. A 78 percent capture rate was reported in one study. Droughts cause snails to bury themselves in the mud of the marsh bottom for the duration. Capture rates under such circumstances drop severely. The passage of a cold front with wind disturbing the surface of the water and decreased activity among cold snails also cause kites to have much difficulty finding snails. To detach the snail from its shell the kite must position the shell correctly, insert the tip of its beak between operculum and shell, and twist off the operculum which acts as a door guarding the snail. The bird inserts its beak into the curve of the shell and severs the muscle holding in the snail. These actions require much practice before young birds become proficient. The kite extracts the snail and tears it up or swallows it whole. The snail's yolk sac and sometimes its digestive tract are discarded. In Florida, the average time to extract and eat a snail was 90 seconds.

The Snail Kite rarely defends a feeding area. Its food is probably quite widespread and cannot be defended under normal circumstances. One unusual case occurred where several nonbreeding kites each vigorously defended their own small feeding territories along a canal

where apple snails were superabundant. As the species Latin name suggests, the Snail Kite is quite social, roosting communally in numbers and also nesting in colonies, in Florida numbering from five to 20 nests. In one study, 71 nests ranged from six to 287 yards (5.5 to 261 meters) from nearest neighbors, the average distance being about 84 yards (76 meters). Solitary nesting also occurs. A small territory surrounding the nest about four yards (3.6 meters) in each direction (sometimes as large as 30 yards) is defended by the nesting parents. After fledging, young from several nests may form a large group which feeds in the same general area and roosts together.

The Snail Kite is fairly unaggressive. Many marsh birds show little fearful response to its presence. However, a nesting adult kite will dive at a passing potential predator, such as a Northern Harrier.

Several displays are known. On rare occasions early in the breeding season, groups of kites have been reported circling and darting at one another, grappling and somersaulting in mid-air. This may represent an early stage of pair formation. The male may sky-dance, rising up and then closing his wings to dive steeply two to four yards (1.8 to 3.6 meters), before opening his wings and rising again to repeat the movement. He often carries a stick. He may dive upon a potential mate, or intruders near his future nest site. He may call either the "ka-ka-ka-" vocalization or the "ker-wuck" call during this display. The male may also give deep wing-beats, flying with very accentuated downward wing beats, the wing tips reaching well below the body. He may direct this display toward a potential mate near his future nest site or intruders in the same area. Other displays include a shallow 'pendulum' dive with some wing flapping, followed by a tight turn, and the whole process repeated, and mutual soaring of two prospective mates flying close together while diving and rolling.

The male may begin to construct a nest or defend a nest site before securing a mate. After attracting a female, the male captures a snail and feeds it to her, landing atop a potential nest site with the snail and the female flying to him. The male initiates copulation. During copulation he gives a rattling, gurgling call. Often after copulation the male leaves to find nesting material. The male finds the bulk (80 percent) of the nest material and also provisions the female as well, bringing her 83 percent of her food. He also chases away other kites or potential predators.

The oldest bird in the wild lived 13 years. The average adult life span may be only six years. Likely the main cause of adult mortality is starvation due to drought. Snail Kites are tame and often allow humans to approach them closely. Illegal shooting has caused deaths in Florida during waterfowl hunting season and when birds disperse over large areas because of drought. Nestlings have suffered injury and mortality because of wounds caused by gnawing dermestid beetles. Nests are also plundered by raccoons, Boat-tailed Grackles, Northern Harriers, cottonmouths, and rat snakes. Adult kites may also desert nests when the passage of cold fronts cools shallow marsh waters, causing a decrease in snail activity and a corresponding lack of food for the kites.

ADAPTATIONS

The Snail Kite is well adapted to its environment. Physically, its narrow, sharply decurved bill is superbly shaped to remove the protective operculum (shield or door) of the apple snail, and to plunge inside the shell to sever the columellar muscle attaching the snail to its shell. It is also well adapted to the irregular fluctuations in water levels which dramatically affect its food supply and nesting success. It meets the challenges of irregular drought/high water cycles in a number of ways. Firstly, Snail Kites are nomadic in times of drought, searching for areas where snails are still accessible. When food is abundant a nesting pair will raise young to the point where one adult can feed the nestlings her or himself. The other adult deserts the nest to reneest with a new mate immediately. In addition, young Snail Kites

are capable of successfully breeding when less than one year old. Finally, breeding can take place at any month in the year. Working alone or in combination, these adaptive features allow Snail Kites to propagate well in good years, and survive by dispersing in bad ones.

HABITAT

The Snail Kite frequents flooded freshwater alkaline marshes, shallow lake edges, and occasionally canal banks. Water depth is up to three feet (.9 meters). Vegetation is usually low and open with extensive open water areas with aquatic vegetation just below the surface. Shrubs and short tree hammocks (islands) act as scattered perches and nest sites. Typical species include holly, willow, wax myrtle and buttonbush. Suitable habitat often includes rush (*Eleocharis*) or grass flats and sloughs with white water-lily in a sawgrass, cattail, or bulrush marsh. Kites hunt over shallow open water and avoid dense vegetation or floating mats of aquatic vegetation such as water hyacinth. Their main prey, the apple snail, requires frequent flooding of the marshes. During drought, the apple snails burrow into the muddy bottom and kites are forced to disperse, hunting along canals, over small ponds, borrow pits, and even agricultural fields. Nests are located above water in shrubs (often willow) or in drought season in sawgrass or bulrush beds.

VOICE

The most frequently heard vocalization is a cackle which sounds like "ka-ka-ka-ka-ka-ka" or "kor-ee-a-a-a-a". This is the general call and is called at both kites and humans near the nest or feeding perch. A second common call is a rasping "ker-wuck ker-wuck" heard at roosts, in the male's courtship displays, and aggressively toward other kites. The male also gives a rattling gurgle during copulation. The female gives a watch-winding call near the nest to elicit food from her mate. Nestlings give screams sounding like a Red-tailed Hawk.

FOODS

The primary food of the Snail Kite in Florida is almost exclusively the freshwater snail *Pomacea paludosa*, the apple snail. Elsewhere in its range, the kite consumes other *Pomacea* species including *P. chemnitzii* (Columbia), *P. dolioides*, and *P. glauca*. Recently, in Florida, it has been seen eating an introduced snail, *P. bridgesii*. The Snail Kite also feeds on crabs in Venezuela and a giant ramshorn snail in Columbia, though its beak is so well adapted to *Pomacea* snails that it cannot easily extract ramshorn snails nor handle other prey easily.

In Florida, during drought conditions, the Snail Kite was forced to turn to other foods including (frequently) young turtles, and once a small mammal (probably a rice or cotton rat). During the drought of 1982, kites fed for six weeks almost exclusively upon a very small aquatic snail, *Viviparus georgianus*. Normally a bottom dweller, this snail was exposed at low water. The snail was easily consumed but weighed only about a tenth that of an apple snail.

PELLETS

Snail Kites have favorite snail extracting perches, sometimes old unused nests. Empty apple snail shells will accumulate at such feeding perches. This bird probably does not regularly produce well formed pellets.

NESTING

In Florida, the male gathers most of the nest material. The nest is bulky and flattened. Branches and twigs form the base, with vines and other herbaceous plants lining the cavity. Occasionally a few green leaves are added just before hatching. Nests may have a diameter

of 13 to 16 inches (33 to 41 centimeters), a height of eight to 12 inches (20 to 30 centimeters), and a depth of three to four inches (eight to 10 centimeters). The nest is located normally less than 8 feet (2.5 meters) high, but has been found as high as 28 feet (8.7 meters) over water. It may be located in cattails, sawgrass, and maidencane, but most commonly in shrubs such as willow, wax myrtle and pond apple as well as buttonbush, elderberry, and bald cypress. The nest may be conspicuous or hidden and is usually three to 15 feet (0.9 to 4.7 meters) above water. A new nest is required for each nesting attempt. During renesting a new nest is often built near an old one. The Snail Kites often nest colonially, and often colonies include nesting herons and Anhingas.

Clutch sizes average two to three eggs in Florida, with some evidence to suggest that the Snail Kite lay larger clutches in the early decades of the twentieth century. Today's smaller clutches may be in response to the increasing unpredictability of favorable nesting conditions in southern Florida. The egg is about 1.8 inches (45 millimeters) in length and 1.4 inches (36 millimeters) in breadth. It is of a short elliptical shape and is smooth without gloss. The ground color is white which is sometimes completely obscured by spots, blotches, specks and washes of very dark to pale warm brown. Only rarely is an egg almost pure white without few spots or scrawls.

Both sexes incubate the eggs, but the male incubates more than does the female. One parent will often arrive with a stick to place on the nest and exchange duties with its partner. The eggs are incubated 24 to 34 days. Both parents brood the young until two weeks old and feed them. One parent usually brings more food than the other. The tiny young are fed bits of snail. Around weeks three to six the young are fed whole snails, at first "prepared" for consumption, but later intact and still sealed. At this same time usually one of the parents deserts the nesting, leaving it entirely in the care of the other. After desertion, the remaining parent feeds the young at a rate comparable to that of both parents bringing food. The young begin their first flights around the nest between 23 and 28 days and leave it at 28 to 39 days. They are not capable of true sustained flight until 42 to 49 days old. They are fed by the single parent until 63 to 77 days old. By this time, juveniles can catch their own snails, but are clumsy at handling and extracting the snail from its shell.

The Snail Kite practices sequential monogamy. The deserting parent finds another mate and begins a new nesting, if food is sufficiently plentiful. When snails are scarce no mate-nest desertion will occur in the first place.

CONSERVATION

The Snail Kite in Florida is classified as an endangered species by the Federal government. Elsewhere in its New World range, the species' status ranges from scarce to locally common. The Florida population has varied from a low of 65 in 1972 to a high of 668 birds in 1984. An average of 298 per year was found during an annual survey from 1969 to 1991.

The Snail Kite population responds to drought, as in 1971 and 1981, by dispersing and, ultimately through starvation, dramatically decreasing. However, in years of favorable water conditions the population is quick to increase, partially because of the species' adaptations to drought-high water cycles (see above) and partially because of recovery efforts by conservationists.

Despite federal attention, the Snail Kite faces some serious conservation problems. The vast aquatic reservoir that is the Everglades is under increasing pressures from a growing human population in Florida. By the 1950s, drainage for agriculture had eliminated major portions of the Everglades. Kite populations plummeted. However, in the 1960s, the establishment of large water impoundment's enabled the kites to increase again. By the late

1970s, one impoundment no longer supported either apple snails or Snail Kites, possibly because of the effects of pollution. In addition, pressures were mounting to divert some of the stored water for other human and wildlife uses, incompatible with the needs of the kite. The continued survival of the Snail Kite in Florida will depend upon a continuing supply of fresh water for marsh flooding.

During low water years the small shrubs and tree hammocks which the kites use as nest sites become dry land and no longer used by birds that always construct over water. Instead the kites build in much less secure cattails and bulrushes. Nest collapse and failure part way through the nesting season became common. Biologists have taken collapsing nests and placed them in wire baskets atop poles in the water and the kites have accepted this management technique readily. These efforts have greatly enhanced nesting success.

Another threat facing the Snail Kite is the melaleuca tree, a native of Australia that is spreading across the Everglades, turning marshes into aquatic woodlands that the kite will not inhabit.

A final threat to the kite is global warming with its associated rising sea levels and the flooding of the Everglades with salt water, which would wipe out the freshwater apple snail.

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Mississippi Kite

Ictinia mississippiensis

GENERAL DESCRIPTION

The Mississippi Kite, a summer visitor to North America, is a slim, graceful hawk which is quite gregarious in its habits. The adult is easily recognizable with long, narrow, falcon-like wings, a long black slightly flared tail, gray underparts and a pale gray to white head. The immature has brown streaked under parts and a barred tail. Although not exclusively an insectivore, this kite specializes in the aerial capture of large insects such as dragonflies and cicadas. It glides much more than it flaps, and commonly forages in flocks above its nesting site. It also hunts from a perch. Mississippi Kites nest as solitary pairs and in small colonies of up to 25 to 40 pairs. Nests are located at the edge of riparian flood plain forest in the Southeast, in prairie shelter-belt trees on the southern Great Plains, and increasingly, in urban parks and golf courses in the south-central United States.

SIZE

The Mississippi Kite is a small raptor. Females are slightly larger than males. Lengths of females average 14 inches (36 centimeters) and males 13.7 inches (35 centimeters). Wingspans are up to 38 inches (96 centimeters) for both sexes. Weights average about 11.3 ounces (324 grams) for females and 9.3 ounces (266 grams) for males.

MORPHS

This species has no morphs.

SPECIFIC DESCRIPTION

Adult - Perched

- a slim, sleek gray hawk with a whitish to light gray head (paler on males than females)
- red eye; black feathers between eye and very small beak
- medium gray underparts
- darker gray back and upper wings
- very pale gray patch on midsection of folded upperwing (secondary feathers)
- blackish flight feathers extend past tip of tail
- longish flared black tail
- feet gray with orangish under toes

Subadult - Perched

- like adult but lacks the light gray patch on the upperwing surface
- blackish-gray tail banded with two to four narrow white bands on undersurface (retained immature tail)
- often has small white spots on gray underparts and some may retain immature streaks
- red eye; black feathers between eye and very small beak

Immature - Perched

- brown streaked crown and cheek; creamy eyebrow; dark eye; small beak with yellow cere and black feathers in front of eye
- unstreaked buffy throat
- underparts buffy, and heavily streaked with rufous-brown

- brown upperparts with very narrow rusty edges to feathers
- blackish-brown flight feathers show pale tips
- blackish tail crossed by three to four narrow white bands on undersurface

Adult - Flight

- very graceful and buoyant falcon-like hawk, with pointed wings; often glides.
- shows pale head, gray underparts, gray underwings, and black tail
- the leading primary is much shorter than the other primaries
- very narrow white trailing edge to inner underwing
- upper surface of wing shows broad whitish secondaries contrasting with dark wing tips.

Subadult - Flight

- like adult but its black undertail is crossed by three to four narrow white bands (retained from immature plumage)
- brown underwing linings and dark gray flight feathers
- small white spots on gray underparts
- lacks the white trailing edge of the inner underwing and the white secondaries on the upperwing surface

Immature - Flight

- dark head with white eyebrow and pale chin
- rufous-brown streaked underparts
- brown underwing linings and dark gray flight feathers
- black tail crossed by three to four narrow white bands

SIMILAR SPECIES

The Mississippi Kite has a very distinctive appearance and is not likely confused with many other species. Of all raptors, the White-tailed Kite most closely resembles the Mississippi Kite, but there are major differences between the two species. The White-tailed Kite has white, not gray underparts, a white, not black tail and black shoulders on gray upperwings, not white secondaries on gray upperwings. The immature White-tailed has a whitish tail, not banded like the immature Mississippi Kite. An immature Broad-winged Hawk superficially resembles an immature Mississippi Kite but has broad soaring wings and a generally whitish tail crossed by several narrow gray bars and whitish underwings. The Peregrine Falcon has a similar silhouette in flight but does not have an all black tail and whitish secondaries on its upper wing surface. The Merlin has a banded tail similar to the tail of a subadult or immature but is a much smaller, faster flying bird with a patterned face and barred flight feathers (undersurface). The immature Mississippi Kite is like an immature Peregrine Falcon but it has a different tail and no mustache.

OTHER NAMES

The Mississippi Kite has also been known as the Blue Kite, Gray Kite, Louisiana Kite, and Mosquito Kite.

ETYMOLOGY

The scientific name *Ictinia mississippiensis* translates to "kite" (iktinos - Greek) "of Mississippi" (mississippiensis - Latin form).

MYTHOLOGY

No mythology could be found for this species in North America.

RANGE

The Mississippi Kite breeds in central and southeastern Arizona, much of New Mexico, southeastern Colorado, southwestern and central Kansas, the western two thirds of Oklahoma, Texas, central Arkansas and along the valley of the Mississippi River and across the Gulf Coast states to South Carolina and south through Florida. Isolated populations exist in central coastal Texas, northeastern Alabama and northeastern Georgia. This species has recently expanded its western and northern ranges.

The Mississippi Kite winters in central South America. A few scattered individuals may occasionally winter as far north as southern Texas.

There are no subspecies recognized.

MIGRATION

The Mississippi Kite is a long distance migrant, like the Broad-winged Hawk and Swainson's Hawk, and in all likelihood probably follows similar routes through Central America. Virtually the entire North American population north of the Mexican border migrates to South America to spend the winter. This kite commonly travels in flocks numbering as high as 200 individuals or more.

Fall migration begins in mid- to late- August. Small groups of kites have already begun to assemble earlier in the month. August assemblies may also feed heavily to put on fat for their trip. More study is required concerning this aspect of their life history. Large flocks are often encountered into September. Most kites are south of the United States / Mexico border by mid-October. Little is known of this species' migration timing or routes through Mexico and Central America or of conditions on the wintering grounds where, presumably, it forages for insects. Two nestlings banded in the southeast United States in July-August were shot in October of the same year in Guatemala. Spring migration north through Central America is also poorly known. Migration peaked north of Veracruz, Mexico in the fourth week of April. By late April small numbers have reached Kansas, Oklahoma and the northerly parts of the eastern range. Re-occupation of colonies occurs usually by mid-May.

BEHAVIOR

The Mississippi Kite is well known for its graceful flight. Its foraging behavior is described below. It holds its wings quite flat with only the primary tips slightly upturned. It can hover like an American Kestrel and may dive or stoop vertically for several hundred feet at high speed. Occasionally it will rise, alone or in a flock, so high above ground that it becomes lost from view. It is not a conspicuous bird, however, and can be overlooked even in urban situations. The Mississippi Kite is gregarious and is rather tame around people.

The Mississippi Kite hunts in flight and by hawking from a perch. Hunting flights are invariably described as elegant and graceful with the kite effortlessly soaring, circling at various altitudes, and catching even fast flying prey, usually large insects, with slight, easy movements such as a turn, a rise or fall, a half barrel roll, and a quick foot extension to seize the prey. Characteristically a kite will suddenly spread its tail when sighting prey, hang for a second in midair, then close its tail and coast downward to capture the insect in its talons. The insect or other prey item is then held in the toes while the bird consumes it, often discarding inedible parts. Soaring depends upon suitable air currents found most commonly as the day warms; therefore, soaring is generally the most frequent foraging pattern used

during the middle of the day. Hawking from a perch usually involves a kite suddenly leaving its perch - often bare, dead branches above the canopy- to make a short, quick flight (< 16 yards) after prey which is either flying or on foliage. Hawking from a perch is the common foraging type early and late in the day, during windy or dead calm weather and while parents are feeding nestlings. Most foraging is done within a third of a mile of the nest. One study reported 96 percent of prey delivered from hunting within 450 feet (140 meters) of the nest. Occasionally, in response to a concentration of food at some distant location, kites as individuals or a group will leave a nesting colony to travel up to five miles (8 kilometers) directly across country to another area to forage. Kites also land on the ground, often near streams and, besides bathing and drinking, may also be attempting to catch amphibians. Sometimes kites will course harrier style low over prairies in search of prey. Kites also follow large mammals such as bison, horses, deer and people, which unintentionally act as beaters, scaring up insects for the kites to seize. Mississippi Kites will also follow a fire edge like harriers and several other raptors do, catching fleeing prey. Individuals also pursue bats in flight. Several people have fed flying Mississippi Kites by throwing large insects into the air for them.

It appears that the Mississippi Kite does not defend a nesting territory from other members of its species. It commonly nests in colonies often of four to six nests (individual nesting has also been widely reported). The proximity of nests to each other vary from one region to the next. The closest nests, averaging 377 feet (117 meters) apart were reported in shelterbelts on the Great Plains. Nests as close as 43 feet (13 meters) have been reported. In Arizona nests were on average 400 to 1800 feet (124 to 558 meters) apart. Individuals will band together to defend nests and colonies with calling, pursuit, and high speed diving at the intruding predator. Mississippi Kites have been reported responding very aggressively toward Great Horned Owls, striking them and forcing them to the ground.

Mississippi Kites will defend their colony against other birds of prey. They will also engage in joint attacks against people too close to the nests though reactions vary according to individual birds and time of nesting. Kites seem to be most aggressive toward humans at hatching time or shortly thereafter. Kites will dive at, and sometimes strike people near the nest tree. When several birds engage in such behavior simultaneously the effect can be dramatic.

The courtship of the Mississippi Kite is poorly known. Courtship may occur on the wintering grounds or on migration prior to the kites' arrival on the breeding grounds. More study is required. A swoop display and ritualized posturing by two adults perched on a branch have been reported, as well as pursuit flights with squeals and chipperings. Copulation is usually preceded by the male offering food to the female. Copulation may also occur without preliminaries as the two birds perch side by side. Copulation is brief. The female shows no marked posturing. The duration of the pair bond is not known.

The oldest, wild Mississippi Kite is known to have lived to be eight years old. It is suspected that mortality rates are highest in the individual's two years of life but thereafter a bird might live as long as an additional eight or nine years. Causes of mortality among fledged birds include shooting, formerly much commoner than it is today, though kites harassing people near their nesting colonies are sometimes shot. Among nesting birds egg-collecting was a significant cause of reproductive failure. Nest predators include fox, squirrels, raccoons, bobcats, American Crows, Swainson's Hawks, and Great Horned Owls. Snakes, and several other species of birds and mammals, may also be nest predators.

ADAPTATIONS

The Mississippi Kite feeds mostly upon insects. When the cold weather of North America's fall and winter arrive, insect life becomes very hard to find. A major adaptation to

insect scarcity is the kite's migration to South America where it can enjoy austral spring and summer. The kite also arrives on its North American breeding grounds much later than do most other North American raptors, matching its nesting efforts to the maximum abundance of insects in early summer. Another adaptation to its colonial nesting habits is colonial nest defense, wherein most flying members of the colony band together to harass potential predators.

HABITAT

The Mississippi Kite favors woodlands for nesting and woodland edge, prairie, grassland, and savanna for foraging. Most nests are located in tall trees near the woodland's or grove's edge. Large groves are preferred. In the East, kites nest in and forage over mature, undisturbed stands of hardwoods in the lowlands and along flood plains. In the central parts of its summer range the Mississippi Kite breeds in riparian cottonwood groves, oak savanna and mesquite savanna where individual nesting is common, and forage over the open spaces surrounding the nest trees. In Arizona and New Mexico, which the kite has recently invaded, cottonwood groves with salt cedar (Tamarisk) are common habitats. It has recently expanded into shelterbelts in the west where colonies are frequent. These are often rows of mature cedars and elms originally planted as long ago as the 1930s to control the soil erosion of the Depression. Kites forage over nearby open areas as well as over the nesting trees themselves. In the 1960s and 1970s kites began to appear in treed urban settings in many south-central cities such as Meade, Kansas and San Angelo, Texas, often appearing at golf courses. Mississippi Kites are able to inhabit a wide variety of woodland types as long as bare tree tops and high, dead branches are available for perches.

VOICE

The most common call is a two-noted whistle described as "phee-phew", which is often repeated, with the first syllable very short and the second syllable downward inflected, and about two to four times as long (at one half to one second in duration). The "phee-phew" call is given by adults and between adults and young. It is also uttered emphatically by kites when they are harassed by predators. A second call "phee-ti-ti-ti" is called by excited birds, in courtship feeding. The young make a quieter "Phee-phew" call by 14 days of age and "chipper" loudly. Hungry young just out of the nest call a high-pitched squealing when a parent approaches.

FOODS

The Mississippi Kite is highly insectivorous, although it is not a wholly obligate insectivore since it also eats some vertebrates including amphibians, reptiles, birds, and mammals. In one study, 11 percent of prey items brought to three nests were vertebrate prey. The bulk of its North American diet consists of large insects including cicadas, grasshoppers, dragonflies, and katydids. Other insects taken include Carabidae (ground beetles), Dytisidae (predacious diving beetles), Acrididae (short-horned grasshoppers), Scarabaeidae (scarab beetles), Hydrophilidae (water scavenger beetles), Silphidae (carrion beetles), Hymenoptera (sawflies, ichneumons, chalcids, ants, wasps, and bees), and Lepidoptera (moths). Mammals taken include bats and probably mice, ground squirrels, kangaroo rats, and young rabbits. Birds taken include Cliff Swallows and Chimney Swifts pursued in flight, young House Sparrows, and up to seven other species. Reptiles include three species of lizards, small box turtles, and a snake. Amphibians include frogs and toads. At least some vertebrate prey were scavenged road kills.

PELLETS

Because the Mississippi Kite is so insectivorous, its pellets are masses of crushed insect

exoskeletons, roughly cylindrical and about 1.18 inches (30 millimeters) long and 0.6 inches (15 millimeters) wide. So far, no pellets have been found containing bird or mammal remains though this species is known to pursue and kill birds and bats. This lack of evidence may be because the kite does not ingest bones, feathers or hair to begin with. More study is required here. Prey remains often litter active nests, sometimes cementing together the green leaves that are brought to the nest throughout the nesting period.

NESTING

The Mississippi Kite generally locates its nest high in deciduous trees near the edge of the woodland. Nests in the Great Plains have been found in several species of trees, with no particular preference, though cottonwood, elm, osage orange, and black locust account for 80 percent. Conifers are seldom used. Nests are located from 2.18 to 49.2 yards (2 to 47 meters) in height. Shelter belt nests are often at 6.5 to 11 yards (6 to 10.2 meters) and those in mesquite and oak savanna are generally at 3.2 to 5.4 yards (3 to 5 meters). Nest building is often quite leisurely but when they need to, pairs can build rapidly. Both sexes aid in construction. Most nests are located in crotches with three to four supporting limbs. Average dimensions of plains nests are 10.6 x 9.4 inches (27 to 24 centimeters) and 5.1 inches (13 centimeters) in depth. Nests often appear flimsy. The nest bowl is shallow and lined with green leaves. Both old kite nests and the nests of other species are used for nesting. Nest site tenacity is marked from year to year. Nests are generally used for two to three years. Rarely is a nest used longer. Occasionally other species like Mourning Doves and House Sparrows, as well as wasps, will share the same nest tree with kites.

Clutch sizes average two eggs, with one to three possible. For reasons that are not clear, about half the nesting pairs end up incubating only one egg. The egg is about 1.6 inches (41 millimeters) long and 1.3 inches (33.6 millimeters) wide. It is between elliptical and short subelliptical shape and is smooth without gloss. It is white. Both sexes incubate. Incubation lasts 29 to 31 days. Both parents forage for, carry food to, brood, and attend to the nestlings and grow increasingly defensive around the nest tree as the young grow. Very young nestlings are fed regurgitated, crushed insects until about day 11. Nestlings can stand well by three weeks of age and begin moving onto neighboring branches by about four weeks. First flight occurs at 34 days or earlier. Young are fed by their parents until at least 60 days of age. Feeding can take place both at the perch and on the wing. Mississippi Kites are single brooded and lay replacement clutches only after the loss of the nest's single egg or a single egg plus a nest early in the season. Yearling kites sometimes assist adult parents at the nest by sharing in incubation, brooding and nest defense.

CONSERVATION

The Mississippi Kite suffered a serious population decline around 1900 in the southeastern United States. Loss of riparian habitat may have been a major cause as well as shooting and egg collecting. However, by the 1950s, the southeastern population was recovering and the central and western populations were expanding due to colonization of prairie shelterbelts and the invasion of urban groves and golf courses for nesting. As well, Mississippi Kites expanded their range into Arizona and New Mexico. It appears that this species may still be expanding its range since numbers of kites have occurred beyond their usual range.

Threats to the Mississippi Kite seem few. Biocide poisoning has not been found. The species has attracted negative attention locally in several towns in Kansas, Oklahoma, and New Mexico where urban kites have dived at people who ventured too close to their nests in public parks, golf courses and along city streets. In one such case 28 kites were shot. Public education and conservation strategies are needed to avoid such disastrous ends to bird-human confrontations. In general the outlook seems positive for the Mississippi Kite.

However, conditions on the wintering ground are unknown, as are the effects of global warming and other hazards that await in the future.

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Bald Eagle

Haliaeetus leucocephalus

GENERAL DESCRIPTION

The Bald Eagle is a large, dark brown to blackish-bodied raptor that attains a white head and tail when it is about 4.5 years old. Up until that time, the plumage varies from an all brown juvenile stage through a series of brown bodied plumages that show varying degrees of white on the belly, on the underwings and on the back, with dark or mottled heads and tails. The white patches on the underwings of subadults always occur in the inner linings and "axillars" with some light areas shown in parts of the primaries. By contrast, subadult Golden Eagles always have dark inner wing linings. In flight, they are impressively large with wingspans that range from 6 to 8 feet (1.9 to 2.5 meters) with the smaller birds in the southern populations.

The in-flight profile is of a wide-winged bird whose head extends almost as far ahead of the body as does the tail behind. The wings are held flat when soaring and the wing beat is slow and fluid, rising higher on the upstroke than deeper on the downstroke. Although resident over its entire range (except for the colder parts of the northern interior of the continent), birds are highly mobile as they move from nesting areas to abundant food sources. Migration is well-developed.

SIZE

The Bald Eagle, along with the Golden Eagle, is the larger, regularly-occurring raptors in North America. Its size range is very close to that of the Golden Eagle with the upper extreme measurements of length and wingspan being only slightly longer. Females average slightly larger than males. Length measurements range from 28 to 38 inches (71 to 97 centimeters) and the average is closer to 31 inches (79 centimeters). The wingspan ranges from 66 to 96 inches (168 to 234 centimeters) with an average of about 80 inches (203 centimeters). Weights range from 6.5 to 14 pounds (2.9 to 6.3 kilograms) and average 9.5 pounds (4.3 kilograms). Northern birds are larger than southern birds with the largest breeding in Alaska and the smallest breeding in Florida. The variation in between is apparently gradual.

MORPHS AND MOLT

There are no color morphs of the Bald Eagle, but individuals may be in any one of six stages of molt. The first full plumage is the juvenile, followed by five basic plumages. The definitive or "adult" plumage is attained at the 5th basic stage. The sexes are similar looking and either one plumage per year is acquired or some molting is occurring all year except in winter months in northern birds. Each basic plumage is acquired by molts that begin during the spring and are substantially finished or completed by late fall of the same year. The new plumage is worn throughout the winter until the pre-basic molt begins the next spring.

The juvenile plumage is acquired during the 1st calendar year of life and is retained until the spring of the second calendar year when the first pre-basic molt begins. Thus the birds are about 5.5 years old (6th calendar year) by the time that they acquire the adult plumage. Adult-like plumage may first be observed when birds are 4.5 years old and they are all but indistinguishable from 5.5 year old birds.

Some field guides assign names to the various molt stages as follows:

Age	Plumage	Field	Name
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1st	year	Juvenile	immature
2nd	year	Basic	1 white-belly 1
3rd	year	Basic	2 white-belly 2
4th	year	Basic	3 adult transition
5th	year	Basic	4 adult
6th	year	Basic	5 adult

Variations in the adult plumage are known and commonly consist of degrees of dark feathering through the eye and crown of the head set against an otherwise white head. Entire dark feathers have been seen in white tails.

SPECIFIC DESCRIPTION

Adult - Perched

Apart from being slightly larger, the female plumage is identical to that of the male.

HEAD

- the entire head, neck and throat are white
- the beak and cere are deep yellow
- the eye is pale to buffy yellow

BODY

- the entire body on the under and upper parts is a dark brown to fuscous black
- the margins of the dark feathers are yellowish brown near the tips giving somewhat of a scalloped look to the body at close range

WINGS

- the wings are dark brown like the body feathering

TAIL

- the entire tail on both surfaces is white
- both the upper and lower tail coverts are also white
- occasionally, small flecks of brown may be seen near the base of a few feathers

LEGS

- the legs and feet are deep yellow
- the talons are black
- the tarsi are feathered with dark brown plumage

Immature (Juvenile - First year) - Perched

HEAD

- all head feathers are a dark, blackish brown
- some birds may have grayish feathering at the base of the beak behind the cere
- the basal portions of the nape feathers may be whitish
- the beak and cere are very dark
- the eye is dark brown

BODY

- the underparts vary from tawny to dark brown with the breast darker brown
- white streaking may be evident where the breast and belly meet or lightly over the

entire underside

- the vent area may be whitish in some birds due to fading
- the back and general upperparts are very dark brown to blackish

WINGS

- the coverts are generally dark brown, occasionally with buffy feather margins giving a tawny look that contrasts with the primaries
- the primaries and secondaries are sooty black

TAIL

- the tail is longer than in other plumages
- usually white in the central portion with dark coloration at the base and in a band across the tip
- from beneath, the tail looks whitish near the base with a dark terminal band much as in an immature Golden Eagle
- from above, it can look generally dark with a whitish central band
- some individuals will have a solid dark tail

LEGS

- the legs and feet are yellow
- the talons are black

Subadult (White-belly 1 - Second year) - Perched

HEAD

- the crown is a light buffy brown or tan that contrasts with the cheek and auricular area
- the sides of the face are a darker brown as is the neck
- the throat may show some light feathering and there may be a light area at the base of the beak
- the beak is predominantly blackish gray but some with paler gray cere
- the eye is buffy brown but may lighten to a cream color in some birds

BODY

- the breast is darker than the belly, giving the appearance of a bib even if it is variably streaked with white
- the belly and underparts are very variable and can range from being dark through to nearly white
- the back is generally dark but some white feathering may appear on the upper back to form an inverted triangular patch

WINGS

- the wing coverts are brownish olive and are variably mottled with white
- the primaries are dark brown to black

TAIL

- the tip has a dark band much as in juvenile plumage but overall the tail may appear somewhat lighter

LEGS

- the legs and feet are yellow
- the talons are black

Subadult (White-belly 2 - Third year) - Perched

HEAD

- the crown is palish gray brown
- the throat is largely whitish or buffy white that extends down to the top of the breast
- the cheek is more whitish and the auricular area is very dark giving the birds a look similar to the Osprey
- the beak is blackish gray with an increased amount of yellow mottling at the base that may look like a yellow spot and the tip is buffy-yellow
- the cere is mixed yellow and gray
- the eye is cream colored

BODY

- the breast is darker than the belly, giving the appearance of a bib even if it is variably streaked with white
- the belly and under parts are very variable and can range from being dark through to nearly white
- the back is dark but the upper back will still retain the whitish triangular patch found in White-belly 1 - Second year birds

WINGS

- the upper coverts are all brown but some birds retain white mottling
- the primaries are dark

TAIL

- identical to White-belly 1 age class

Subadult (Adult transition - Fourth year) - Perched

HEAD

- more closely resembles the adult plumage
- basically white all over with brown streaking on the crown and forehead
- a brownish or grayish stripe extends through the eye and back towards the rear of the head
- the beak is yellow with a dark line extending from the nasal area along the crest of the upper mandible
- the cere is essentially yellow or mottled with gray
- the eye is pale yellow

BODY

- most of the body feathers are dark brown but some white flecking may occur on the belly

WINGS

- the coverts are dark brown and may show some white flecking
- the primaries are dark

TAIL

- the tail is mostly white on both surfaces with some dark banding in the terminal portion

LEGS

- the legs and feet are yellow
- the talons are black

Subadult (Adult - Fifth year) - Perched

HEAD

- overall white feathering with usually less brown flecking than in Adult transition -

Fourth year birds

- brown streak through the eye is usually less extensive
- the beak is yellow or mostly yellow
- the cere is yellow
- the eye is pale yellow

BODY

- all of the body feathers are dark brown with the margins of the tips a buffy brown color

WINGS

- the coverts are dark brown with buffy edges
- the primaries are dark

TAIL

- the tail and the coverts on both the upper and lower surface are white
- brownish flecking may occur throughout
- there is a dark irregular band on the tip of the tail

LEGS

- the legs and feet are yellow
- the talons are black

Adult (Adult - Sixth year) - Perched

As described above.

Note: Both sexes very similar, but female may appear larger.

- a large raptor with a dark brown body with a white head and tail
- the underwings are all dark as are the uppersides of the wings
- the head appears to extend as far in front of the bird as the tail extends behind
- in soaring birds, the wings appear very long and uniformly wide throughout their length although they are narrower than the wings of first-year birds
- the wings are held flat when soaring with no hint of a dihedral as in a Golden Eagle and they are held at right angles to the body
- the wing beat is slow and describes a large arc, rising higher on the upstroke than they plunge on the downstroke

Immature (Juvenile - First year) - Flight

- overall, the appearance is of a very large dark raptor with a dark head
- the back and upper wing coverts are tawny brown and contrast with the dark flight feathers
- the dark brown breast contrasts with the tawny belly and the undersides may have some white streaking in places
- the tail may be noticeably longer than in older plumages and it may be all dark or generally dark with a pronounced central whitish band. It can be broadly rounded
- the axillaries and most underwing coverts have whitish patches
- the longer secondaries with toothed points help to give the trailing edge of the wing a serrated look

Subadult (White-belly 1 - Second year) - Flight

- the breast is dark and contrasts with the variably whitish belly

- the wing linings are variably mottled white contrasting with the darker extremities of the flight feathers
- all birds retain some juvenile secondary feathers that produce an uneven trailing edge to the wing
- the tail has a variable amount of white with a dark tip on both surfaces
- the upper surface of the birds are generally dark but the interscapular area is a mottled white, or tawny, with an inverted white triangle

Subadult (White-belly 2 - Third year) - Flight

- the breast is dark and contrasts with the variably whitish belly
- the wing linings are variably mottled white contrasting with the darker extremities of the flight feathers
- all juvenile secondary and primary feathers are replaced, except one or two at most
- the tail has a variable amount of white with a dark tip on both surfaces
- the upper surface of the birds are generally dark but the interscapular area is a mottled white, or tawny, with an inverted white triangle

Subadult (Adult transition - Fourth year) - Flight

- these birds appear more adult-like in that they have whitish heads and tails that contrast with the darker bodies, but they lack the hard line of definition
- the underparts are dark brown with varying amounts of white flecking
- the upperparts are dark but there may be a hint of lightness in the upper back on some birds
- the tail is more extensively white with a brown terminal band and some brown flecking throughout

Subadult (Adult - Fifth year) - Flight

- this is essentially a very adult-like plumage with a white head and tail contrasting with the overall dark body
- the body contour feathers are dark brown with buffy edges
- has irregular dark band on tail
- at any distance, this plumage may be impossible to distinguish from the Adult - Sixth year or full adult plumage

Adult (Adult - Sixth year) - Flight

- this is the adult plumage and is as described above

SIMILAR SPECIES

In terms of regularly occurring species within continental North America, no other species resembles the distinctive adults. The White-tailed Eagle has a creamier head, a shorter, wedge-shaped tail and brown undertail coverts. The Steller's Sea-Eagle is larger and has huge white shoulder patches and a longer, more wedge-shaped white tail than the Bald Eagle.

The juvenile Bald Eagle is more likely to be mistaken for a Golden Eagle, but the white wing linings (axillars) and more prominent head in flight distinguish all subadult Bald Eagles from all plumages of the Golden Eagle. The white marks in the underwings of an immature Golden Eagle is in the primaries not the inner wing linings. The immature White-tailed Eagle is similar in all plumages to an immature Bald Eagle but generally appears darker underwing with less white in the axillars and the tips of the tail feathers have white spikes. The long,

wedge-shaped white tail of the immature Steller's Sea-Eagle distinguish the various brown plumaged birds from their similarly-aged counterpart Bald Eagle.

OTHER NAMES

The Bald Eagle is also popularly known as the "American Eagle", "Bald-headed Eagle", "White-headed Eagle", "Brown Eagle" (immature), "Fish Eagle", "Old Patriarch", "Common Eagle", "White-headed Sea Eagle", and "Sea Eagle."

ETYMOLOGY

The genus *Haliaeetus* is Greek for "sea eagle" and is formed from "halos" meaning salt and "aetos" meaning eagle. The reference is clearly about the fondness of this species for ocean edge habitats. The specific name *Leucocephalus* is Greek for "white-headed" and is formed from "leukos" meaning "white" and "kephale" for "head." Bald is used with its less common definition meaning "marked with white" in obvious reference to the head and tail of the adults and possibly the patchy white markings of the various subadult plumages.

MYTHOLOGY

Eagles have had a long history of symbolic omnipotence and superhuman attributes in many societies. Such characteristics as courage, freedom, independence and truth are common. There are over 300 ways in which various parts of the Bald Eagle's anatomy have been modified in art to impart some meaning, atmosphere or interpretation. The Bald Eagle is an ingrained part of the mythology of many North American Indian peoples and the feathers have been used as part of the head dress for some groups. Carvings and totems are typical amongst coastal communities. As a major recognition of the esteem with which this bird is held, the Bald Eagle was declared the national symbol for the United States of America in 1782, despite the paradoxical opinion that the bird was of questionable moral character, dishonest, cowardly and a feeder upon dead matter and offal.

RANGE

Breeding birds occur in the north to the limit of the treeline from Alaska including the Aleutian Islands across Canada to Newfoundland. The Bald Eagle is apparently absent from Keewatin, the arctic archipelago, and northern Quebec. In the west, the breeding range extends south through British Columbia to northern California, northern Nevada, and northwestern Colorado. It becomes disjunct further south but populations breed in Arizona, New Mexico, and northern Mexico. East from British Columbia, it breeds in the forested regions of all of the provinces and south into the states surrounding the Great Lakes and vicinity such as Minnesota, Iowa, Wisconsin, Illinois, Michigan, and northern Ohio, Pennsylvania, and New York. Breeding also occurs along the east coast from Maine south to Florida and along the Gulf coast to Texas. The Bald Eagle is generally absent as a breeder throughout the remaining states.

Wintering birds can be found in the Aleutian Islands and along the south coast of Alaska south along the British Columbia coast and inland across the southern one-fifth of the province. Wintering birds can also be found throughout southernmost Canada and south throughout most of the United States but with higher concentrations along the upper Mississippi drainage and sporadically throughout such central states as Colorado, New Mexico, Wyoming, Oklahoma, Kansas, and Nebraska.

Birds can be found year-round in the Aleutian Islands and south along the Alaska and British Columbia coasts to northern California. Inland, the Bald Eagle occurs from about the southern one tenth of British Columbia to northwestern Colorado. Resident birds can also be

found in the Great Lakes states, east along the St. Lawrence drainage, and south along the east coast to Florida and Texas.

The Bald Eagle only occurs in North America and two races are recognized. *Haliaeetus leucocephalus leucocephalus* breeds in the southern United States and Baja California south of an arbitrary 40 degrees of latitude. This race intergrades with *H. l. alascanus* that occupies the remaining range north to Alaska.

MIGRATION

The movement patterns of the Bald Eagle is complex. The continental picture consists of some seemingly simpler north-south migrations, local movements, post-breeding dispersal north by southern breeders, east-west shifts, and aggregations at significant food supplies followed by movements to other major food sources (in any direction). These, coupled with movements by resident birds, widespread winter population shifts and large winter ranges can make it difficult to analyze patterns based upon isolated observations or limited data.

In some areas, eagles are resident near the nesting locality and return to the nest for roosting. Elsewhere, lack of year-round food or harsh weather force them to migrate. In general, northern breeders tend to go south after the nesting season and some southern breeders (as far north as 49 degrees) move northwards after nesting and move south again during the fall. These northbound birds may arrive in the territories of northerly breeders while young are still in the nest. Recently fledged birds in southern Canada and the northern United States will migrate south in the fall, but their breeding range will be filled with southbound migrants that were fledged in the northern parts of the continent. Thus, areas may be utilized by eagles on a year-round basis, but they are different birds.

Virtually all migration movements are confined within the overall North American breeding range. Migration seems to take place throughout the day, particularly in the fall, with no pronounced peaks or lulls, although some reports indicate increased activity during the afternoon. Local weather and thermal conditions dictate when birds tend to take flight. Flight elevations for some birds are so high that they pass areas largely unnoticed, but most birds probably average between 600 and 1,800 feet (186 and 558 meters) above ground. The average distance traveled by birds in one study in the west was about 60 miles (96 kilometers) per day but one bird traveled 300 miles (480 kilometers) in a single day. The earliest southbound migrants tend to be the young of the year, and in general, they are also the latest to return north. Family units do not appear to function as a group during migration, but rather, travel independently. Adults generally return to their nesting territories and young birds may return to the general vicinity or disperse widely in many directions from the wintering grounds.

To add a touch of confusion, it should be noted that there is much in the way of local movements over a distance of several hundreds of miles that occur as non-breeding birds fly "circuits" over a period of several weeks or months. Fall migration can be protracted as birds visit local food concentrations for varying lengths of time (days or weeks) enroute to the final wintering destination which may not be reached until January or February. Some wintering birds become relatively sedentary with localized movements while others continue a nomadic lifestyle. As well, movements to local food sources such as salmon spawning sites in the Pacific Northwest occur during November and December with departure again during January or February as the food supply dwindles and birds move to local nesting territories, other food sources, or simply start the general migration north. As well, some birds will make tentative northbound movements in the spring of perhaps 100 or more miles (160 kilometers). They may remain at the new site for a few days and then return to the original departure point, only to depart again later in the season. Thus, it is not unreasonable to expect mobile eagles during many or all months of the year somewhere in North America.

During September and October, birds move easterly along the Gulf of Alaska. Presumably not just from areas to the north, large numbers of eagles congregate along the Chilkat River during October and remain until late December. Cold weather and diminished food sources during January cause juveniles and immatures to move south into British Columbia and Washington state. Adult and subadult birds move west to the coast and perhaps northwest as far as Cook Inlet. Adult-plumaged birds arrive on the Chilkat later and stay later than brown-plumaged birds.

Through the Pacific Northwest, there is a complex picture involving resident birds, southbound migrants and birds moving north while others move south. There is a fall southerly movement along the coast fed in part by birds from the interior of British Columbia and western Canada. There is also a movement south throughout the western cordillera as birds visit known food sources enroute to wintering sites such as the Klamath Basin, Idaho, Utah and Nevada. Movements are between October and December. Birds from northern Alberta and the MacKenzie River drainage move into the western interior states primarily during October and November. Birds from parts of north central Canada such as Saskatchewan and Manitoba move into the southern midwest states from October through early February with the Missouri River drainage being a major wintering area. By the end of January or early February, they have reached states such as Arizona, New Mexico, Texas, and Michigan.

Movements through the Great Lakes and northern Mississippi River drainage reaches a peak in late December as birds move into states bordering the river. Some birds from the Great Lakes area and north will however, move westward to the Rockies and eastwards to the Atlantic coast south of Maryland. In the maritime provinces and New England states, some migrants are noted as early as late August with the movements largely finished by late November.

Northbound birds in the west are well in evidence as they pass through the northern tier of states from late February through late March and early April. Birds pass out of New Mexico from early to mid-March and are generally gone by the first of April. Coastal movements seem less-well understood due to the large number of resident birds that are difficult to separate from migrants. Recently-fledged birds in the Pacific Northwest can be heading in a northerly direction to food sources in Alaska and northern Canada by August. A large concentration of eagles occurs on the Stikine River during April with birds probably coming from Alaskan wintering grounds as well as more southerly wintering areas. Young California birds in their first summer-fall, move north to other food sources and then south again later in the year. From the western interior states, wintering birds move along the eastern foothills of the Rockies and on into the MacKenzie and other drainages. This movement passes the Canadian border during March and April but non-breeding birds are still moving northwards in the Northwest Territories as late as early August. The adults move in a fairly direct fashion but immatures tend to wander more erratically northwards and include some east-west wanderings in their migration.

Spring migrants in the central portion of the continent leave the southern United States during March and April and are back in Saskatchewan beginning in March. Northern passage through the Great Lakes occurs from February through May and March through April for the northeast states and maritime provinces. Recently fledged birds depart north from Florida from late March through May, dispersing along the Appalachian chain and inland along waterways and lakes. Movement can be rapid as some birds have arrived in Canada only one month after leaving Florida. The pattern of moving north after breeding occurs in birds as far north as Chesapeake Bay and is not restricted to the most southerly breeders in the United States.

In some wintering areas, particularly the Pacific Northwest and Alaskan coasts, movement during the winter months is noted in relation to the patterns of aquatic food supplies. Typically, eagles move onto salmon bearing streams during late November, December and January to take advantage of late spawning species of pacific salmonids. The peak numbers on many of these streams occur during January with steady and at times rapid declines noted through February and March. Some rivers such as the Skagit, Skykomish and Columbia in Washington State, or the Fraser and its tributaries in British Columbia penetrate considerable distances into the interior areas. Birds wintering in more inland sites may simply depart northwards from there during the early spring. From other rivers, they may migrate westward to the coast and thence north to the breeding territories. Elsewhere, winter movements may not be on the scale of the coastal shifts, but birds may travel over large winter ranges that can reach 600 square miles (1,554 square kilometers).

BEHAVIOR

The flight of the Bald Eagle is deliberate, steady and more fluid than stiff. The wing beat is slow, describing an arc with the wings being raised higher on the upstroke than the depth of the downstroke. Flapping may be continuous or not at all as the bird soars on stiff wings held horizontally at right angles from the body. The Bald Eagle is a very agile flier for its size and performs quite spectacular aerial maneuvers at times. Birds often perch on large dead trees, live conifers, or man-made objects such as power poles.

During the winter, eagles leave the roosts to feed early in the morning. Depending upon weather and other conditions, they may depart between two hours before and one hour after sunrise to fly to favored feeding areas. Feeding activities may be bimodal with one peak before 10:00 am, and another 1.5 hours before sunset. In some areas, there may be major feeding activities between 1230 and 1400 hours.

Hunting may be grouped into at least 12 basic strategies, as follows:

Perch and Wait

- birds sit atop a vantage point such as a snag or cliff and swoop down to grasp their prey. It is a very successful technique.

Ground Perching and Hunting

- numerous examples exist of birds walking through colonies of gulls and seabirds and even excavating burrows.

Low-level Flight

- birds will fly low over water or land and snatch prey with their feet, including fish swimming near the surface.

High Level Flight

- some hunting is done by soaring over water or land and then swooping down upon the prey.

Hovering

- birds will hover above the water before plunging in after prey or they will hover over ducks and coots in order to cause them to dive repeatedly and tire themselves out.

Aerial Attack

- ducks and geese will be taken in flight as the eagle overtakes them and will sweep beneath them, roll over and sink its talons into the underside of the victim.

Flushing

- birds will alight on the ground near prey or walk through bush in order to flush their quarry.

Cooperative Hunting

- two or more birds have been seen to chase prey or drag prey ashore through water. One wonders if this is truly cooperative or competitive as certainly if one bird can make off with a kill, it will do so at the expense of the others.

Piracy

- the Bald Eagle will harass Ospreys and other raptors for their prey.

Carrion Eating

- this is a frequent source of food during the winter at salmon spawning sites, on carcasses of wild and domestic mammals or opportunistically as dead animals are found at any time of year. The after-birth of domestic cows and sheep as well as stillborn young are eaten regularly.

Using Beaters

- the Bald Eagle will follow other animals and capture suitable prey that is flushed.

Wading in Water

- the birds will wade in water and snatch fish with their beak.

Much of the Bald Eagle's prey is seized with the talons and dies from puncture wounds. The swoop or dive is made with outstretched feet and one or both feet used to snatch the prey, depending upon its size. Some live food is taken with the beak such as when fishing by wading. Food may be consumed in flight but feeding platforms such as nests are used.

The Bald Eagle is somewhat more social than many raptors. The minimum distance between nests can be as low as 400 feet (124 meters) but distances vary from 0.25 miles to 1 mile (0.4 to 1.6 kilometers) or more. Defense of the nesting territory varies from minimal to full flight pursuit of intruders. Primarily, they have a reputation of seldom attacking a human intruder approaching a nest. Rather, they fly off and perch or disappear. After hatching occurs, nest defense may be more aggressive and climbers to a nest have been struck. Approaching helicopters have been attacked. Communal roosting at night is common in winter and one roost tree may fill before nearby trees are used by incoming birds. Signs of hostility are limited. Day roosts near food supplies such as salmon streams can have hundreds or thousands of eagles in close proximity and communal feeding on carcasses occurs with tolerance of other eagles. Play has been noted between individuals that includes dropping and catching sticks while in flight along with a variety of aerial maneuvers and chase activities.

The defended territory size varies from as small as 0.5 to 0.8 square miles (1.3 to 2.1 square kilometers) in Florida to about 2.4 square miles in Saskatchewan (6.2 square kilometers). In coastal Alaska, defended territories averaged 0.1 square miles (0.3 square kilometers; 57 acres) and some were as small as .05 square miles (0.1 square kilometers; 28 acres). Coastal eagles in British Columbia may only defend an area more or less above the nest site in the shape of a cone. In areas of high density and abundant food supply, territorial aggression may be reduced given that it could become a major pre-occupation if every eagle that flew by was attacked by a nesting pair. Tolerance would be an advantage from the perspective of energetics and maintenance of essential nesting duties. Home ranges do not seem to have been studied a great deal but have been estimated at 1.2 to 5.5 square miles (3.1 to 14.2 square kilometers) in Oregon, and in Arizona they averaged 25 square miles (65 square kilometers). In coastal Washington state, the average territory was about 3.2 square miles (8.3 square kilometers) in the San Juan Islands but the defended area

was likely much smaller.

Pair formation likely occurs before the full adult feathering is attained. Birds in pre-adult feathering engage in high soaring, pursuit flights, talon-grasping and other activities normally associated with pair formation. The pair bond is believed to be life-long but a lost mate is replaced and often quickly. Maintenance of the bond is achieved through soaring together, billing, stroking each other, nest building and repair, sitting together on the nest and the male bringing food to and feeding the female.

"Pursuit flights" begin during the early spring where individuals chase others in rapid flight. "High soaring" and pursuit flights will also occur together during the pre-nesting period. An undulating "sky dance" has been described that may be used to advertise territorial limits. To display his presence, the male may simply engage in a "fly around" display that occurs before nest building. Another aerial display consists of the two birds locking talons after a series of swoops and dives and then spinning rapidly downwards only to separate just before crashing into the earth or water below. Perched birds will engage in a "head toss" display by tossing the head backward and then forward and down. Loud calling starts during the backwards phase. This may be used to elicit a duet from the female or to indicate concern about intruders.

Copulation occurs on a solid support such as a tree branch. It begins with the pair perched side by side. Either sex may then approach the other, calling softly. If the female initiates the action, she lowers her head and spreads her wings somewhat. The male then flaps his wings and pumps his tail after which the female positions herself with a lowered head. With his talons curled in a ball, the male then steps aboard her back and maintains his balance by wing flapping during copulation which is brief. It can occur before, during or after nest construction but most copulation occurs from six days before to three days after the laying of the first egg.

Territorial defense may be as limited as a few vocalizations when other eagles fly by, or it may consist of aerial pursuit of intruders until they have left the territory.

Some studies suggest that at least 20 percent of migratory birds survive until they are three years of age. Aleutian populations may see as many as 90 percent of fledged birds die before reaching adult plumage and possibly 5.4 percent of adults dying annually. Mortality has been attributed to winter starvation, shooting, electrocution, cold weather, accidental trapping, eating poisoned carrion intended for other animals, pesticide poisoning, mercury poisoning, lightning, collisions, a variety of diseases and occasionally by other birds of prey such as territorial falcons. A captured nestling lived for 20 years during the United States Civil War only to die prematurely due to the inhalation of greasy smoke. Fifty years has been described as "not unusual" for captive eagle lifespans.

ADAPTATIONS

The social nature of the Bald Eagle is of benefit in allowing food resources such as spawning salmon and carrion to be exploited during the winter. It has one of, if not the widest prey base of any raptor in North America.

HABITAT

Apart from habitat that is being flown over in migration, the one common factor of the habitats frequented by the Bald Eagle throughout much of the year is the presence of water. It is found throughout a wide variety of climatic zones and ecosystem types that include salt water coastlines, archipelagos, estuaries, arid interior ecosystems, boreal forests, mixed coniferous and/or hardwood forests, wet agricultural lands such as rice paddies or pastures

with seasonal standing water, large freshwater swamps with trees interspersed or bordering them, older age wet coastal rainforests and dry interior coniferous forests. Areas that have more extensive land-water interfaces are preferred over areas that lack substantial aquatic habitats. Bald Eagles are absent or in very low numbers as breeders throughout the interior grasslands and prairies of the continent unless a major river, lake or reservoir creates suitable habitat. Foraging habitat within these varying ecosystems tends to be open and spacious with little foraging done under the canopy of adjacent forests.

During the winter, the Bald Eagle will hunt over open country, particularly, but not always when aquatic ecosystems are frozen. Agricultural areas that produce carcasses are favored places to hunt. In Arizona and New Mexico, the Bald Eagle is frequently seen away from water bodies over upland habitat at elevations where the winter weather is more severe. The prey base is more concentrated in these areas than in more temperate locations. Open gravel bars and beaches are preferred over brushy river banks for feeding, but these may also be the places where food resources such as salmon carcasses tend to accumulate. Estuary islands with few or no shrubs but with drift logs or rocks for perching are well-used as are small, rocky islets or wooded islands.

Some key habitat attributes are the presence of water capable of supporting populations of fish or waterfowl, large trees for nesting with clear approach flight paths, snags for perching within 100 feet (31 meters) of watercourses, roosting trees, trees interspersed with open areas, especially near water, and nesting sites that are relatively free of human disturbance. In the Pacific Northwest, the preferred nesting habitat consists of dominant or codominant trees in a heterogeneous mature or old growth coniferous stand. Coastal nests tend to be within 600 feet (186 meters) of the shoreline but some may be as far as 1,600 feet (496 meters) inland. Other studies indicate that at least 85% of all Bald Eagle nests are within one mile (1.6 kilometers) of a major water body.

Perches may consist of trees, logs, rocky outcrops, pilings, driftwood, ice, the ground, haystacks, powerlines and fenceposts. A very small percentage of Bald Eagles are seen perching more than 600 feet (186 meters) from a river, lake or water system and most are probably within 100 feet (31 meters). Most tree perches are bordered by at least one edge type ecosystem that is quite open. The Bald Eagle avoids roosting in dark, woody growth and selects large diameter trees with numerous horizontal limbs such as black cottonwoods or Douglas-fir, that offer clear viewing in one or more quadrants. Along rivers, eagles may tend to concentrate on points of land or at bends in the river. Day perches tend to be located close to food sources and although the eagles must be opportunistic about selecting somewhere to perch, preferences are shown whenever choices are available.

Night roosting habitats are not necessarily near water and can be nearly 20 miles (32 kilometers) away from the nearest feeding area, but most are likely within 5 miles (8 kilometers). Protection from wind is a key characteristic of these roosts and if it is not provided by the tree stand, then the aspect and exposure of the site are critical. Leeward slopes or wind-protected canyons or valleys are examples of favored roost locations. Roost tree species vary from many types of conifers through deciduous trees such as cottonwood, elm, willow and oak or maple.

VOICE

The voice is rather thin and weak for a bird of this size. The female's voice is lower pitched. When disturbed at the nest, the adults utter a kah-kah-kah and if annoyed by the presence of other eagles or large birds they will give a ye-ha-ha-ha or whee-he-he-he repeatedly and with variations. This latter call has been likened to the "neighing" of a horse. Gull-like wails may be mixed with these calls. Similar calls are given by the female when soliciting food or copulating. The wail is also used during pair formation. Adults during

display and hungry nestlings will also give a yaap-yaap-yaap call that also has a wailing or gull-like quality. A "chitter" call is given by both sexes when changing over nest duties or during other activities around the nest site.

FOOD

Collectively, the Bald Eagle is an opportunistic feeder with a large number of prey items recorded. Over 250 species of fish, birds, mammals, reptiles, amphibians, and invertebrates are known to have been consumed by eagles continent-wide. Clearly, the diet varies geographically and particularly seasonally as these birds adjust their feeding behavior to take advantage of the most readily-available food source. Live prey is taken frequently but some consider the Bald Eagle to mainly be a carrion eater given that its food is often dead or dying from other causes before being eaten. Small amounts of vegetable matter are also eaten, whether intentionally or incidentally while consuming animal prey.

Overwhelmingly, fish is the single most important food type but birds and mammals are also heavily consumed. Conclusions from studies of diet seem variable. Some studies suggest that coastal eagles eat more birds and less fish and mammals than inland eagles that ate more fish and mammals and less birds. Other studies showed coastal birds eating more fish and birds whereas eagles from dry, interior ecosystems were almost entirely mammal eaters. Despite the inevitable variations, reptiles, amphibians and all other species are a small percentage of the diet compared with fish, birds and mammals. These latter three groups represent more than 90 percent of the Bald Eagle diet across North America.

One summary of diet studies showed the following percentages of foods:

Food type	Prey items	Biomass
Fish	32%	33%
Birds	43%	35%
Mammals	19%	32%
All others	6%	.1%

Another summary showed the results of various studies on a geographic basis:

FOOD	Coastal Group Number 1	Coastal Group Number 2	Eastern States	Kansas
Fish	65%	19%	52%	0
Birds	19%	59%	33%	1%
Mammals	1%	5%	5%	99%

In Cape Breton Island, Nova Scotia, fish were 66 percent of all prey items and were found in 92 percent of all samples of eagle diets that were studied. Cod totaled 71 percent of the fish component.

The total list of fish species consumed is long and does not only reflect fish that are easy to catch live because they primarily live near the surface. Some deep dwellers come near the surface to spawn or their carcasses become accessible after the breeding season. Some examples of known prey include all pink, chum, coho, chinook and sockeye salmon, kokanee, rainbow trout, herring, eulachon, Pacific sandlance, various flounders, sculpins, various rockfish including red snapper, dogfish, various species of catfish, suckers, carp, perch, pollock, striped bass, mackerel, gizzard shad, sheepshead, blue pike, northern pike, pickerel, sunfish, mullet, shiners, eel and char. Entrails or unwanted species from fishing operations are often taken in inshore waters.

The total list of birds eaten throughout North America contains the most number of

species of the 3 main food groups. Many are taken as live prey but carrion or hunter-wounded species are also eaten. The following list gives some sense of the size and variety taken: loons (2), grebes (5), Northern Fulmar, shearwaters, petrels (2+), Brown Pelican, cormorants, Great Blue Heron, Cattle Egret, herons (6), Canada Goose, Emperor Goose, ducks (20 +), ptarmigans, domestic chickens, Black Oystercatcher, Wild Turkey, Sora, American Coot, gulls (7+), tern (2+), murre, auklets, puffins, murrelets, Northern Flicker, Common Raven, sparrows (3), Lapland Longspur, and Rosy Finch.

As with fish and birds, mammal prey is taken live or eaten as carrion. Live prey tends to be the smaller species such as rodents or ground squirrels with larger animals eaten as carrion. Examples of food items include introduced and native hares and rabbits, various ground squirrels, fox pups, Norway rats, sea otter pups, young pigs, muskrats, opossum, skunk, voles, weasel, marten and as carrion, white-tailed and mule deer, elk, whales, sea lions, domestic sheep and cattle and miscellaneous road killed animals. The afterbirth of domestic livestock is eagerly eaten but documented examples of calves or lambs being killed are few. Other scavengers such as ravens and magpies or coyotes cause injury or death to domestic animals before the Bald Eagle takes advantage of the carcass.

The list of reptile and amphibian species taken is short but includes frogs, black rat snake, racers, and musk turtle.

There are at least 20 species of invertebrates eaten and many are marine organisms including squid, octopus, abalone, crabs, mussels and amphipods.

Much misinformation surrounds the maximum size of prey that an eagle will attack or can carry away. In all likelihood, based upon experiments to test weighted flight capacity, prey items weigh no more than five pounds (2.3 kilograms) and usually much less. It is unlikely that an eagle could fly very far with items weighing five or six pounds (2.3 to 2.7 kilograms). A bald Eagle can drag objects in water weighing over 10 pounds (22 kilograms) for very short distances (25 feet [8 meters] or less).

PELLETS

Bald Eagle pellets are quite large, averaging 4 inches (10.2 centimeters) long and 1.5 inches (3.8 centimeters) wide. While mammal and bird remains are well-represented, fish may be under-represented in pellets due to the relative ease with which they are digested, especially smaller ones.

NESTING

Nest sites are generally in a forested area and not far from a major water body. In essence, while nests may be within a broadly forested zone, they are located close to the edge of larger openings created by lakes, rivers or seacoasts, grasslands and so forth. Most, if not all nests are within one mile (1.6 kilometers) of a major water body and the highest percentage are within 600 feet (186 meters) of water. Nests are primarily in trees with coniferous, preferred but large, flat-limbed deciduous trees are used. The tree species vary geographically and include Douglas-fir, ponderosa pine, red pine, loblolly pine, sycamore, elm, cypress, mangrove, and black cottonwood. The selected tree is usually taller and generally larger than the surrounding trees or is more isolated than the others. A clear flight approach from the water side is preferred and perch trees or elevated lookouts are located nearby. The stands are generally mature or old-growth with second growth shunned by nesting eagles. The nest may be built at almost any height from the ground up to 80 feet (24.8 meters) but most nests are in excess of 30 feet (9.3 meters) and the average may be closer to 50 feet (15.5 meters). In treeless areas, nests are built on the ground, on hillsides, ridge tops or sea stacks on offshore islands. Manmade structures are used.

Nests are constructed of branches, sticks and debris of various kinds. Recently-constructed nests that have not been refurbished vary in height from one to three feet (0.3 to 0.9 meters) and from three to six feet (0.9 to 1.9 meters) in diameter. Over the years, the nests are repaired and added to such that the largest may reach 20 feet (6.2 meters) in height and over 9 feet (2.8 meters) in diameter, weighing some 4,000 pounds (1,814 kilograms). Most probably last only about five years but some have been refurbished and used for 35 years. One nest tree was used for over 70 years in Alaska. The interior cavity used to receive the eggs is a depression about 4 inches (10.2 centimeters) deep and 14 inches (35.6 centimeters) in diameter. The lining is comprised of finer items such as grasses, sedges, seaweeds, Spanish moss or other plant materials. Leafy twigs are added during the nesting period. Up to five extra nests may be built within one mile (1.6 kilometers) of the main nest with some as close as 0.25 of a mile (0.4 kilometers) away. Both sexes bring nesting material but the female does most of the construction.

Bald eagles are single-brooded with two being the typical clutch size, although if not two, it is more likely to be three than one. The eggs average 2.8 inches long (71.1 millimeters) by 2.1 inches (53.3 millimeters) wide but may be as large as 3.3 by 2.5 inches (83.8 by 63.5 millimeters) or as small as 2.3 by 1.9 inches (58.4 by 48.3 millimeters). They are rough-shelled, white and non-glossy. If the first clutch is lost early enough, a second may be laid after four weeks or more but captive birds may replace eggs earlier. The number of replacement eggs may not equal the number lost. Egg laying starts as early as October 26 in Florida with the normal laying period becoming progressively later as you move westward and north such that in parts of Alaska, May is the normal end of the laying period. Between late October and mid-May, egg laying occurs in virtually every month somewhere in North America.

The interval between egg laying can be as much a four days with an incubation period of 34 to 36 days. Both sexes incubate with the female probably doing most of the day time incubation. The nestling period is 10 to 12 weeks with constant attention by at least one parent during the first two weeks. Brooding the young at night lasts for at least four weeks after which the young are quite mobile and they move from the nest cup to the outer portions of the nest. Siblicide is documented but is apparently less common than in the Golden Eagle. The killed young is often eaten. The family bond during the early flight stage is of variable duration and ends between six and 13 weeks after fledging. Following dispersal, birds may return to the general area of their birth during their second or third calendar year. In declining populations, the fledging rate may be as low as 0.34 young per nest whereas stable populations fledge at least 0.75 young per nest. A high of 1.03 fledged young per nest was noted in populations that were increasing. Widespread studies and summaries show that about 43 percent of territorial pairs produce young and that about 58 percent of occupied nests were successful.

CONSERVATION

Once much more common across North America than today, the Bald Eagle saw its first major impacts during the late 1800s as settlement spread across North America and prey populations were decimated and habitat changed or lost. Extensive declines in Bald Eagle populations were noted during the 1950s and by 1978, it was listed as "Endangered" or "Threatened" in the coterminous United States. At this time, it was estimated that fewer than 500 pairs of the southern race existed with habitat loss and the effects of pesticides (DDE) being the major reasons for the decline. In other areas including Alaska, the declaration of a bounty on Bald Eagles, due to the erroneous impression that they were impacting commercial fish populations, resulted in at least 100,000 birds being shot between 1917 and 1950. The widespread response to the destructive effects of pesticide use, coupled with the increased interest in raptor conservation helped the flagging eagle

numbers. By 1982, the population of all of the coterminous states was estimated at 1,500 pairs and productivity was increasing. A 1983 estimate for North America was 70,000 birds with 48,000 in British Columbia and Alaska and the remainder scattered across the continent.

Today, conservation concerns must still account for environmental contamination by chemicals and heavy metals as well as continued persecution and shooting by the ignorant and uninformed. Mercury, DDE and PCBs are still being found in many raptor eggs including those of the Bald Eagle, although at levels well below those originally considered destructive. The persistent, sublethal physiological stress of non-natural chemical compounds must continue to be studied and understood. Acid rain in some areas has the potential to eliminate food supply and new forms of environmental contamination from our industrialized society may impact predators at the top of the food chain in ways yet to be identified. Unintentional human disturbance around nests must be understood and managed. Lead shot contamination in waterfowl wounded by hunters has been of concern in some areas but this is being phased out in favor of steel. But perhaps the single most unabated threat to the Bald Eagle, and other raptors, is the pervasive loss of habitat throughout its range. The constant demand for natural resources, particularly timber, is inexorably eliminating old growth forests, except for some of the most remote and inaccessible areas. The narrow fringe around major water bodies that is preferred for nesting tends to be older forests, particularly in the northwestern parts of the eagle's stronghold in Washington, British Columbia and Alaska.

Future habitat management will need to address the retention of not only the individual, larger trees in a stand that offer nesting potential, but mixed age stands of sufficient size and distribution that will attract eagles for nesting. The reduction of nesting in second growth stands is dramatic. As well, site specific characteristics must be maintained such as clear flight paths to nesting trees, nearby perch sites, freedom from human disturbance and other characteristics as noted above. Known nesting sites must be protected and managed appropriately. The high degree of nest site fidelity means that some pairs may suffer reduced productivity as they return year after year to the same nest site but are unable to breed due to disturbance or other factors. Unless the nest tree disappears or other factors force them to move, pairs of eagles may be almost permanently excluded from adding young to the population, despite being reproductively capable. Even if they are forced to move, some pairs may never breed again. Breeding sites require site specific management plans that determine a protected core around the nest surrounded by a sensitively managed buffer zone that considers the topography, habitat fragmentation, food resources and human activities that may impact eagles.

The management and protection of habitats near major food supplies such as salmon spawning streams or reservoirs will require site specific prescriptions. In general, the need to maintain nearby perching habitat and suitable roosting areas will need to be integrated into the habitat management scheme of the site. The behavior of the local eagle population must be studied in order to determine where preferred roosting groves are located, as they may not be immediately adjacent to the food source.

The preservation and sound management of critical food supplies such as anadromous salmon and kokanee in the west is essential to the western Bald Eagle populations. Losses and reductions of these sources have a pronounced impact on eagle use of the affected areas and may cause long term population declines of this fish-oriented raptor.

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White-tailed Eagle

Haliaeetus albicilla

GENERAL DESCRIPTION

The White-tailed Eagle, whose range includes northern Eurasia and Greenland, is a very rare visitor to North America. It resembles a Bald Eagle in plumage, size, and diet. The combined appearance of the head and tail is the most obvious difference in adult plumage between the two species. In the White-tailed Eagle, the tail is the only part of its body that is completely white compared to the all-white head and tail of the Bald Eagle. Immature and sub-adult plumages of the White-tailed Eagles are also similar to those of the Bald Eagle.

The White-tailed Eagle is about the same size as the Bald Eagle in Alaska, making it a large-sized raptor. It is also a superb fisherman, and an accomplished pirate, like the Bald Eagle.

Although quite rare, and in low numbers, the White-tailed Eagle occurs throughout the year in south-western Alaska. There are also several other accidental occurrences for northern parts of the continent.

SIZE

The White-tailed Eagle is a large bird of prey in which the female is larger than the male and averages about 20 percent heavier. Combined, their lengths vary from 27 to 36 inches (69 to 91 centimeters) and average about average 33 inches (84 centimeters). Wingspread measurements vary from 82 to 97 inches (208 to 247 centimeters) with an average of 91 inches (231 centimeters). The weight varies from 6.8 to 15.2 pounds (3.1 to 6.1 kilograms) with an average of 10.6 pounds (4.8 kilograms). The usual weight of a male is about 10 pounds (4.5 kilograms) and a female about 13 pounds (5.9 kilograms).

MORPHS

There are no light or dark color morphs although total albinism has been reported.

SPECIFIC DESCRIPTION

Adult - Perched

- head and neck appear pale, usually a light buffy-brown, or creamy buff in color
- head blends into brown breast and back without obvious contrast as in Bald Eagle
- yellow beak and cere
- eye appears pale or yellowish-white
- upperparts various shades of brown, sometimes grayish-brown, with pale edges to feathers
- underparts brown progressing to dark brown on the belly
- feathers under the tail are dark brown
- all-white tail
- legs yellow with dark brown feathers

Immature (First year) - Perched

- all dark brown head and eyes with black beak and cere
- feathers on upperparts are a mottled honey-colored brown, and patterned, and contrast

with the all brown-black primary feathers

- breast is darker brown than belly but former has whitish to buffy streaks, latter shows darker streaks
- pale yellow legs with brown feathers
- longer tail than adult; usually dark (sometimes mottled) with flecks of white; from below tail appears lightish or whitish
- tip of tail appears to have white spikes

Adult - Flight

- light buffy brown or creamy buff head with yellow bill
- all-brown body with broad wings that appear rectangular
- all-white tail that appears short for the size of the bird and is wedge-shaped
- feathers under the tail are dark
- tips of outer seven primary, or flight feathers, are noticeable. There are six showing in the adult Bald Eagle.

Immature - Flight

- dark head with dark bill
- underparts contrast with a dark brown breast, often with white or light brown streaks, and lighter brown belly without streaks
- pale buff feathers in "armpits" (axillaries)
- individual tail feathers with white spears or spikes
- tail is noticeably longer than the adult's
- tail feathers show dark sides and white inners that together gives a whitish appearance from below
- tips of seven outer primary feathers visible; six in the immature Bald Eagle

SIMILAR SPECIES

The White-tailed Eagle, within its range in Alaska, should only be confused with the Bald Eagle and Steller's Sea-Eagle. The adult Bald Eagle has a pure white head and short fan-shaped tail that is well defined and sharply separated from the dark body. The White-tailed Eagle has a light brown, tan, or creamy buff head and the tail is white but longer and wedge-shaped. Feathers under the tail are white in a Bald Eagle and dark in a White-tailed Eagle. The Steller's Sea-Eagle shows large white wing patches.

Immatures are easily confused as they resemble one another. The tail of immature Bald Eagles have an even and broad dark band near the tip while in the White-tailed Eagle the tail feathers appear spiked. Immature White-tailed Eagles have small whitish armpit areas and few white diagonal lines or white on the wing linings. Seven versus six "fingers" on outer primary feathers of the White-tailed Eagle separates it from a Bald Eagle. Also, the contrast of the breast to belly is less defined in immature White-tailed Eagles. Immature and subadult Steller's Sea-Eagles show mostly white, extremely wedge-shaped tails and very large yellow beaks.

OTHER NAMES

The White-tailed Eagle is also known as the "Cliff Eagle", "Sea-Eagle", "Shore Eagle", "White-tailed Sea Eagle", "Gray Sea Eagle", and "Erne" which is an Anglo-Saxon term meaning "the soarer". The latter name is a favorite selection for crossword puzzles!

ETYMOLOGY

The genus *Haliaeetus* stems from the Greek word *halos* meaning "sea", and *aetos* meaning "eagle". The specific name *albicilla* is from Latin word *albus* meaning "white" and *illus*, a diminutive suffix used mistakenly to mean "tailed". Translated, *Haliaeetus albicilla* is "White-tailed Sea Eagle."

MYTHOLOGY

None is known for North America.

RANGE

The White-tailed Eagle breeds mainly in Greenland and Eurasia from western Greenland, Iceland, Scandinavia, northern Russia and northern Siberia to northern Europe. In North America it occurs year-round only in south-western Alaska, and here mainly on the outer Aleutian Islands. It breeds on Attu Island and has been seen on Kodiak Island. Individual birds have been seen in eastern North America in the eastern Canadian Arctic and off the Massachusetts coast.

It winters primarily within its breeding range in North America.

Two subspecies exist, *H. a. albicilla*, which ranges from northeastern Asia to the western Aleutian Islands, and *H. a. groenlandicus*, which is resident in south-western Greenland.

MIGRATION

The White-tailed Eagle is essentially a non-migratory species but sometimes it is forced to move seasonally, especially in far northern parts of its range, when water freezes and food supplies are unavailable.

BEHAVIOR

The White-tailed Eagle shares similar aquatic habitats with the Bald Eagle. Its flight style is described as "active with slow, stiff labored wingbeats. It soars on flat, to slightly upraised wings, and gliding occurs on level or slightly arched wings."

It searches for food from a perch but also has hunting forays for fish or marine birds that involve low flights over the ocean. On occasions, it may plunge its entire body into the water for food. It also patrols shorelines in search of carrion.

Like the Bald Eagle, the White-tailed Eagle frequently hunts together to tire its diving prey, mostly sea ducks, before capture. At sea, it has been seen chasing Northern Fulmars into narrow passageways, such as fjords, before capturing them.

The White-tailed Eagle is an opportunist, and pirate, and will harass fish from other raptors, such as an Osprey or sea mammals such as a sea otter, and often follows commercial fishing boats for fish scraps. It has also been seen in Alaska feeding on dead sealions, whales, and otters.

Nothing is known about the eagle's home range, territory, interspecific interactions, and courtship activities in Alaska.

HABITAT

In Alaska, the White-tailed Eagle is mainly a bird of the rocky sea coast. Here it visits estuaries, rocky and cliff shores, the open ocean, and sometimes tundra regions with lakes

or ponds.

VOICE

Near its nest the White-tailed Eagle utters a "ga" sound. A "kee" or "klee" is given when another White-tailed Eagle approaches the nest. During courtship the female utters a "kee" , "kee", ... series which ends in a "ka". Calls have also been described as a series of stuttering yelps that sound like "kyick, kyick, kyick..."

FOODS

No information is available on foods in Alaska but the White-tailed Eagle probably feeds mainly on fish. Carrion may also be important and certainly marine birds will be taken as available.

In other parts of its range fish species eaten include lumpfish, salmonids, cod, and sculpin. Birds such as passerines, sea ducks, Eurasian Coot, and Common Eider are taken. Mammal prey, especially voles, as well as hares and rodents are also eaten. Invertebrate prey may include marine mollusks, freshwater mussels, snails, cuttlefish, crabs, lobster, starfish, and sea urchins.

NESTING

The White-tailed Eagle was first found breeding in North America on Attu Island, western Alaska, in May 1982. Small numbers probably breed on the outermost Aleutian Islands most years.

The nest location usually requires an unobstructed view of the surrounding ocean and is often built on the ground on an isolated islet or on a cliff ledge. The nest itself is composed of sticks and branches and is often lined with a variety of marine debris.

Clutch sizes vary from one to four eggs but two is the normal clutch. The egg is all-white and non-glossy. It measures about 3.03 inches long (77 millimeters) and 2.32 inches wide (59 millimeters). The incubation period ranges between 37 and 38 days and the age of first flight is between 70 and 84 days.

CONSERVATION

Very little is known about the biology and ecology of the White-tailed Eagle in North America so conservation concerns and efforts have not been addressed.

In Eurasia, where the species is widely distributed, mercury poisoning and shooting has been a concern. One study in Germany showed that of 194 dead eagles examined between 1947 and 1971, 39 percent had been shot, 13 percent had been poisoned, 7.5 percent died in territorial fighting, and 6 percent died accidentally.

Locally, where the species future is in doubt, artificial feeding programs have been established for younger birds. Also, a program to raise birds in captivity for release into the wild is ongoing in some areas and re-introductions in areas where the species has been extirpated has been attempted.

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Steller's Sea-Eagle

Haliaeetus pelagicus

GENERAL DESCRIPTION

This large Asiatic bird does not breed in North America but visits the Aleutian Islands, in western Alaska, only rarely. It is larger and heavier than the more familiar Bald Eagle and its plumage is unmistakable. Sexes look alike but females are larger in body-size. Full adult plumage takes four years. Adults have pure white shoulders, thighs, and tail and an immense orange-yellow beak. Immatures are mostly brown with a mottled brown-and-white tail and a huge beak. As its name implies this bird is at home along the sea coasts.

SIZE

The Steller's Sea-Eagle is a very large raptor. Although females are larger, measurements and weights overlap considerably, except at the extremes. Combined length measurements for males and females range from 33 to 41 inches (85 to 105 centimeters). The combined wingspread ranges from 87 to 96 inches (220 to 245 centimeters). Weights range from 11 to 20 pounds (5 to 9 kilograms). One bird, of unknown sex, and kept in a zoo weighed 15.25 pounds (7 kilograms)!

MORPHS

A color morph has been reported that shows no white on the forehead, wings, and leg feathers. One authority lists the morphs as a "normal" morph and a "dark" morph. Only the "normal" phase has been reported in North America.

SPECIFIC DESCRIPTION

Adult - Perched

- large, all-white wing patches
- very large orange-yellow beak and cere
- face skin is orange-yellow
- long, white tail that appears pointed
- dark brown to black head with white patch on forehead and light to white streaks from top of head to neck
- light brown eyes
- legs are orange-yellow

Immature (First year) - Perched

- body appears all blackish-brown or very dark
- light streaking on neck and upper breast
- very large yellowish beak and cere
- face skin is yellowish
- dark brown eyes
- long, light-mottled brown tail that appears pointed
- legs are yellow

Adult - Flight

- white shoulder patches show as white areas on the leading edge of the wings

- all-white tail that is pronouncedly wedge-shaped
- all dark brown body with light streaks on breast
- very large orange-yellow beak
- feathers under tail are white

Immature (First year) - Flight

- very dark body with various amount of lightish mottling under wings and in armpits (axillars)
- tail markedly wedge-shaped with various amounts of brown mottling
- body very dark brown, or blackish, with light streaking on neck and upper breast
- very large yellowish beak

SIMILAR SPECIES

The Steller's Sea-Eagle should only be confused with the Bald and White-tailed eagle. The adult Bald Eagle has a pure white head, squarish shaped tail and lacks white patches on the wing. The adult White-tailed Eagle has a buffy-brown head and also lacks the white wing patches.

Immature Bald Eagles have much smaller beaks, pronounced white armpits (axillars), and dark borders or wide appearing bands on tail. Tail is not wedge-shaped. The immature White-tailed Eagle also has a much smaller beak, lacks the wedge-shaped tail, has buffy armpits (axillars), and shows white "spears" or "spikes" in tail feathers.

OTHER NAMES

The Steller's Sea-Eagle is also known as the "Pacific Eagle", "White-shouldered Eagle", "Big-beaked Eagle, and "Amchitka Sea Eagle."

ETYMOLOGY

The genus *Haliaeetus* is Greek for "sea eagle" and is formed from "halos" meaning salt, and "aetos" meaning "eagle" which refers to the bird's preferred habitat. The specific name *pelagicus* is Latin for "oceanic, marine," again with reference for its environment. Steller is in reference to George Wilhelm Steller, a naturalist on Bering's expedition to Alaska where the Steller's Sea-Eagle was first spotted.

MYTHOLOGY

None is known for North America, probably because the bird is so rare on the continent.

RANGE

A very rare visitor in spring, summer, fall, or winter to the Aleutian Islands, and other islands of south-western Alaska. It has been reported from Attu Island, Unalaska Island, and Kodiak Island, and St. Paul Island in the Pribilof Islands. It does not breed in Alaska.

Its normal breeding range includes the north Pacific coast from northwestern Siberia and Kamchatka south to Sakhalin. It winters south to Korea and Japan.

MIGRATION

Because of its casual occurrence in Alaska no pronounced migration or dispersal movements can be documented. It has been recorded in all four seasons.

BEHAVIOR

The Steller's Sea-Eagle flies with deep, strong wingbeats and soars on flat wings, not dihedral. It usually hunts from perches, such as pinnacles and cliffs, but also while on the wing. It also hunts for food low over the surface of the ocean, sometimes just above the waves.

ADAPTATIONS

The Steller's Sea-Eagle is social which may be an advantage in sharing food resources such as beached mammals and spawning salmon.

HABITAT

In Alaska this large eagle inhabits the sea coast and associated lower parts of rivers. Rarely is it seen inland.

VOICE

Not described for North America.

FOODS

The diet is not known for Alaska but in normal parts of its range it feeds on fishes, such as spawning salmon, and birds, such as sea ducks. It readily feeds on carrion, such as beached seals, sealions, and whales and offal from hunters.

NESTING

The Steller's Sea-Eagle does not breed in North America.

CONSERVATION

It has been estimated that there are about 2,000 pairs of Steller's Sea-Eagles in the main parts of its northern breeding range. There may be at least another 2,300 non-nesters as well. It is the general feeling of some biologists that the eagle's numbers are "quite satisfactory."

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Northern Harrier

Circus cyaneus

GENERAL DESCRIPTION

The Northern Harrier is one of the most widespread and easily recognized diurnal raptors in North America. Both sexes are medium-sized, slender birds with long wings, long tails and white upper tail coverts. The male is gray above, and whitish below, with black wing tips. The female is brown above and streaked below. Harriers forage by cruising low over open ground, slowly and somewhat erratically flapping and gliding, suddenly rising, stalling, turning, hovering, and dropping into the grass to seize a vole or small bird. The Northern Harrier is most commonly associated with wetlands such as marshes, muskegs, and estuaries, but also frequents dry grassland areas. It can respond to high population levels of its favorite prey, the vole, by mating polygamously.

SIZE

The Northern Harrier is a medium-sized raptor. The female is larger than the male. Lengths average 19 inches (48 centimeters) for females and 17 inches (43 centimeters) for males. Wingspans average 46 inches (116 centimeters) for females and 41 inches (103 centimeters) for males. Weights average 1.1 pounds (496 grams) for females and 0.8 pounds (346 grams) for males.

MORPHS

The Northern Harrier has no color morphs.

SPECIFIC DESCRIPTION

Adult Male - Perched

- pale lemon yellow eye in distinctive owl-like facial disk
- gray head and chest forming a hood
- slender body and long tail
- white underparts with occasional brick-brown spotting on belly and flanks.
- variably medium-gray to light gray upperparts
- black wing tips
- tail is gray above and whitish below with indistinct barring
- white leggings sometimes spotted with brick-brown bands
- long yellow legs

Adult Female - Perched

- eye brown to yellow depending upon age (oldest birds have palest eyes)
- owl-like facial disk
- dark brown head, breast, and upperparts with tawny mottling on head and lower shoulder
- underparts off-white or tan with dark brown streaks on breast, sides, flanks and undertail coverts
- slender body and long tail
- long yellow legs

Immature - Perched

- like female but has dark brown eye (immature female) or gray to light gray brown eye (immature male), darker brown upperparts and warm cinnamon underparts (fall) to tan or buffy underparts (spring)
- owl-like facial disk
- collar of dark brown streaks on upper chest and throat
- slender body and long tail
- long yellow legs

Adult Male - Flight

- slender hawk with long wings and tail
- gray upperparts ranging from pure gray to gray with brown mottling
- white upper tail coverts
- wings long with slightly rounded tips
- black wingtips and black tips on secondaries
- underwings mostly white with black wing tips and black tips on secondaries
- underparts white with gray upper breast band and light brown spotting on breast and flanks
- tail mostly whitish below and gray above, with indistinctive narrow bands

Adult Female - Flight

- slim hawk with long slender wings and long tail
- whitish underparts streaked with dark brown, including the undertail coverts
- underwing shows darkish secondaries, median coverts, and axillars and light primaries with dark brown bars
- underwing linings are buffy with dark spotting
- upperparts are brown with some tawny mottling especially on lower shoulders
- vivid white upper tail coverts
- tail is brown with darker bands

Immature - Flight

- slim hawk with long slender wings and long tail
- underparts are a rich cinnamon (fall) or a washed out cinnamon (spring) including undertail coverts
- upperparts are dark brown with some rusty mottling on lower shoulder
- vivid white upper tail coverts
- underwing shows darkmedian coverts, axillars, and secondaries and whitish primaries with dark bars.
- tail is brown with darker brown bands; can show light cinnamon bands in outer tail feathers

SIMILAR SPECIES

The Northern Harrier is a very distinctive bird but under some conditions can be confused with other species. Over its open ground habitat it might be confused with a light morph Rough-legged Hawk. Both species show white around the tail. However, the Rough-legged Hawk has a black rectangle on the bend of each underwing, usually shows a fairly heavy dark belly band, and shows either a broad subterminal band or a narrower series of dark bands on its tail. The Rough-legged Hawk's tail base is usually whitish. The Northern Harrier always has a generally dark tail which may show indistinctly some dark bands, but it always has white upper tail coverts above the root of the tail.

Both the Turkey Vulture and the Northern Harrier can appear as dark birds with wings held in dihedral. The Turkey Vulture has a broad eagle-like wing that shows two tones, the dark wing linings and the silvery flight feathers. The Northern Harrier has a long slender wing displaying no such effect. Also, harriers in all plumages are much lighter on their underparts than the black Turkey Vulture and harriers show white rumps while Turkey Vultures do not.

A White-tailed Kite and a male Northern Harrier are about the same size and share similar proportions but the kite has pointed wingtips, shows a black oval at the bend of its underwings, black shoulders on its upperwings, and lacks the black bar on the secondaries and the white rump of the harrier.

The Red-shouldered Hawk is similar to the female Northern Harrier. It may show white barring on its uppertail coverts but nothing like the unbroken white upper tail coverts of a harrier. The Red-shouldered Hawk has shorter, broader wings and in both adult and immature plumages shows a much broader, more contrasty tail - black with thin white bands in the adult and gray with thin white bands in the immature. The Red-shouldered Hawk also shows white, or tawny, crescent "window" in the primary feathers. The harrier's tail is long, usually folded and is silvery gray with medium dark bands.

Swainson's Hawks also often show a white crescent on the rump, but it is nothing like the broad unbroken white rump patch of a harrier. The immature Northern Goshawk is similar to the adult female Northern Harrier but the former lacks the dark secondaries and axillars of the harrier.

OTHER NAMES

The North American race of the Northern Harrier was formerly known as the "Marsh Hawk." Other names include the "Blue Hawk", the "Frog Hawk", the "Mouse Hawk", and the "White-rumped Harrier." The Old World race is commonly known as the "Hen Harrier" and the South American race is known as the "Cinereous Harrier."

ETYMOLOGY

The scientific name *Circus cyaneus* translates into "circle "(*Circus* from the Greek *kirkos*) and "dark blue" (*cyaneus* from the Greek *kyaneous*) referring first to flying in circles and then to the color of the male's upperparts.

MYTHOLOGY

In various European cultures from the time of Pliny (~A.D. 50) harriers have been considered omens of good luck, either in general or specifically for marriage and financial affairs.

RANGE

The Northern Harrier breeds from central Alaska, excluding the north slope, east across the Yukon and western two-thirds of Mackenzie to Manitoba, Ontario, southern Quebec, New Brunswick, Nova Scotia, Prince Edward Island, but not Newfoundland, and south including British Columbia, Alberta, Saskatchewan south to central California and east across northern Arizona, New Mexico, northern Texas, Oklahoma, Missouri, the southern two-thirds of Iowa, Illinois, southern Wisconsin, Indiana, southern Michigan, northern Kentucky, Ohio, West Virginia, northern Virginia, Pennsylvania, New York, Massachusetts, Connecticut and Rhode Island. In southern parts of the breeding range the Northern Harrier is present year-round which includes a band across the United States from Washington south to central California

and east across southern Idaho, Nevada, Utah, Colorado, Kansas, Missouri, Illinois, Indiana, and northeast to Nova Scotia.

This species formerly bred in southern California, northern Baja California and Florida.

It winters from extreme south coastal Alaska, coastal and extreme southern British Columbia and southern parts of the breeding range south through the rest of the United States.

There are three subspecies of the Northern Harrier, only one of which occurs in North America. It is referred to as *C. c. hudsonius*.

The Northern Harrier also occurs in South America, Europe, and Asia.

MIGRATION

Southern populations of the Northern Harrier are generally nonmigratory but most northern and central populations migrate. Migrants travel singly, or in small groups. Harriers use thermals to gain altitude, like buteos do, but generally employ much more flap-and-glide flight to cover distances. They often migrate at generally low elevations but are also capable of high flight. They migrate throughout the day and sometimes at night. They readily migrate in poor weather which grounds other migrant hawks. They will interrupt their travel to hunt, using their usual low level coursing. Harriers cross water readily except for huge expanses like the Great Lakes and the Gulf of Mexico. Migrants have been seen crossing narrower bodies like the Bay of Fundy, Delaware Bay, Yakutat Bay (Alaska), and the Gulf of Maine, and have reached Bermuda, the Bahamas, and the West Indies.

Fall migration begins in August with the dispersal of juvenile birds, which precede older birds. Migration continues until late in November in the northern United States, making the fall movement of Northern Harriers the most protracted of any North American raptor migration. Peak movements at both Hawk Mountain, Pennsylvania and San Francisco, California, are from mid to late October. Huge concentrations do not occur since the birds migrate over broad fronts, both inland and along the coast. The largest numbers have occurred at Cape May, New Jersey (3000+ fall, 1980).

Spring migration begins in February and March in Central America and is protracted, continuing into mid May in the northern United States and into the first week and a half of May in southeastern Alaska. There appear to be no great peaks in numbers. Males generally arrive before females, and females before immatures.

BEHAVIOR

The Northern Harrier quarters low (generally less than 10 feet [3.1 meters]) over marsh and field, employing an unsteady "tipsy" style of flap and glide flight, utilizing the slightest breezes over rough terrain. It will crisscross natural and man-made edges like run-off channels and fences, double-back on its path, and habitually suddenly pull up to hover a few feet above the grass, with long legs dangling, and then may drop into the vegetation to seize prey. This type of flight is most often associated with hunting and is characterized by more than five sharp turns per minute. During migration, the Northern Harrier is capable of direct gliding or flap-and-glide flight, often at high elevations. Occasionally, both during the breeding season and in migration, the bird will soar on thermals with wings and tail spread. The Northern Harrier habitually perches both on the ground and on low perches like posts, stumps, and rocks.

The Northern Harrier hunts all day long, and in some locations show peaks of hunting

activity in the early morning and in the hour before dusk. The rate of prey capture diminishes during windy or rainy weather. It cruises low over open ground and upon sighting, or hearing prey, may hover above it, drop pouncing upon it after a few seconds. The crisscross flight path increases the element of surprise in the harrier's flight which would be minimized if the hawk simply flew straight down a ditch or along an embankment. Some authorities differentiate between "quartering" and "border following", the main difference appearing to be that quartering occurs over non-border areas. Borders include the edges of certain vegetative patches, fence lines, ridges, shorelines, and other borders. The male harrier tends to fly lower and faster than females. The harrier also "foot-stabs" to flush prey from cover, lowering a foot into grass while hovering. The harrier also habitually flushes prey to "test" its condition, seldom pursuing large active prey. The harrier's grasp is relatively weak so prey is killed with the beak while the bird feeds. The Northern Harrier has hearing at least four times more acute than other hawks and is able to locate prey by sound alone. The harrier will hunt newly mown fields for uncovered prey, and attend prairie fires and sometimes follow mammal predators such as red foxes, perhaps using the animal as a beater. The harrier will also hunt from the ground, waiting to surprise prey or from a low perch. It occasionally strikes waterfowl on the surface of the water, often snatches ducklings and American Coot chicks, and only rarely takes fish like an Osprey. Occasionally the harrier will feed on carrion.

The Northern Harrier defends home ranges, breeding territories, and winter territories. This species commonly roosts communally within the span of October to April but individuals may defend winter territories distant from their roost. It establishes hunting and nesting territories by the time of egg-laying. Nonbreeders also can establish territories and build dummy nests. Territories vary in size depending upon whether nesting is colonial or solitary. Ditches, windrows, and roads often become territorial boundaries between neighbors. Territorial conflicts are most frequent early in the nesting cycle, and involve aerial chases and talon grappling.

Larger birds like the Ring-necked Pheasant and Greater Prairie Chicken will stand their ground against Northern Harriers. Harriers carrying prey are often mobbed by songbirds. Chases and stoops between harriers and Short-eared Owls are common. Harriers will also rob Short-eared Owls of their prey. Harriers will also attempt to rob other species including Peregrine Falcons and Prairie Falcons, and are robbed themselves by other raptors including the Crested Caracara, Prairie Falcon, Peregrine Falcon, and Bald Eagle. Harriers will also chase other raptors such as Red-tailed and Rough-legged hawks from their home ranges.

The Northern Harrier's primary display is called sky-dancing and is performed mostly by males, though occasionally a female will sky-dance, particularly late in the season. Harriers will sky-dance over marshes even while on migration. Breeding has taken place without sky-dancing; however, this display is a normal part of courtship. The male engages in a series of steep dives and pull ups, or U's, with the bird turning sideways at the apex of each U in a barrel roll. Tumbling may also occur with the diving bird throwing its wings over its back and tumbling like a pigeon as it descends. A male may dive, with beating, with partially retracted wings, or may actually flip over at the crest to start the descent while upside down. Copulation often follows the male presenting food to the female, sometimes in a mid-flight drop. Copulation generally takes place on the ground.

The oldest wild bird lived to be 16 years five months old. Causes of mortality include predation by Great Horned Owls and Red-tailed Hawks, predation of nests by several mammals including raccoons, minks, weasels, coyotes, skunks, foxes, and by American Crows, trampling of nests by livestock, destruction of nests by mowing and haying equipment, illegal shooting, and collisions with vehicles. Harriers have also died from fowl cholera and type C botulism probably contracted from contaminated prey.

ADAPTATIONS

The Northern Harrier is the only North American hawk that has evolved an owl-like facial disk. This disk has sound gathering qualities that enable the harrier to hunt prey by sound as well as sight. Tests indicate that the harrier's hearing is at least as acute as that of most North American owls.

The harrier is also unique in its ability to respond to high populations of prey species, such as voles, by becoming a polygamous breeder. Males can have up to seven mates who each build a nest and raise young.

The Northern Harrier also adapts to its environment by diversifying its diet according to seasonal and local abundance of different prey species.

HABITAT

The Northern Harrier is a hawk of open spaces. It is found from sea level to 10,300 feet (3193 meters). It nests in damp or wet areas like marshes, swamps, cranberry bogs, riparian growth around prairie sloughs, ponds and lakes, muskeg and estuaries. It builds its nest in dry sites like farm fields, clear cuts, tundra, and plantations of young conifers. In winter, it occurs in deserts, grazing land, marshes and tidewater areas, playas, fallow fields and some croplands. It tends to avoid areas of continuous forest. Age and sex differences in habitat use may occur. For example, in South Carolina, male harriers comprise the greater proportion of harriers inland than in coastal marshes. In general the species needs undisturbed nest sites and rich foraging areas like marshes and other wetlands.

VOICE

The Northern Harrier is most vocal during breeding and is mostly quiet the rest of the year. Displaying males call a series of rapid "keks", "quiks", or "eks". This call is also heard occasionally at winter roosts. The alarm call of both sexes is similar but higher pitched like the "ke-ke-ke-ke-ke" call of a Northern Flicker. The female gives a piercing down-slurred scream "eeyah, eeyah", in couplets or triplets, when she sees the male carrying food, to solicit copulation and while protecting food. After fledging, young birds also give the "eeyah" scream as they approach their parents for food. Birds will also give the "eeyah" scream during the nonbreeding season.

FOODS

The Northern Harrier is an opportunistic hunter which varies its diet depending upon the local abundance of prey. However, across much of its range it depends heavily upon its primary prey, voles (*Microtus* species); in fact, vole populations can have a strong effect upon the harrier's mating systems and productivity. During nesting, many harrier populations also prey upon fledging grassland and marsh songbirds. Harriers will also exploit other temporarily abundant and vulnerable prey like young ground squirrels and young cottontail rabbits. Reptiles, amphibians and invertebrates make up a minor part of its diet. Carrion is eaten, and can be an important food source in hard winters. Rarely, fish are taken.

Mammals taken include voles, cotton rats, shrews, skunks, muskrats, brush rabbits, marsh rabbits, snowshoe hares, cottontails, and jackrabbits. The larger species taken are young, injured, or dead animals. In Canada and the United States, small rodent prey predominates from late fall until spring. Birds taken belong to at least 80 species including Clapper Rails (an important food species in some southeastern marshes), young Bobolinks, Mourning Doves, blackbirds, House Finches, meadowlarks, flickers, ducklings, and sparrows. Young birds mostly appear in the diet in spring. Larger birds are occasionally attacked, for

example American Wigeons, and several other duck species which are often found crippled by hunters. Young upland gamebirds, and occasionally small poultry, is also taken.

Other food includes rattlesnakes, garter snakes, racers, Leopard Lizards, fence lizards, whip-tailed lizards, horned toads, toads, and frogs. Invertebrates include spiders, crickets, beetles, and grasshoppers, sometimes a common prey item.

PELLETS

The pellets of Northern Harriers are usually about 1.4 to 2.0 inches (35 to 50 millimeters) long and 0.8 to 1.0 inches (20 to 25 millimeters) in diameter (sometimes up to 2.6 inches [65 millimeters] in length) and are most likely to be confused with those of Short-eared Owls. However, because harriers break up field mice bones more than owls do, the harrier pellets are spongy compared to the owls' firm pellets. Fresh harrier pellets are also less coated in mucus.

In one study, 85 percent of prey were eaten on the ground and 15 percent while perched, mostly on fence posts. Prey is eaten piecemeal beginning with the head. The gastrointestinal tract is often discarded. Avian prey is usually plucked first. The legs, sternum, and sometimes the wings usually are not eaten. Large avian prey is not always plucked. Harriers have been seen to neatly skin frogs and strip fur from voles.

NESTING

The Northern Harrier can be monogamous or polygamous, with the male having two to seven mates. Polygamy occurs in dense populations of harriers where voles are abundant. Polygamous males tend to favour certain females with more food and more vigorous nest defense. Whether monogamous or polygamous, the harrier tends to nest semi-colonially, in favored locations with, for example two or three nests per 400 yards (364 meters). Birds show little mate fidelity at their next mating. Nests are located in a variety of site types, ranging from dry habitats such as cultivated and uncultivated fields, pastures and grasslands (about 40 percent), freshwater marshes (18 percent), marsh meadows (17 percent), bogs, swamps brackish marshes, and dried wetlands (7 percent), to miscellaneous sites such as sage rangelands, brushlands, deciduous woods, stubble, and brushy rangelands (20 percent). Nests are built on the ground in a range of cover often including grasses, sedges, willows, spirea, or other vegetation often next to a bush or tree, and often near water, or over water on a muskrat house or floating mat of cattails. The male may initiate construction by building a platform or 'cock nest' with the female finishing the job, or she may build a new nest herself. Occasionally, the same nest is reused when new materials are added. The nest is usually a hollow lined with grasses, or in damp situations, sticks or weed stalks. The nest's structure differs from dry to wet sites. A dry site nest may be only one to two inches (2.5 to 5.1 centimeters) high and 15 to 18 inches (38 to 46 centimeters) across with a shallow or nearly flat bowl. A wet site nest may be 15 to 18 inches (38 to 46 centimeters) high and be a floating raft. Green grass and other leaves are often added to the nest during incubation and while the young are in the nest.

Clutch size ranges from two to 10 eggs, but averages four to six eggs. Larger clutches are laid during times of high vole populations. The egg is an average of 1.8 inches (46.3 millimeters) in length and 1.4 inches (36.3 millimeters) in breadth with a smooth, non glossy shell and a shape between elliptical and short subelliptical. A fresh egg is a very pale bluish but very quickly fades to soiled white during incubation. About 10 percent of clutches show scattered spotting of very pale brown.

The female incubates the eggs for 29 to 39 days per clutch or 29 to 31 days per egg. Young birds are fairly precocious, very active and noisy by two days of age. They vocalize a

high "cheek-cheek-cheek". The female will shade young by standing over them. Females retrieve young accidentally knocked from the nest. When frightened, young over five days hide up to 20 feet (6.2 meters) or more away from the nest, returning when the female returns with food. Young will also shade themselves in cover away from the nest. At three weeks the young begin to beat their wings. The male does all hunting and provisioning of the female and young until the female resumes hunting (close to the nest) when the young are over five days. The male usually transfers prey to the female in flight. The young start to fly at 30 to 35 days. By the time the young disperse from the nest the female is providing most of the food. Monogamous males tend to provide young with food longer than polygamous males do. The young remain together near the nest area for 21 to 50 days after fledging. During this period they hunt invertebrates and snakes and are also fed by their parents. Dispersal from the home area is apparently solitary. Each breeding female has a single brood. Replacement clutches are rarely laid.

CONSERVATION

Declines in harrier populations occurred in the 1960s, more in the eastern half of the continent than the western half. Although it was placed on the National Audubon Society's Blue List in 1972 to 1986, the harrier is not officially listed in the United States or Canada as of concern. DDT poisoning was strongly indicated during the late 1960s and 1970 when serious behavioral disturbances such as the absence of sky dance courtship displays were noted in Wisconsin. Some egg shell thinning was also noted although the biocides appeared to stop the birds from laying eggs. Since the ban on DDT, Wisconsin birds have returned to normal population levels and are once again displaying.

The species is probably suffering a slow decline throughout most of its North American range. Several states, including Illinois, Iowa, Missouri, Indiana and Ohio, have listed it as endangered. The main factor appears to be continuing habitat loss. Although the species often nests in dry sites, it favors wetlands, marshes and potholes that are particularly at risk of being drained. Preservation of wetlands is of primary importance for this bird's continuing survival. In some areas of its range, particularly in southern California where habitat loss is extreme, the Northern Harrier has become virtually extirpated as a breeding bird.

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Sharp-shinned Hawk

Accipiter striatus

GENERAL DESCRIPTION

The Sharp-shinned Hawk is one of the most common, yet most secretive, raptors in North America. It is like a miniature Cooper's Hawk that gets its name from the sharp edge to the front of its legs. It is a small, robin-sized, very manoueverable, forest hawk that occurs mainly in boreal forests. During migration it can occur in any treed area. Adults are dark gray above with a cinnamon chest and belly barred with white. The tail and wings are strongly barred and the vent is pure white. The head is gray, the throat pale, and the eyes are orange (young adults) to red (full adults). The beak is gray at the tip, pale at the base, and with a yellow cere. The legs and feet are yellow. Colors of adult males are brighter than adult females. Immatures are brown above and streaked with brown and white on the chest and belly; their wings and tails are strongly barred, as with adults. In flight, Sharp-shinned Hawks have short, rounded wings and a square-tipped tail. It soars and glides on level wings with a slight bend at the wrist.

The Sharp-shinned Hawk feeds mainly on small birds that live in woodlands and along forest edges. Males and females differ in sizes and because they look similar to Cooper's Hawks, a female Sharp-shinned Hawk may be difficult to separate from a male Cooper's Hawk. The surest way to distinguish between them is to hear their voices near their nest.

SIZE

The Sharp-shinned Hawk is strongly sexually dimorphic in size, with females being up to 50 percent larger than males. It is the smallest of the three accipiter hawks and, of all our hawks and falcons, is larger than only the American Kestrel. Lengths average 12 inches (31 centimeters) for females and 10 inches (26 centimeters) for males. Wingspans average 25 inches (62 centimeters) for females and 21 inches (54 centimeters) for males. Weights average 6 ounces (177 grams) for females and 3.6 ounces (101 grams) for males. The largest females may reach weights of half a pound.

MORPHS

There are no light or dark color morphs for this species. Albinism is known to occur very rarely. Individual birds have been reported with white wings, partially albino tail feathers, and white mottling in some body feathers. This is especially true in immatures that show white mottling on dorsal areas when the feathers are fluffed.

SPECIFIC DESCRIPTION

Adult - Perched

- dark to slate-blue or gray back including nape and head
- head always round-looking because hackles are not raised
- long strongly barred (black on gray) tail, usually square-tipped or slightly notched
- tail with three to four dark bands of equal width
- narrow or thin terminal tail band
- small rounded head with orange (young adults) to red (full adult) eyes
- yellow legs and feet
- cinnamon chest and belly finely barred with white
- wingtips extend less than half way to tip of tail

Immature - Perched

- brown back, head, nape, and top of wings
- head always round-looking
- long strongly barred (brown on buff) tail, usually square-tipped or slightly notched
- three to four dark bands of equal width
- small rounded head with grayish or greenish eyes
- pale line above eye
- yellow legs and feet
- whitish underparts heavily striped with reddish brown
- wingtips extend less than half way to tip of tail

Adult - Flight

- short round wings and long narrow tail
- tip of tail slightly notched or squarish and with a narrow white or light terminal band
- head extends to about leading edge of wing
- slate blue back with cinnamon or rufous-red barring on all of the breast and belly
- very rapid wingbeat
- back of male more bluish than browner female

Immature - Flight

- short round wings and long narrow tail
- tip of tail slightly notched or squarish and with a narrow white or light terminal band
- head extends to about leading edge of wing
- upperparts brown with some mottling; underparts creamy with heavy, usually reddish, or brown streaks
- very rapid wingbeat
- note that the brownish immature plumage is replaced with the more colorful adult plumage during their second year

SIMILAR SPECIES

The Sharp-shinned Hawk is most often confused with the similar-looking Cooper's Hawk. The Sharp-shinned Hawk is much smaller on average. In flight, the Sharp-shinned Hawk has a small and narrow head and wings that jut forward at the wrist whereas the Cooper's Hawk has a bulkier head and holds its wings straighter. The Sharp-shinned Hawk usually has a square-tipped tail with a thin white terminal band and Cooper's Hawk usually has a rounded tail with well-defined and wide white terminal band. Immature sharpies appear dark below in flight whereas immature Cooper's appear light. Also streaks on the underside of a Cooper's Hawk appear thin while those on a Sharp-shinned Hawk are heavier and darker which makes them appear darker or lighter. Finally, sharpies flap their wings more quickly than the Cooper's Hawk.

Merlins and American Kestrels are similar-sized raptors, but both have the characteristic sharply-pointed wings of a falcon.

OTHER NAMES

The Sharp-shinned Hawk is also known as "chicken hawk", "little chicken hawk", "sharpshin", "sharpy", "bird hawk", and "little blue darter."

ETYMOLOGY

The scientific name *Accipiter striatus* translates into "striped bird of prey". The striped "striatus" name refers to the streaked underparts of immatures.

MYTHOLOGY

None is known.

RANGE

Breeds from western and central Alaska, northern Alaska, western and southern Mackenzie, northwestern Saskatchewan, central Manitoba, northern Ontario, central Quebec, central Labrador and Newfoundland south to central British Columbia, eastern Washington, eastern Oregon, Idaho, western Montana, northern Wyoming, North Dakota, Minnesota, northern Wisconsin, northern Illinois, southern Ontario, to northern Maine.

May be present year-round in southern parts of its breeding range, including the Queen Charlotte Islands and Newfoundland, but is resident from southern British Columbia, excluding Vancouver Island, south to central California, northeastern Arizona, northern New Mexico, northeast to southern Minnesota and along the Atlantic coast from Prince Edward Island and Nova Scotia through forested environments, especially the Appalachians to northern Georgia.

Winters mainly in western California and south across the southern United States to southern Wisconsin and Michigan and in the East to Delaware.

There are 10 recognized subspecies of the Sharp-shinned Hawk throughout its range in North America, the West Indies, Central America, and South America. Three races occur in North America with only subtle differences in shading between them. The race *A. s. velox* is the most widely distributed subspecies. *A. s. perobscurus* breeds, or is resident, on the Queen Charlotte Islands off the north coast of British Columbia, and possibly southern Alaska south to Oregon. The most colorful race, found breeding in southern Arizona in 1971, is *A. s. suttoni*. It has darker upperparts and solid rufous thighs which helps to separate it from the other two races. Generally, birds from the northwest coastal areas tend to be darker than interior birds.

BEHAVIOR

The Sharp-shinned Hawk tends to remain close to forest cover where it can be seen darting through open forest or soaring close over the canopy. It is a "sit and wait" predator that perches in a concealed place then dashes out quickly to capture its prey. It also courses low, alternating rapid wingbeats and glides, through open forest looking for prey, using brush, hedgerows, and trees for concealment. The Sharp-shinned Hawk pursues small birds through dense foliage and will even run after prey on the ground. It hunts only during daylight hours. It grasps prey with its needle-sharp talons, usually killing the prey on impact. Prey is carried to a perch, where it is plucked and torn into pieces. Occasionally it eats carrion or captures insects attracted to carrion. Bird banders even lose the occasional songbird trapped in a mistnet to this fearless little hunter. It is the most common hawk seen around feeders.

On sunny days the Sharp-shinned Hawk often soars in thermals, like larger hawks and eagles. During migration it uses thermals to gain altitude before gliding off. Migrant Sharp-shinned Hawks often share these thermals with other accipiters, hawks, and Golden Eagles and the tiny sharpies take the occasional playful run at the larger birds.

The Sharp-shinned Hawk migrates on broad fronts across North America. Most birds

leave interior Alaska and Canada during September and head south. This hawk is most visible at this time when they can be found in almost any treed area. In the West and East, the Sharp-shinned Hawk follows along the edges of north/south running mountain ranges. The return spring movement occurs in March through May.

Although widely distributed, the Sharp-shinned Hawk is also widely dispersed. Breeding home ranges ranged from 26 to almost 324 acres (65 to 800 hectares). Densities of breeding pairs have been estimated as 24 pairs per 41 acres (100 hectares) in Alaska to 4 pairs per 47 acres (117 hectares) in Oregon.

Courtship behavior is not well described. Males establish territories then try to attract females by soaring in broad circles over treetops with tail closed and undertail coverts flared, and giving a repeated nasal call. As pairing occurs, males and females roost and fly around together. Males then bring food to their mates. Nest sites are then inspected by the female and copulation occurs as the nest is being built.

ADAPTATIONS

Extreme sexual size dimorphism (females almost twice as heavy as males) may have evolved to increase food supplies available to pairs during the breeding season. The larger female tends to capture larger prey and the smaller male tends to capture smaller prey. In this way, mates do not compete for the same prey source, and can provide more food for their young.

Short rounded wings and a long rudder-like tail assist with prey capture in woodlands and forests.

HABITAT

The Sharp-shinned Hawk frequents coniferous or deciduous forests and open woodlands. Good habitat includes abundant populations of small birds, this hawk's main prey. Most populations occur in coniferous forests, with most breeding in boreal forests. Nests are usually built in stands of young, and dense, even-aged conifers adjacent to clearings, brushy areas, wetlands, or open woodlands. During the nonbreeding season, namely the migration period and winter, the Sharp-shinned Hawk may be seen in subalpine areas, hedgerows in agricultural areas, and backyards near bird feeders.

VOICE

The Sharp-shinned Hawk is usually silent except during the breeding season. Mates often duet early in the nesting season. Males give a sharp, clearly spaced "kip...kip" when arriving in the nesting territory. Their alarm call is a long series of sharp "kik...kik...kik...kik" or "kew...kew...kew...kew". Both sexes cackle and squawk during copulation.

FOODS

The Sharp-shinned Hawk feeds mainly on small birds. It takes a higher proportion of birds as prey than do the other accipiters, the Northern Goshawk and Cooper's Hawk. Bird prey includes sparrows, warblers, finches, swallows, thrushes, blackbirds, quail, flycatchers, and vireos. Small mammals such as squirrels, voles, mice, shrews, small rabbits, and bats are taken frequently. Other prey include frogs, snakes, lizards, grasshoppers, dragonflies, crickets, beetles, butterflies, and caterpillars.

PELLETS

Pellets, parts of birds, and bones cleanly stripped of flesh can be found near nest trees, roost sites, and plucking posts. The pellets, usually few in number, are small elongated structures of gray material, especially if small mammals are part of the diet. They average about 0.75 inches (19.1 millimeters) long by 0.45 inches (11.4 millimeters) wide.

NESTING

The Sharp-shinned Hawk breeds in coniferous or deciduous forests. Nests are usually situated in dense stands of younger conifers. The Sharp-shinned Hawk nests in younger forests with less dense overstory than Cooper's Hawk and Northern Goshawk. Nests are bulky platforms of small sticks, placed on a limb next to the trunk, and are usually 16 to 26 feet (five to eight meters) above ground. Nests are not normally reused, but the same grove of trees are often reused for two or three years. Details of breeding biology are not well known.

The Sharp-shinned Hawk lays clutches of three to six eggs, but four to five eggs are most common, with one egg laid every second day. The eggs are spherical to short-oval in shape and the shell is smooth and not glossy. The eggs are beautiful with a wide variety of markings. The ground color is dull white to a pale bluish with large splotches and splashes of rich brown which may collect at the end or middle of the egg. Egg size average 1.5 by 1.2 inches (37.5 by 30.4 millimeters). The incubation period is 30 to 34 days. Females perform virtually all incubation while the male brings her food. Young remain in the nest 24 to 27 days. Males provide most of the food during the first two weeks while the female broods the young. After two weeks the female begins to leave the nest regularly to hunt for food for the young. Parents care for young for two to four weeks after they leave the nest, then all tend to disperse.

CONSERVATION

The Sharp-shinned Hawk is widely distributed across North America. Western populations appear stable but eastern populations were in decline during the 1970s. During the 1970s, eight to 13 percent of eggs in the east showed evidence of eggshell thinning due to DDT contamination. Populations in the east have shown definite upswings in recent years. One authority estimates at least 30,000 Sharp-shinned Hawks winter in Canada and the United States.

Breeding habitat appears secure in boreal and western regions. Opening up of dense, mature forests may even increase habitat for this hawk, by creating openings and new stands of younger trees.

This hawk suffers considerable mortality when it enters urban areas by flying into windows and collision with vehicles. Other causes of mortality include predation by Northern Goshawk and Cooper's Hawk, and indiscriminate shooting.

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Cooper's Hawk

Accipiter cooperii

GENERAL DESCRIPTION

The Cooper's Hawk is a crow-sized, very manoeuvrable, forest hawk that occurs mainly in open mixed deciduous and coniferous forests. During migration it can occur in any relatively open treed area. Adults are dark gray above with a cinnamon chest and belly barred with fine lines of white. Adults also have black crowns (top of head) which are darker than the back color. That is, the dark cap contrasts with the pale nape and blue-gray dorsal area. The tail and wings are strongly barred, and the vent is pure white. The head is gray, the throat pale, and eyes red in full adults. In immatures, the eyes are gray to yellow. The beak is gray at the tip, and pale at the base with a yellow cere. The legs and feet are yellow. Colors of adult males are brighter than adult females. Immatures are brown above and vertically streaked with brown and white on the chest and belly; their wings and tails are barred, as with adults. In flight, Cooper's Hawks have short, rounded wings and a long round-tipped tail with a noticeable white terminal band. It soars and glides on level wings with wings held straight out from the body or in a slight dihedral.

It is a secretive, and often inconspicuous woodland hawk, especially during the breeding season. It breeds throughout most of southern Canada, the United States, and northern Mexico. It feeds mainly on medium-sized birds and mammals like jays and chipmunks.

The Cooper's Hawk is a common migrant at many eastern and western hawk watch locations.

SIZE

The Cooper's Hawk is strongly sexually dimorphic in size, with females being up to 50 percent larger than males. It is the medium-sized accipiter hawk, being about 50 percent larger than the Sharp-shinned Hawk but about half the size of the Northern Goshawk. Lengths average 18 inches (45 centimeters) for females and 15 inches (26 centimeters) for males. Wingspans average 33 inches (84 centimeters) for females and 29 inches (73 centimeters) for males. Weights average 19 ounces (530 grams) for females and 12 ounces (340 grams) for males. The largest females may reach weights of 1.5 pounds (675 grams).

MORPHS

There are no light or dark morphs phases for this species. Partial albinism is only known from British Columbia. A gray aberrant plumage has recently been described in California.

Specific Description

Adult - Perched

- dark gray (at times slate-blue) back and head; light gray nape
- head often squarish-looking because of raised hackles
- crown (top of head) much darker than nape and back
- long tail, strongly barred (black on gray), and usually rounded with three to four dark bands of equal width
- wide white tip on tail
- orange (young adults) to red (full adults) eye; yellow legs and feet
- cinnamon chest and belly finely barred with white
- males are brighter than females overall.

Immature - Perched

- brown back and top of wings
- squarish-looking head a very tawny to golden color
- strongly barred (brown on buff) tail that is very rounded at end
- three to four dark bands of equal width
- wide terminal tail band
- grayish or greenish eye, yellow legs and feet
- whitish underparts striped with fine neat brown lines which are heaviest on breast and upper belly
- brownish immature plumage is replaced with the more colorful adult plumage during their second year.

Adult - Flight

- crow-sized with short wings and long, rounded tail
- wide white terminal tail band
- head extends out from wing
- underparts barred reddish or orange

Immature - Flight

- head and neck very tawny colored
- crow-sized with short wings and long rounded tail
- wide white terminal tail band
- head extends out from wing
- underparts white and streaked with fine, neat brown lines
- breast more streaked than belly

SIMILAR SPECIES

The Cooper's Hawk is most often confused with the similar-looking Sharp-shinned Hawk. The Cooper's Hawk is much larger on average, but female (the larger sex) Sharp-shinned and male (the smaller sex) Cooper's Hawk can appear to be the same size although they never are. In flight, the Cooper's Hawk has a bulky-looking head and holds its wings straighter, whereas the Sharp-shinned Hawk has a small and narrow head and wings that jut forward at the wrist. The Cooper's Hawk usually has a rounded tail with a well-defined white terminal band, whereas the Sharp-shinned Hawk usually has a square-tipped tail with a thin white terminal band. Immature Cooper's Hawks appear light below whereas immature sharpies appear dark below. Finally, the Cooper's Hawk flaps its wings more deliberately than does the Sharp-shinned Hawk.

Immature Cooper's Hawks can also be confused at a distance with immature Northern Goshawks, which have similar plumage patterns. The immature Northern Goshawk has dark streaks on the under tail coverts while all immature Cooper's Hawks have white under tail coverts. The Cooper's Hawk underparts appear light whereas the Northern Goshawk underparts appear dirty or dark. Also, the immature Cooper's Hawk lacks the tawny bar on the wing coverts found in the immature Northern Goshawk. Northern Goshawks have deep, powerful wingbeats compared to the Cooper's Hawk more shallow and rapid wingbeat.

Small woodland buteos like the Broad-winged Hawk and Red-shouldered Hawk could be confused with the Cooper's Hawk because they occupy similar habitat and have a few similar features. However, they have broader wings and tail and fly much slower than the Cooper's Hawk.

OTHER NAMES

It has also been known as "chicken hawk", "big blue darter", and "quail hawk."

ETYMOLOGY

The scientific name *Accipiter cooperii* translates into "Cooper's bird of prey". William Cooper was a noted 19th century ornithologist.

MYTHOLOGY

None is reported.

RANGE

Breeds from south-central British Columbia, southern Alberta, southern Saskatchewan, southern Manitoba, southwestern and southern Ontario, southern Quebec, Maine, southwestern New Brunswick south to Baja California, southern Texas, Louisiana, central Mississippi, central Alabama, and central Florida. Winters, and may be present year-round from southern British Columbia, including Vancouver Island, Washington, Idaho, Wyoming, southern South Dakota, southern Minnesota, southern Wisconsin, central Michigan, and Pennsylvania south through most of the United States.

There are no recognized subspecies in North America.

BEHAVIOR

The Cooper's Hawk tends to remain close to forest cover where it can be seen darting through open forest, crossing clearings, or soaring over the forest canopy. Like all accipiters, it is a "sit and wait" predator that perches in a concealed place, then dashes out quickly to capture its prey. When hunting prey on the ground such as grouse, it courses low, alternating rapid wingbeats and glides, through open forest, using brush, hedgerows, and trees to conceal its approach. The Cooper's Hawk also hunts by soaring high, then stooping falcon-like on flying prey such as pigeons and bats. It hunts only during daylight hours. When attacking prey, it flies rapidly, then glides the last 12 to 15 feet (3.7 to 4.7 meters) before impact. It thrusts its pelvis and legs forward to increase body speed and shocking power at the point of impact as it brakes with its wings. It grasps prey with its needle-sharp talons, usually killing the prey on impact or grasping and releasing its grip repeatedly until the prey is dead. Prey is carried to a perch, where it is plucked and torn into pieces. The Cooper's Hawk eats the head first, then the viscera, and then the body meat. Occasionally the Cooper's Hawk eats carrion.

On sunny days it often soars in thermals, like larger hawks and eagles. During migration it uses thermals to gain altitude before gliding off. During active flight it flies with stiff, moderately strong wingbeats. When gliding down towards prey or a perch, it holds its wings level and wrists cocked forward. When soaring the wing is held straight.

In the fall, the Cooper's Hawk migrates between August and November, although some populations are resident. It tends to move as single birds and follow coastlines, lakeshores, and mountain ranges. Immatures tend to move south about one week earlier than adults. Migratory movements usually follow the passage of a low pressure system when birds take advantage of following winds. This hawk is most visible during migration when they can be found in almost any treed area. Migrants tend to avoid the Great Plains region, which has little forest cover. The return spring movement occurs from March through May.

The Cooper's Hawk is widely, but thinly distributed. Breeding home ranges for individuals in different habitats ranged from 988 to 4444 acres (400 to 1,800 hectares). Densities of breeding pairs have been estimated as one pair per 815 to 12,346 acres (330 to 5,000 hectares). In areas of high densities there can be one pair per 815 to 2099 acres (330 to 850 hectares). The maximum known lifespan in the wild is 12 years. Mortality rates are quite high in the first year, about 75 percent from all causes, then declining to about 35 percent annually thereafter. Of 136 birds banded as nestlings and recovered after death, the mean age was only 16.3 months.

Courtship behavior is not well described and is thought to be similar to other accipiters. Males establish territories, then try to attract females by soaring in broad circles over treetops with tail closed, undertail coverts flared, and wings held high above the back. Pairs soar together in thermals. Slow speed display flights occur where both birds fly slowly with exaggerated wingbeats interspersed with glides with the wings held in a dihedral.

ADAPTATIONS

Extreme sexual size dimorphism (females almost twice as heavy as males) may have evolved to increase food supplies available to pairs during the breeding season, as in the Sharp-shinned Hawk. The larger female tends to capture larger prey and the smaller male tends to capture smaller prey. In this way, mates do not compete for the same prey source, and can provide more food for their young.

This hawk is adapted for the quick pursuit of forest birds and mammals. Their short, powerful wings and long tail allow for speed and maneuverability in dense cover. The Cooper's Hawk is a "biomass maximizer" because it tends to capture larger prey than the average size of prey available to them in nature. Individuals can specialize in specific prey when that prey is abundant, for instance, Northern Bobwhite in Georgia, free-tailed bat in Texas, and lizards in California.

HABITAT

The Cooper's Hawk frequents open coniferous or deciduous forests and open woodlands, but is usually associated with riparian woodlands. It occurs in a wide variety of habitats including rural and well-treed urban areas. Good habitat includes woodlands with abundant populations of medium-sized birds, this hawk's main prey. Birds inhabiting city parks and suburbs likely are attracted by large numbers of domestic pigeons (Rock Doves) and European Starlings. This hawk will also stake out suburban yards where it can pick off songbirds attracted to feeders.

Nests are usually built in extensive stands of forest or woodlots larger than 9.9 acres (4 hectares), but occasionally in solitary trees. Forest stands tend to be older and more open than for Sharp-shinned Hawks, but younger and denser than for Northern Goshawks. In Oregon, second growth conifer forests 30 to 70 years old were preferred.

VOICE

The Cooper's Hawk is usually silent except during the breeding season. Mates likely communicate mainly by calling because of the poor visibility in their woodland habitats. Females have up to 42 different calls and males up to 22 different calls. Female voices are lower and slower than males. During the nesting season, the loud alarm call "cak-cak-cak-cak..." is the most often heard call. Males give a "kik" call when returning to the nest with food, to announce his presence to the female, during courtship, and while nest-building. Females give the "kik" call when trying to locate the male, when flying towards the nest, or

during nest-building. The females give a "whaaa" call during food exchanges with the male; when flying towards the male and expecting food; when plucking prey; and when flying to the nest with food. Both sexes give short "whaaa" calls during copulation. Nestlings chirp and cheep at one to two weeks of age, then whine when begging for food.

FOODS

The Cooper's Hawk feeds mainly on small to medium-sized birds, but also eats small mammals, reptiles, and a few invertebrates. Prey preference varies regionally. Preferred prey included American Robin and eastern cottontails in Washington; Blue Jays and eastern cottontails in Missouri; and American Robin, Varied Thrush, eastern cottontail, California Quail, and other thrushes on Vancouver Island in British Columbia. Other bird prey includes poultry, grouse, pheasants, woodpeckers, sparrows, crows, coots, screech-owls, shorebirds, Least Bitterns, European Starlings, hares, squirrels, cotton rats, voles, deer mice, shrews, lizards, minnows, frogs, grasshoppers, dragonflies, crickets, and butterflies.

This hawk is commonly known as the "chicken hawk", along with the Northern Goshawk, because it will readily take domestic fowl. The Cooper's Hawk will even boldly enter coops to capture chickens, quails, and pigeons.

PELLETS

Pellets, birds and mammal carcasses, and bones cleanly stripped of meat can be found beneath nest trees and at plucking posts. The pellets are often oval in shape and gray. They range in size from 1.25 to 2.0 inches (32 to 51 millimeters) in length and 0.50 to 1.0 inches (13 to 25 millimeters) in width.

NESTING

The Cooper's Hawk nests in mixed coniferous or deciduous forests. Nests are bulky platforms of sticks, placed in a main crotch or on a limb next to the trunk, and are usually 26 to 49 feet (8 to 15 meters) above ground. Nests are usually partially concealed by foliage. Many nests are built on top of old squirrel nests, other hawk nests, or in mistletoe clumps. Nests tend to be broad and flat in conifers and taller in deciduous trees. The nest cup is lined with bark chips and green conifer tips.

Males show strong attachment to traditional nesting territories and Cooper's Hawks tend to build nests in proximity to previous nests. Some nests can be used for up to three years. Some females breed as yearlings, but males do not breed until two years old.

The Cooper's Hawk lays clutches of three to six eggs, but four to five eggs are most common, with one egg laid every second day. The eggs are short-oval to oval in shape and the shell is smooth but not glossy. The ground color is a pale cobalt or bluish white when freshly laid, but becomes dirty white during incubation. Occasionally pale spots may be present. Egg size ranges between 1.8 and 1.9 inches (47 and 49 millimeters) in length and 1.4 and 1.6 inches (36 to 42 millimeters) in width. Incubation begins usually after the third egg is laid and lasts for 30 to 36 days. Females perform virtually all incubation while the male brings her food. Males take short turns at incubating while the female leaves the nest to consume food brought by the male. Replacement clutches are laid if the first clutch is lost. Young remain in the nest 27 to 34 days. Young are brooded constantly by the female for the first two weeks. After two weeks the female begins to leave the nest regularly to hunt for food for the young. After fledging, young return to the nest for one to two weeks to receive food. Parents care for young for up to seven weeks after they first leave the nest, then young tend to disperse.

CONSERVATION

The Cooper's Hawk is widely distributed across the United States and southern Canada. Western populations appear stable but eastern populations are widely thought to be declining, although there is little data to back up that claim. During the 1940s and 1950s, populations declined in the United States due to pesticide contamination. One authority estimates at least 20,000 Cooper's Hawks winter in Canada and the United States.

Breeding habitat is diverse and does not appear to limit populations in some areas. Populations are likely more dependent on food supplies than availability of suitable nesting sites. Breeding success is likely lower in areas that are grazed more heavily, because of lower prey populations. Populations are likely smaller in areas where large tracts of forest have been removed.

This hawk suffers considerable mortality when it enters urban areas by flying into windows and collision with vehicles. Shooting of "chicken hawks" was an important cause of mortality until the 1970's, with immatures suffering mortality rates approaching 50 percent in their first year. Shooting is not a major problem now, except for populations wintering in Mexico.

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Northern Goshawk

Accipiter gentilis

GENERAL DESCRIPTION

The Northern Goshawk is a large, fast-flying, powerful forest hawk that occurs mainly in open to dense mature boreal forests. It is as large and powerful as a buteo but has the trademark speed and maneuverability of the accipiters. It has long, broad wings that taper towards the tip and a long, broad tail that is held closed unless soaring. The head is large and bulky.

Adults are dark gray above with a light gray chest and belly heavily streaked with black and darker grays. This is distinctive among the hawks. It has a prominent dark patch extending from the nape to the eye, and distinctive pale eyeline. Adults have fierce-looking orange to red eyes. The tail is strongly barred, the wings lightly barred, and the vent is pure white. The beak is gray at the tip, pale at the base, and with a yellow cere. The legs and feet are yellow. Colors of adult males are brighter than adult females. Immatures are brown above with heavy vertical streaking with brown and white on the chest and belly; their wings and tails are much more strongly barred than on any adult.

In flight, Northern Goshawks have heavy, deep wingbeats when flying level. This accipiter often soars like a buteo, but also looks like a falcon, with sweptback wings, when closing in on prey.

Since the female is much larger than the male, she handles most of maintaining breeding territory, taking care of the young, and defending the nest from intruders. The smaller male does much of the hunting and bringing food back to the female at the nest. Outside the breeding season the Northern Goshawk is solitary.

Populations and reproduction of Northern Goshawks are declining in parts of the western United States due to uncontrolled forestry practices and urbanization. It has been designated as a Management Indicator Species by the United States National Forest Management Act.

Every 10 years or so cyclic irruptions of Northern Goshawks occur at which time they becomes much more common in southern parts of its wintering range. At the Duluth (Minnesota) Hawk Watch, large numbers were reported in 1972, 1982, and 1992.

SIZE

The Northern Goshawk is sexually dimorphic in size, with females being up to 25 percent larger than males. It is the large accipiter hawk, being about 10 times heavier than the Sharp-shinned Hawk and about the same size as a Red-tailed Hawk. Lengths average 23 inches (58 centimeters) for females and 19 inches (49 centimeters) for males. Wingspans average 43 inches (108 centimeters) for females and 39 inches (101 centimeters) for males. Weights average 2.5 pounds (1,137 grams) for females and 2.0 pounds (912 grams) for males. The largest females may reach weights of 3.0 pounds (1,360 grams).

MORPHS

There are no light or dark color morphs known for this species. Partial albinism has been noted.

SPECIFIC DESCRIPTION

Adult - Perched

- dark gray upperparts, slate black cap, dark patch behind eye, light or white line above the eye
- strongly barred (black on gray), long, broad tail
- undertail coverts are white
- red eye, yellow legs and feet
- light, but dirty gray chest and belly heavily streaked with dark gray and black
- wingtips extend halfway down tail
- males are brighter than females overall and more finely barred on the under side

Immature - Perched

- brown back, head, nape, and top of wings
- pale line above eye
- four dark bands with light "highlight" edges bordering some dark bands
- undertail coverts streaked with brown
- yellow eye, legs and feet
- buffy underparts striped with long streaks of brown
- the brownish immature plumage is replaced with the more colorful adult plumage during their second year.
- pale tawny bar on greater wing coverts

- large hawk with light blue-gray body and bold white line above eye
- long tapered, rounded wings
- primary feathers lightly barred with gray-brown
- feathers undertail white
- dark gray tail with three or four dark bands when fanned

Immature - Flight

- large hawk with buffy underparts striped with long streaks of brown
- pale line above eye
- long tapered, rounded wings
- flight feathers noticeably barred with dark brown
- dark brown tail with wide band at tip and light and dark bands about the same width
- under tail coverts streaked with brown

SIMILAR SPECIES

The Northern Goshawk can be confused with the similar-shaped Cooper's Hawk but it is much more massive, a more powerful flier, and more broadly proportioned. Adult plumage is distinctly different from Cooper's Hawk but immature plumage patterns are similar.

In flight, this hawk can resemble the powerful Gyrfalcon, with its long heavy body, dark grayish color, and swept back wings as it hurtles after prey. The Gyrfalcon has much more severely tapered wings and typically stoops on prey from above. It should be noted that the Gyrfalcon also "tail chases" a lot in capturing prey.

When perched or soaring, goshawks can resemble buteos like the Red-tailed, Red-shouldered, or Broad-winged Hawk, especially during immature plumage. At a distance, soaring immatures can only be identified by the way they flap their wings: steady, deep, and powerful.

OTHER NAMES

It has also been known as "goshawk", "chicken hawk", "autour des palombes", and "gavilan pollero."

ETYMOLOGY

The scientific name *Accipiter gentilis* translates into "noble's bird of prey". Noble refers to European falconry practices where only members of the nobility (or royal families) could fly this hawk.

MYTHOLOGY

Eurasian falconers prize the Northern Goshawk as a hunting bird more than any falcon, but it is not as highly valued by North American falconers. It is widely known to be a fierce hunter, and is sometimes given credit for taking larger prey than usual.

RANGE

Resident and breeds from western and central Alaska, northern Yukon, western and southern Mackenzie, Ontario, Labrador, and Newfoundland south to central California, eastern Arizona, western New Mexico, northern and western Alberta, northern Saskatchewan, southwestern Manitoba, northern Minnesota, central Michigan, Pennsylvania, central New York, and northwestern Connecticut.

Winters throughout its breeding range but every nine to eleven years irregular movements occur when Northern Goshawks may be seen south to the Gulf of Mexico.

Two subspecies are recognized in North America. *A. g. atricapillus* occurs throughout the continent except on the Queen Charlotte Islands and Vancouver Island off the north of British Columbia where *A. g. laingi* occurs. The latter race is thought to be smaller, and darker, but more research is required to delineate the two subspecies.

BEHAVIOR

The Northern Goshawk tends to remain close to forest cover where it can be seen coursing through open forest, crossing clearings, or soaring along mountain slopes. Like all accipiters, it is a "sit and wait" predator that perches in a concealed place, then dashes out quickly to capture its prey. It tends to hunt prey on the ground or in the lower canopy. When hunting prey on the ground, such as grouse, it courses low, alternating rapid wingbeats and glides, through open forest, using brush, hedgerows, and trees to conceal its approach. It attacks ferociously and will pursue prey through the thickest cover. It hunts only during daylight hours. It grasps prey with its powerful talons, usually killing the prey on impact or repeatedly grasping its victim until it finds vital organs. Prey is carried to a traditional plucking perch, where it is plucked and torn apart. Plucking posts are often within 160 feet (50 meters) of the nest during the breeding season.

On sunny days it often soars in thermals, like *buteo* hawks and eagles. During migration it uses thermals to gain altitude before flying off.

In the fall, the Northern Goshawk migrates between August and November, although some populations are resident. It tends to move as single birds and follows coastlines, lakeshores, and mountain ranges. Immatures tend to move southward earlier than adults. The extent of migration depends on prey availability. Northern populations may move "en

masse" southwards during years with low snowshoe hare numbers, but remain relatively sedentary during years of high hare numbers. These southward incursions occur every few years, on average between nine and eleven years. The return spring movement occurs from late February through early May.

The Northern Goshawk is widely, but thinly distributed. Breeding pairs require relatively extensive tracts of habitat compared to other hawks. Breeding home ranges for pairs in different habitats ranged from 1.2 square miles (212 hectares) to 5 square miles (13 square kilometers). Densities of breeding pairs are higher in broken forests with more edge habitat than in deep, continuous forest. The estimated life span in the wild is about 20 years. Mortality rates are quite high in the first year, about 80 percent from all causes, then declining to about 40 percent annually thereafter. Starvation and illegal shooting is the leading cause of mortality. Some adults and young are killed at the nest by Great Horned Owls.

Courtship behavior is similar to other accipiters. Males establish territories, then try to attract females by soaring in broad circles over treetops with tail closed and undertail coverts flared. Males perform a "sky dance" by circling high in slow, undulating flight, then plunging into the trees. Slow speed display flights occur where both birds fly slowly with exaggerated wingbeats interspersed with glides with the wings held in a dihedral.

This hawk aggressively defends its nest site from predators and will strike large mammals, and even humans, who venture too close.

ADAPTATIONS

Sexual size dimorphism (females larger than males) may have evolved to increase food supplies available to pairs during the breeding season, as in the other accipiters. The larger female tends to capture larger prey and the smaller male tends to capture smaller prey. In this way, mates do not compete for the same prey source, and can provide more food for their young.

This hawk is adapted for the quick pursuit of medium-sized forest birds and mammals. Their powerful wings and long tail allow for speed and maneuverability in dense forests.

HABITAT

The Northern Goshawk evolved in boreal and temperate forests of the northern hemisphere, and while it is considered a bird of these deep forests, it tends to favor forest edges and open woodlands over large tracts of dense forest. It also occurs in mixed deciduous/coniferous woodlots and heavily wooded suburbs. In southern regions it occurs mainly in mountainous habitats.

The Northern Goshawk hunts mainly along edges or openings in the forest such as brushy meadows, burns, avalanche chutes, bogs, regenerating clearcuts, treed ravines in prairies, alpine tundra edge (mainly in migration), or parklands. For breeding, it requires tall, usually deciduous trees, as nest sites. Nests are usually situated in an extensive stand of trees well back from openings in the forest.

Forest stands tend to be older and more open than for other accipiters. In Oregon, conifer forests older than 150 years were preferred.

VOICE

The Northern Goshawk is usually silent except during the breeding season. Mates likely

communicate mainly by calling because of the poor visibility in their woodland habitats. When circling over its territory, males give a loud, clear, gull-like "kree-ah, kree-ah". When attacking a predator near the nest, both sexes give a loud, rapid "gek-gek-gek...". Males give a "guk" call when returning to the nest with food. Pairs duet with a rapid "ki-ki-ki-ki" during the nest building and egg-laying periods. Nestlings chirp and cheep at one to two weeks of age, then whine when begging for food.

FOODS

The Northern Goshawk feeds mainly on snowshoe hares, grouse, ptarmigan, medium-sized forest birds (woodpeckers, Band-tailed Pigeons, jays), rabbits, ground squirrels, and tree squirrels. Bird prey ranges in size from kinglets and sparrows to Mallards and Ring-necked Pheasants. Favored prey in northern areas are ptarmigan and snowshoe hares; in southern areas it is Ruffed Grouse. In Arizona, golden-mantled ground squirrels and cottontail rabbits are preferred mammal prey, while Steller's Jays and Northern Flickers are the birds most eaten. Other mammal prey includes mice, muskrats, domestic cats, young marmots, and chipmunks. It also eats poultry, snakes, grasshoppers, and even caterpillars.

In northern regions this hawk competes for prey with the Gyrfalcon. Individuals can specialize in specific prey when that prey is abundant, such as American Robins and Steller's Jays.

This hawk is commonly known as the "chicken hawk", along with the Cooper's Hawk, because it will readily take domestic fowl. Young Northern Goshawks will even boldly enter coops to capture chickens, pigeons, and quail.

PELLETS

Both pellets and skeletal remains of prey, usually bones and feathers which are stripped clean of meat, can be retrieved below perching places. Pellets may be oval to elliptical in shape and usually gray and fairly smooth in appearance. They range in size from 1.5 to 2.25 inches (3.8 to 5.7 centimeters) in length and 0.75 to 1.25 inches (1.9 to 3.2 centimeters) in width.

NESTING

The Northern Goshawk nests in mixed, pure coniferous, and deciduous forests. Nests are large, bulky platforms of sticks placed in a main crotch of a large deciduous tree, usually 2.5 to 6.2 feet (eight to 20 meters) above ground. Nests are usually easily visible beneath the upper canopy of the forest. This hawk will take over old nests of other hawks or Common Ravens. Nests are reused year after year, with a little refurbishing done each year. Nests are lined with green sprigs, fresh bark strips, and grass each year.

Males show strong attachment to traditional nesting territories and pairs may remain together for many years. The Northern Goshawk lays clutches of two to five eggs, but three to four eggs are most common, with one egg laid every second or third day. The eggs are oval to long-oval in shape and the shell is granulated or appears rough. The ground color is a pale bluish-white without markings when just laid, but becomes soiled as incubation progresses. Egg size ranges between 2.28 and 2.33 inches (57.8 and 59.2 millimeters) in length and 1.76 and 1.78 inches (44.7 to 45.1 millimeters) in width.

Incubation begins with the first egg and lasts between 32 and 42 days. Females perform virtually all incubation while the male brings her food. Males take short turns at incubating while the female leaves the nest to consume food brought by the male. Replacement clutches are laid if the first clutch is lost two to four weeks after the loss. Young remain in the

nest for about five weeks. Young are brooded constantly by the female for the first three weeks. After three weeks the female begins to leave the nest regularly to hunt for food for the young. Nestlings tend to walk out onto branches around the nest a few days before taking first flight. After fledging, young return to the nest for one to two weeks to receive food. Parents care for young for up to five to six weeks after they first leave the nest, then young tend to disperse.

CONSERVATION

The Northern Goshawk is widely distributed across northern and western North America. Populations, which were thought to be declining in eastern North America, now appear to be stable. It may even be expanding its range in the northeastern United States. However, in western parts of its range, numbers are declining locally. One authority estimates at least 8,500 Northern Goshawks winter in Canada and the United States each year.

In local areas, such as coastal Alaska, British Columbia, Washington, and Oregon this hawk is sensitive to large-scale forest harvesting. It is considered a management indicator species of specific habitat conditions (e.g. mature forests), and is listed by the United States Forest Service as a "Sensitive Species" within the Rocky Mountain and Intermountain regions. In the southwestern United States it is also listed as a "Sensitive Species." Recently, many conservationists, biologists, and naturalists have been petitioning the United States Fish and Wildlife Service to officially include the bird under the Endangered Species Act.

During the breeding season the Northern Goshawk is vulnerable to accidental disturbance from forestry operations, as well as deliberate human interference at nest sites. To minimize this disturbance, nest sites must be located and described; sizeable tracts of foraging areas must be maintained; nest trees must be protected; human disturbance must be controlled; and conservation measures such as erecting artificial platforms could be encouraged.

Populations are likely more dependent on quality food supplies than availability of suitable nesting sites.

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Common Black-Hawk

Buteogallus anthracinus

GENERAL DESCRIPTION

The Common Black-Hawk is a medium sized hawk which forages and nests in riparian areas from the southwestern United States to the north-west and the north-central perimeter of South America. It is a rather stout hawk with broad, rounded wings and a short tail. It scans for prey from a well vegetated high perch and will move to closer perches if potential prey is detected. In the field, when perched, this hawk appears jet-black with contrasting yellow legs and cere. When flying, it is recognizable by its rather short yet relatively broad wings and a broad white tail band. Immatures appear black but have a buffy eyeline stripe and the underside is strongly streaked. Throughout its range it is associated with permanent water sources and tends to select riparian zones for foraging and nesting. It is often considered as an "obligate riparian nester."

SIZE

The Common Black Hawk exhibits some reversed size dimorphism with females being about five percent larger (by length) than males. Total length for both sexes range between 16.9 to 22.0 inches (43 to 56 centimeters) and averages about 21 inches (53 centimeters) with a wingspan of about 50 inches (127 centimeters). Males weigh about 1.74 pounds (790 grams) and females about 2.64 pounds (1,200 grams).

MORPHS

There are no light or dark color morphs for this species. Partial albinism has been found in South America but it is extremely rare.

SPECIFIC DESCRIPTION

Adult - Perched

- head is overall black with brown eyes
- end half of bill is black with first half and cere a bright yellow to bright yellow orange
- all-black body including back, neck and breast are slate-black
- long legs and toes are bright yellow
- wide white tail band
- thin white tip to tail
- wingtips almost reach tip of tail

Immature - Perched

- head is variably streaked with dark brown and buff and shows a dark, wide malar stripe that extends down the neck
- end half of bill is black with first half of bill and cere pale yellow
- back is primarily dark brown
- underparts are heavily streaked with brown and buff
- tail is longer than in adults and is obliquely barred bilaterally
- black band on tip of tail
- long legs and toes are pale yellow
- note that the juvenile plumage is replaced with the more consistently black plumage of the adult during the spring and summer following its hatching year.

Adult - Flight

- all-black body
- underside of outer primaries show a white window
- tail is black with a single broad white band placed half way down and a thin white terminal band
- flight pattern is slow with methodical strong wingbeats
- soars on flat wings with tail completely fanned

Immature - Flight

- wing lining is buffy
- longer tail than adult
- secondaries and primaries are strongly barred
- tail is strongly banded with dark and light bands that are not evenly spaced or patterned
- terminal band widest
- primary feathers have a pale "window" which is white on top, and tawny on the under side

SIMILAR SPECIES

The Common Black-Hawk can be confused with the Zone-tailed Hawk, Black Vulture, and dark-morph buteos. It is important to remember that the Common Black Hawk has broad wings and a diagnostic tail band. The Zone-tailed Hawk has narrower wings, a longer tail, a different tail pattern, and flies in a teetering fashion. The Black Vulture lacks the characteristic bright yellow cere and legs and has larger white patches at the base of the primaries.

OTHER NAMES

Depending on place and time it is also known as "Black Hawk", "Crab Hawk", "Cuban Black-Hawk", "Lesser Black-Hawk", "Mexican Crab Hawk", and "Mexican Black-Hawk."

ETYMOLOGY

The latin name for the Common Black-Hawk translates into the Coal Black Chicken Hawk. The genus *Buteogallus* means "chicken hawk" and *anthracinus* means "coal black."

MYTHOLOGY

None is known.

RANGE

The Common Black-Hawk breeds locally only in the southwestern United States. Here it occurs in the watersheds of the Gila and Bill Williams rivers in Arizona and New Mexico and ranges north to southwestern Utah and northwestern Arizona. A small remnant population still breeds in Jeff Davis County in northwestern Texas. Present in summer, but not confirmed breeding, in the Lower Rio Grand Valley and Val Verde County in southern Texas.

Although occasionally a few Common Black-Hawks spend the winter in the United States, most migrate through Middle America to northern South America.

The systematics of the relationships among the black-hawks is complex and has not been sorted out. The subspecies found in North America is *B. a. anthracinus*.

BEHAVIOR

The Common Black-Hawk usually scans for prey from a perch and, when a potential quarry is identified, will drop from its perch to make the kill. The hunt follows a step down approach with the location of a general foraging area the first decision. The hawk will typically alight on a high perch within the foraging zone and scan the area. If a possible target is detected, the hawk will move to a closer perch, and continue to do this until it is in striking distance. From this vantage point the hawk will mount its final attack in swift fashion. If the kill is made in water, the hawk will extend its talons only the length of the legs and will not risk getting its feathers wet. Other hunting strategies are employed, such as standing in water and "herding" fish into the shallower reaches, and catching birds in mid-flight.

It is not clear if pair formation has occurred before arrival at a nest site. In one instance a male was observed performing courtship displays for one week before a female arrived. Once paired, the hawks will perform a number of ritualized flights above the nest stand. These range from circling at high elevations with wings held in a dihedral, to a daring close encounter as one bird stoops (reportedly the male) with legs dangling and narrowly missing the other bird. In one thrilling observation, the male was observed soaring high above the nest stand when it folded its wings and dropped in full stoop, just breaking its fall before a branch, which it broke off with its feet. Whether this was a symbolic act or just the gathering of nest materials is not known. Noisy, raspy calls reminiscent of night herons is often heard during the nesting season. Copulation occurs within 50 to 300 feet (15.5 to 93 meters) of the nest with the male swooping down directly on the female or landing beside the female and then mounting. Copulation rate increases as egg laying nears.

The Common Black-Hawk vigorously defends the nest site from others of their kind. The conflicts are usually most severe at the onset of the nesting season. Aerial combat consisting of calling, chasing, and locking up of talons has been observed.

Like other raptors, the Common Black-Hawk will aggressively defend its nest site from other raptors such as Golden Eagles, Red-tailed Hawks, Peregrine Falcons, vultures, and ravens. Great Horned Owls are implicated in deaths to nestlings.

The oldest age known for the Common Black-Hawk is 13 years six months.

ADAPTATIONS

As with other Falconiformes, the Common Black-Hawk exhibits reversed size dimorphism where the female tends to be larger than the male. There are many benefits to this adaptation, but the underlying cause is not known. Reversed size dimorphism is most pronounced in species which pursue fast moving prey. For example, in the Sharp-shinned Hawk, a specialist of small songbirds, the males are 40 percent smaller in body size and can be 50 percent smaller in body weight than females. The Common Black Hawk, which pursues slow moving prey, is only weakly dimorphic, a probable reflection of their slow moving prey.

Their exceptionally broad wings, relative to other broad winged hawks like the buteos, is interesting. A high wing surface area to volume ratio suggests that this bird would be a superior soarer, being able to obtain good lift, but since it does not hunt from the wing this benefit is not obviously employed.

HABITAT

The common denominator for this species is proximity to water, whether it is at the northern end of its range in southwestern United States or in the core of its range in coastal Panama. The preferred habitat of this species are remote riparian zones with a permanent water source such as streams or pools which accommodate vertebrate and invertebrate prey. Nesting habitat is in similar areas which provide a grove of trees, such as mature cottonwoods, for nesting. It occurs to 7,420 feet (2,300 meters) in elevation.

VOICE

This species has a repertoire of calls, from a series of wheezy, high-pitched, whistle-sounding notes, to a hoarse, heron-like call of Ka-a-a-ah. The common eight-note call may sound like "kee-kee-KEEE-KEEE-KEE-kee, ee, ee." During copulation, a series of 20 to 30 monotonic notes, which last about 30 seconds, are uttered.

FOODS

A consideration of the diet of the Common Black-Hawk throughout its range shows that this species is a generalist and will feed on the prey most abundant and available near its summer home. However, in certain areas which provide an abundance of crabs, the birds will feed exclusively on this prey item. This species can be considered opportunistic in its prey selection as long as the prey is edible, and not poisonous, and of an upper size limit of small birds and small mammals. Fishes, frogs, reptiles, and arthropods that range between 17 and 7,371 ounces (0.6 and 260 grams) are its main prey. Occasionally it will also eat carrion. Outside its North American range it feeds on crustaceans such as crabs.

Food items recorded in order of importance throughout its range include invertebrates (crabs, centipedes, insects, and crayfish), fishes (11 species), reptiles and amphibians, mammals (bats, cottontails, and mice), and birds (small passerines).

PELLETS

No documented information available.

NESTING

The nest of the Common Black-Hawk, built by both sexes, is a large bulky stick platform positioned usually in the crotch of a tree at heights usually between 20 and 30 feet (6.2 and 9.3 meters). Nests at times are found built upon mistletoe. The preferred tree species is cottonwood, while sycamore and large mesquite are also used. The Common Black-Hawk demonstrates high fidelity to nest sites by returning to these areas every year.

The clutch size is between one and three eggs but most often just one or two eggs are laid, mostly two days apart. The eggs are ovate, short-ovate, or nearly oval in shape. The ground color is dull white with a greenish tinge marked by irregular small blotches of reddish brown. The shell itself is granulated. Egg size averages 2.25 x 1.77 inches (57.3 x 44.9 millimeters).

Incubation begins with the first egg laid. If clutches are lost early in the breeding season they will lay replacement clutches. The incubation period lasts between 37 and 39 days although an early period of 26 days has been reported. Age at first flight is between 41 and 52 days. Between 33 and 47 days young in the nest venture onto branches. After about 66 days the adults do not protect their young anymore, although they will continue to feed them for another 50 days or so.

CONSERVATION

The Common Black-Hawk is probably declining in the United States. The critical reason is the clearing of riparian lands for agricultural purposes; water diversion activities for irrigation and storage; and grazing. There has been only one nesting record for Texas since early in this century and the populations in New Mexico and Arizona are becoming more restricted in distribution. Other direct causes of mortality are shooting, human disturbance near the nest, and electrocution.

Conserving and rejuvenating large tracts of continuous and existing riparian habitat is critical if this species is to survive in North America.

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Harris' Hawk

Parabuteo unicinctus

GENERAL DESCRIPTION

The Harris' Hawk is a slim, long-legged, and quite docile hawk of the desert scrub in the American Southwest. It is a medium-sized to large hawk with brown body plumage, chestnut shoulders and legs, and a yellow face. Sexes are alike in appearance. It is swift in flight and graceful, often perching atop giant saguaro cacti in a diagnostic pose, holding its body quite horizontal. Common in groups, the Harris' Hawk both breeds and hunts in social units, which number among the members of adults, subadults, and juveniles from previous broods. This species is well known for having as many as three broods a year.

SIZE

The Harris' Hawk is the size of a large buteo hawk. Females are much larger than males. Lengths average 18 to 23 inches (46 to 58 centimeters) for both sexes. Wingspans are up to 46 inches (117 centimeters) for both sexes. Weights average 2.2 pounds (998 grams) for females and 1.5 pounds (690 grams) for males.

MORPHS

The Harris' Hawk has no morphs or unusual plumages.

SPECIFIC DESCRIPTION

Adult - Perched

- yellow cere and patch between beak and eye (lores)
- dark brown or blackish-looking body
- chestnut shoulders and thighs
- base of tail (both upper and lower surfaces) is white
- wingtips reach half way down tail
- long black tail with broad white band on tip and white base
- long yellow legs

Immature - Perched

- like adult, but upperparts dark brownish and belly streaked with white usually forming a bib with dark breast
- rusty and brown spotted shoulders
- whitish bars on rusty thighs; variants can have solid rusty thighs
- base of tail (both upper and lower surfaces) is white
- uppersurface of tail is black with white band on tip (narrower than adult)
- undersurface of tail is gray with darker bands and a white band on the tip
- wingtips reach half way down tail
- tail appears longer than in adult
- long yellow legs

Adult - Flight

- tricolored effect: shoulders, wing linings and thighs are chestnut, flight feathers, body,

and tail are blackish or dark brown, and tail with a wide white base and tip
- long tail

Immature - Flight

- like adult but underparts are streaked with white on belly
- underwing shows chestnut lining
- undersurfaces of flight feathers are gray with large white crescent at the base of the primaries
- undersurface of tail is gray with a few darker bands and has a white base and a narrow white tip.
- uppersurface of tail like an adult's
- wings narrower than adult

SIMILAR SPECIES

The two other large black hawks of the Southwest, the Zone-tailed Hawk and the Common Black-Hawk, have blackish, not chestnut wing linings. Both have black-and-white banded tails, not a black tail with a white base and a white tip. Virtually all dark-morph buteos lack the chestnut wing linings combined with the dark tail with its white base and white tip of the Harris' Hawk. A dark Ferruginous Hawk has rusty wing linings and a dark body, but shows a whitish tail and whitish flight feathers from below. A Red-shouldered Hawk shows reddish wing linings but has a black and white banded tail, barred flight feathers, and a lighter body color. The immature White-tailed Hawk is superficially similar to the Harris' Hawk but has cold dark brown body plumage with a large white breast patch, and lacks the Harris' Hawk's chestnut shoulders. Its upper tail surface is gray with fine black bars, a thin white tip and a narrow white rump totally unlike the broad white base, black tail and white tail tip of the Harris' Hawk. The subadult White-tailed Hawk has some rufous on the shoulders, but less of it than the Harris' Hawk, and also has a white back and is white below with dark barring. The Snail Kite has a similar white base to the tail but shows all dark underwings, and no chestnut shoulders or under wing linings.

OTHER NAMES

The Harris' Hawk is also known as the "Bay-winged Hawk", "Eastern Harris Hawk", and "Dusky Hawk."

ETYMOLOGY

The scientific name *Parabuteo unicinctus* translates to "close relative of a buteo" (para - Greek; buteo - Latin) that has "one girdle or band" (uni - Latin; cinctus- Latin), a reference to the white at the base of the bird's tail.

MYTHOLOGY

No mythology is known for this species.

RANGE

The Harris' Hawk is resident in semi-open habitats from northern Baja California, southern Arizona, southern portions of New Mexico, and central Texas south through Central America and South America to Chile and northern Patagonia. It was resident in southeastern California and southwestern Arizona along the Colorado River but was extirpated from the area in the 1960s. Individuals recorded far to the north or east of the species' range are likely to have escaped from falconers. Recently, the hawk's range has extended into San

Simon and Sulfur Springs valley in eastern Arizona.

There are two recognized subspecies of this hawk. The race *P. u. harrisi* occurs in North America.

MIGRATION

The Harris' Hawk is generally considered non-migratory in North America. Larger than usual flocks may assemble after breeding season and individuals may wander from their home ranges, but this is not considered a true migration, but more of a local dispersal.

BEHAVIOR

Although a large hawk, the Harris' Hawk usually does not have the soaring flight of a buteo hawk. Capable of swift and agile flight, this species can dart around brushy cover in pursuit of quick moving small mammals, birds or lizards. In Arizona, it often perches atop giant saguaro cacti. The Harris' Hawk is quite socially tolerant toward other members of its group. It is not unusual to see one bird perch on the back of a clan member. Such "backstanding" may lead to "totem poles" of three birds, and apparently has nothing to do with mating or aggression. The Harris' Hawk is fairly tolerant around people except near its nest where reactions to intrusion vary among group members according to their breeding status and age. Immature helpers on the periphery may quietly leave the nest area, while adults of the nesting "core" will soar low over the nest and call.

The Harris' Hawk is a social hunter and often forms hunting parties of four to six individuals. The whole group assembles at the beginning of the hunt, then divides into smaller parties which search in different directions. Group leaders watch the progress of all parties. Once prey is flushed all parties converge. Three tactics are used in variable sequence during a chase. The first is the "surprise pounce" with several hawks quickly converging on prey separated from protective cover. The second is "the flush" with one or more hawks flushing prey from cover while the other hawks wait. The third is the "long chase." Individual hawks stoop at the prey, driving it toward other hawks in a relay. These tactics exhaust the prey, often a rabbit, enabling one hawk to kill it at minimal risk to itself. Thus large prey can be taken which hawks hunting as individuals would not be able to handle. Groups have greater success than individuals. Groups of five have the highest kill rate of any group size. All group members share in feeding on the prey.

This species has a large home range varying in size from 1.9 square mile (5 square kilometers) per active nest site in Arizona to 0.8 to 1.3 square miles (2.13 to 3.3 square kilometers) in Texas. A typical home range contains several old nests within 1.1 miles (1.5 kilometer) of each other but occasionally up to twice that distance apart. A territory is well defined and is defended against intruders. Within its own groupings, the species is highly social.

The Harris' Hawk will chase Red-tailed Hawks and Ferruginous Hawks from its territory. Little information is available on other interactions.

The courtship of the Harris' Hawk is poorly known. High-circling has been observed in which groups of adult plumaged hawks circled while calling with one or more individuals making long vertical stoops and also tail chasing each other. A sky-dance has also been described where a male stoops from a height with wings folded, swinging up to land on the back of a female to copulate with her. Group stoops of two males and a female have also been seen. Some copulation's occur without preceding courtship displays. Copulation sometimes occurs after a male has stood on the back of a female for a long time.

In the wild a Harris' Hawk has lived to 12 years and seven months of age. Causes of mortality include electrocution, death in coyote traps, and drowning in livestock watering tanks. Birds also suffer injuries from cholla cacti.

ADAPTATIONS

The Harris' Hawk has an unusually large supraorbital process which is a bony shield above the eye that protects it from the thorns and spikes of desert plants. The Harris' Hawk uses saguaro cacti as perches and nest sites. Young hawks quickly learn to stand on one foot to pluck saguaro spines from the other foot. The Harris' Hawk displays much versatility in its prey choices, shifting from one prey to another depending upon local availability; an important adaptation for a raptor living in a harsh environment. Perhaps its most significant adaptation is its evolution of group hunting, enabling individual hawks access to larger prey than would be available through "normal" solitary hunting.

HABITAT

The Harris' Hawk frequents desert and semi-desert brushlands and thickets typified by mats of thorny shrubs with scattered dwarfish trees. It inhabits a variety of desert vegetation types including saguaro-paloverde desert scrub in Arizona; mesquite dominated thorn scrub brushland with opuntia understory and yucca cactus- creosote bush desert in Texas, and locally, juniper-oak groves on the Edwards Plateau of Texas. The Harris' Hawk used to frequent drowned mesquite, cottonwoods, and willows along the Colorado River in southeastern California, but became extirpated by about 1970.

In Central and South America this species also occurs in grasslands, farming areas, ranchlands, and mangrove swamps.

The Harris' Hawk inhabits areas having one of the most extreme climates on the continent. Summer temperatures in Arizona can soar as high as 115 degrees Fahrenheit and drop below freezing in winter. The extreme heat may restrict Harris' Hawks to areas where water is available.

VOICE

The Harris' Hawk has a small repertoire of vocalizations. The alarm call is a scream, given as a "iirr", lasting up to three seconds. It also gives a Cooper's Hawk-like cackle at intervals for five to 10 seconds. During prey exchanges, or while anticipating a prey exchange or delivery, an "eerrp" call is given, lasting one to three seconds. Young begging for food give a plaintive "eechip" lasting about two seconds. A scream "oo-EEK" has also been described, as have monotonous peepings given by adults.

FOODS

The Harris' Hawk eats a wide variety of small mammals, birds, some lizards, and occasionally insects. In one Arizona study the desert cottontail, Gambel's Quail, and desert spiny lizard were the primary prey. However, various studies have found differing distributions of prey types, probably the result of the hawk's ability to shift to whatever prey is locally most abundant.

Mammals taken include ground squirrels, wood rats, kangaroo rats, cottontails, jack rabbits, pocket gophers, and pocket mice. Birds taken include poultry, night-herons, quail, flickers, wrens and other raptors including American Kestrels, Cooper's Hawks, and Elf Owls. Reptiles and amphibians include common lizards including members of the following groups - Sceloporus, Callisaurus, Cnemidophorus, and Phrynosoma and frogs. On rare occasions

goldfish are taken. Insects eaten include beetles, grasshoppers, ants, and ticks. The Harris' Hawk also may eat carrion in winter.

PELLETS

There is no information on pellet appearance or dimensions for this species.

NESTING

The Harris' Hawk nests atop saguaro cacti, in short desert trees, and occasionally in pines and on transmission towers. In Arizona, the nest is commonly situated just below 19.3 feet (6 meters) in a saguaro branch or in the branches of a paloverde. Heights average between 10.2 and 20.2 feet (4.4 and 6.3 meters). Cottonwoods, mesquite and ironwood are also used in Arizona. In Texas and New Mexico, nests are constructed in mesquite, hackberry, Spanish Dagger, and also in stands of live oaks with persimmon.

The bulky nest is constructed of twigs with finer twigs, grass, Spanish moss, bark, and elm shoots as lining. Birds add green sprigs continually while eggs or nestlings are in the nest. The nest is often built atop a mistletoe mass which partially conceals it from below. The Harris' Hawk will refurbish old nests and sometimes use extra nests as feeding platforms.

Clutch size ranges from one to five eggs, but the average is only three to four eggs. The egg averages 2.1 inches (53 millimeters) in length and 1.7 inches (42 millimeters) in breadth. It is of a short subelliptical shape and is smooth without gloss. It is very pale bluish, fading to white during incubation, plain, or lightly dotted or spotted with lavender or light brown.

The Harris' Hawk commonly breeds in groups, the composition of which may vary within an area and from one region to the next. In Arizona, a common pattern is for two males and a female to form a polyandrous trio. Both males mate with the female and all trio members defend the nest and feed the young. Usually a number of "helpers", often juveniles, immatures, and adult plumaged birds from previous broods, bring food to the core group. Occasionally "immigrants" from other families will join a new group. The core group can vary from a monogamous pair to two males and two females mating with each other. Group breeding has also been found in New Mexico but not Texas.

Generally the female does most of the incubation while the male(s) feed her. Incubation lasts 33 to 36 days with an average of 35 days (34 in captivity). The female broods, shades, and feeds the young with food brought by the male (and food brought to the core group by the helpers). Little aggression has been reported between nestling siblings. The young become 'branchers' at about 40 days and begin short flights soon thereafter. Immatures may associate with the breeding group for months or years after fledging.

The Harris' Hawk commonly has more than one brood a year, sometimes up to three. Helpers aid in provisioning the young so that in some cases eggs of a second brood can be laid while the young of the first brood are still in the nest. Renesting after the failure of a nesting attempt is also common.

CONSERVATION

The Harris' Hawk was extirpated from southeastern California where re-introductions have had limited success. Populations have declined in other parts of its range, particularly in southeast Arizona along the Gila, Santa Cruz, and San Pedro Rivers. It was on the National Audubon Blue List from 1972 to 82, listed as a species of Special Concern in 1982, and one of Local Concern in 1986. The major threat in the United States and Mexico is habitat

destruction. In the vicinity of Tucson and Phoenix, in Arizona, saguara habitats are rapidly being lost to housing developments. While Harris' Hawk adapts well to partially developed areas, it needs unbroken blocks of native vegetation for foraging and nesting.

Recent warming trends in the climate are apparently causing giant saguaro cacti to grow on steep mountain slopes, declining on the flatter desert areas favored by Harris' Hawks. This loss of hunting perches and nesting cacti decreases the quality of formerly productive habitat.

In Arizona, densities may be dependent on man-made cattle watering ponds.

Five thousand five hundred Harris' Hawks were estimated to winter in the United States in the mid 1980s.

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Gray Hawk

Buteo nitidus

GENERAL DESCRIPTION

The Gray Hawk is one of the rarest of all hawks in North America. It breeds in Arizona, Texas, and probably New Mexico, and withdraws from these areas during the nonbreeding season. It is a subtropical to tropical species and populations within the core of its range are nonmigratory. The plumage, as the name suggests, is primarily gray; the back is solid gray with the breast and stomach whitish gray flecked with darker gray. The tail is black with a broad centrally located white band, and a narrower terminal white band. The hawk has an accipiter flight style with rapid shallow wingbeats followed by a glide. It breeds in riparian areas embedded within an arid landscape. The favored prey item is arboreal lizards, but also includes birds and small mammals.

SIZE

The Gray Hawk is a small buteo with an average length from head to tail of 17 inches (42 centimeters) and a wingspan of 34 inches (87 centimeters). The male wing chord length averages 9.6 inches (24.5 centimeters) and the female is 10.1 inches (25.7 centimeters). Average weight for males is between 0.88 and 0.91 pounds (399 grams) and females 1.4 pounds (635 grams).

MORPHS

There are no reported color morphs for this species.

SPECIFIC DESCRIPTION

Adult - Perched

- gray upperparts extending from head to rump
- short tails
- gray barred underparts
- prominent yellow cere
- black tail is long with one wide and one narrow inner white band
- wingtips reach about mid tail
- white "U" on upper tail coverts

Immature - Perched

- brown upperparts with streaks on head, nape, and neck
- underside streaked white and brown
- dark brown eyeline bordered by buffy eyebrow and white cheek patch; dark malar stripe
- prominent yellow cere
- upper leg feathers barred
- dark bands on long tail become narrower towards body; terminal tail band widest
- wingtips reach about mid tail
- white "U" on upper tail coverts

Adult - Flight

- flight mode of accipiter - a series of flaps followed by a glide
- wing lining and underside of flight feathers whitish to pale gray
- shotish black tail crossed with two white bands
- outer primaries and trailing edge of wing tipped in black
- white crescent-shaped patch on upper tail coverts

Immature - Flight

- similar to adult in flight pattern but much longer tail
- outer primary feathers with bars
- long tail has multiple bands of black and gray which become narrower towards the body
- widest band on tail is near tip
- contrasting and bold face pattern
- white crescent-shape on upper tail coverts

SIMILAR SPECIES

It is similar in overall size and flight style to the Cooper's Hawk. The immature can be confused with the Broad-winged Hawk, but it has stronger barring on the head, a white crescent-shaped rump patch, and barred leg feathers.

OTHER NAMES

The Gray Hawk has also been called the "Mexican goshawk", "Shining Buzzard-Hawk", and "Sonora Gray Hawk."

ETYMOLOGY

The latin for Buteo means "a kind of hawk or falcon" and nitidus means "bright or shining". Hence, bright hawk or shining hawk.

MYTHOLOGY

No information for North America.

RANGE

The Gray Hawk occurs as a summer visitor in south-central Arizona, migrates to southern wintering grounds in October and returns in March and early April. It is present year-round in extreme southern Texas in the lower Rio Grande valley. There are also isolated breeding records from the west-central part of New Mexico.

This species also occurs in Mexico and Central America.

The subspecies in North America is *B. n. plagiatus*.

BEHAVIOR

Behavior of the Gray Hawk is not well described. It uses two basic hunting methods for the capture of different prey as follows: 1) when pursuing arboreal lizards and birds, it conceals itself in the dense foliage of a bush or tree, and then ambushes unaware prey; and 2) for rodents, it employs a low level soar in open areas and pounces on unsuspecting quarry.

Breeding behaviour is similar to other hawks in that the Gray Hawk demonstrates possession of a territory through an elaborate sky dance performed in pairs or alone. One observation reported a lone bird soaring high. It was soon joined by another hawk, whereupon they both climbed to between 300 and 450 yards (279 and 419 meters), then plummeted towards land, crossing flight paths while doing so. These flights are performed from mid April to early May. Another observation reports a pair circling with the male closely following the female and both sexes communicating through "flute-like" calls. It appears that copulation takes place early in the morning.

ADAPTATIONS

The Gray Hawk has evolved a slightly different wing pattern from other buteos, with the wingtips being squarish rather than round. This adaptation, it is theorized, has provided the species with increased maneuverability for pursuing prey within wooded areas.

HABITAT

The Gray Hawk is strongly associated with riparian habitats and a permanent water source, often a river, throughout its range. In Texas, it selects old cottonwood and willow stands along the Rio Grande valley. In Arizona, the interphase between the desert shrubland and the prairie grassland, where pockets of mesquite forests occur, are important foraging areas. Nest areas are in groves of cottonwood, willow and other large tree species.

VOICE

The voice of the Gray Hawk has been compared with notes from a flute, uttered during aerial courtship, and a peacock when agitated or in a defensive situation. A "Cree-ee-ee" is given throughout the breeding season between birds, and is thought to play a role in pair maintenance. When birds are stressed, such as in territorial defence, they will cry "Yee-ee-ee" followed by a "Pee-yeer". At times only the "Pee-yeer" will be used with the second syllable loudest.

FOOD

Early observations reported that this species was primarily a bird and small mammal eater, but recent studies have shown that the major prey items are lizards. The main lizard group are the tree lizards (Sceloporous species) which inhabit the mesquite forests. Other prey includes birds (towhees, kingbirds, quail), mammals (mice, woodrats, cottontail rabbits), and other reptiles such as snakes.

NESTING

Nest sites are usually in groves of trees, typically cottonwood, but also willow, sycamore, and ash. Less frequently, nests are placed in solitary trees. Nest placement is as high in the crown as possible and with sufficient support for the structure. The nest is a platform composed of green twigs and sticks and lined with leaves pulled off from branches near the nest. The Gray Hawk tolerates other raptor species, such as the Cooper's Hawk, Red-tailed Hawk, Zone-tailed Hawk and Common Black- Hawk, nesting as close as 323 feet (100 meters). Other Gray Hawks may nest as close as a 3,226 feet(1000 meters).

Eggs are laid in mid May and the normal clutch size is two to three eggs. The eggs are nearly elliptical in shape. The ground color is usually white or pale bluish when freshly laid. They may become stained during incubation. The average egg size is 2.1 inches (52.1 millimeters) in length and 1.6 inches (41 millimeters) in width. Incubation is primarily done by the female and lasts about 32 days. Nestlings fledge at about 42 days.

CONSERVATION

Pesticides have not posed a problem for this species, but habitat alterations have had significant impacts. The elimination of large riparian cottonwood stands for human settlement has meant a serious reduction in potential nesting sites as has grazing of young trees by domestic stock. It is encouraging to note that the United States Bureau of Land Management has recently set aside a large tract of cottonwood habitat along the San Pedro drainage where almost half of the Gray Hawks nesting in North America are found.

The total United States population has been estimated at 50 pairs, making it one of the rarest hawks in North America, along with the Aplomado Falcon and the Hook-billed Kite.

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Roadside Hawk

Asturina magnirostris

GENERAL DESCRIPTION

The Roadside Hawk is a common, and relatively tame, hawk of tropical and subtropical zones but in North America it only casually enters the Rio Grande valley of southern Texas. As its name suggests, it can frequently be seen perched in a tree, on a fencepost, or some other structure adjacent to roadways. It appears to be tolerant of human presence and it will often allow a close approach before taking wing. It is similar in size to the Broad-winged Hawk yet has a different plumage pattern. The Roadside Hawk has an accipiter style flight pattern with three to five wingbeats followed by a glide. This bird possesses an acute sense of hearing which it uses when perched and waiting for prey to become available.

Adults and immatures are similar in appearance. Overall, the adult is a dark grayish brown bird with a dark bib and a pale, barred belly. The tail is tipped in white, and the undertail is a pale brown with four dark crossbars.

SIZE

The female is larger but there is substantial overlap between the sexes. Total length ranges between 13 and 15 inches (33 and 38 centimeters), weight between 7.25 and 12.25 ounces (200 to 350 grams), and wingspan between 28 and 31 inches (72 and 79 centimeters).

MORPHS

There are no light or dark color phases for this species.

SPECIFIC DESCRIPTION

Adult - Perched

- dorsal side of bird is a brownish gray
- belly is lighter in color than back; dark bib on breast
- sides, abdomen, and flanks are buffy to white (paler) with reddish-brown bars
- iris is pale lemon yellow
- tail has white distal band and is paler underneath with four distinct and exposed crossbars
- wingtips reach just over halfway to the tip of the tail

Immature - Perched

- creamy short line over eyes
- dorsal side is more brownish than in the adult
- breast and abdomen is whitish with subtle brown vertical streaks on bib and brown transverse barring on belly
- iris is orange to yellow-orange
- creamy line above eyes
- tail may have four to five dark bars, almost all of equal width
- wing tips reach just over half way to the tip of the tail

Adult - Flight

- accipiter flight style
- underwing shows reddish-brown in primaries and secondaries
- reddish underparts with dark brown bib and barring
- tail with four bands, almost evenly spaced apart, and irregular in shape; white tip to tail
- barred tips to outer primaries

Immature - Flight

- accipiter flight style
- creamy underparts with streaked bib and barring
- tail with four to five narrow bands evenly spaced; white tip to tail
- creamy line above eyes

SIMILAR SPECIES

The Roadside Hawk is similar in size to the Broad-winged Hawk but has a different patterning. It is also similar to the Gray Hawk, but the adult Roadside Hawk has a dark bib and barred belly while the immature has a streaked breast and barred belly. It also has more bars on the tail.

OTHER NAMES

The Roadside Hawk is also referred to as the "Insect Hawk."

ETYMOLOGY

The genus name *Buteo* refers to "hawk", and the specific name *magnirostris* means "large beak." Literally, this bird is a "large-beaked hawk."

MYTHOLOGY

No information is available for the Roadside Hawk.

RANGE

The Roadside Hawk only casually visits North America from its more southern range in Mexico, Central America, and South America. It does not breed here but has been seen in the vicinity of Bentsen State Park in the Rio Grande valley, and in Cameron County of extreme southern Texas.

BEHAVIOR

The Roadside Hawk is a relatively unstudied raptor compared to other birds of prey with more substantial ranges in North America. Thus, little is known about the behavior of this bird. It is not a high soaring hawk. It prefers to hunt using a "sit and wait" approach or frequently hunts from a low patrol similar to a harrier. It appears to have keen hearing which it uses to detect prey. Like other raptors, the Roadside Hawk demonstrates possession of a nest territory by circling above the occupied site. The circling is interrupted by periodic chases, dives and calls. It tends to build new stick nests each year. However, the territories it nests in are occupied more or less continuously.

ADAPTATIONS

It demonstrates acute hearing but whether or not significantly more than other *buteos* is not known. Its apparent tolerance for humans and human modified landscapes has permitted this bird to occupy a niche which few other raptors have been able to do.

HABITAT

The nesting habitat is not well described, although proximity to a permanent water source appears important. Habitat in which the bird can be seen foraging is quite diverse which is not surprising considering its generalist lifestyle. In tropical parts of its range it shows a preference for dry woods and wood edges.

VOICE

The Roadside Hawk has a similar call to the Red-tailed Hawk, which has been described as "a reedy drawn-out eeyaaaa" or a "kree-e-e-e-e". Others interpret the call as a high hoarse whistle sounding like "seeeu."

FOODS

This hawk is reported to take a wide range of prey throughout its distribution, including invertebrates such as insects and scorpions and vertebrates such as lizards, snakes, nestlings, and some small mammals.

PELLETS

Details of pellets have not been described.

NESTING

Although the Roadside Hawk does not breed in North America it nests just across the border in Mexico. There it builds a bulky or compact stick nest and conceals it in the crowns of deciduous trees. Reported nest heights range from 25 to 35 feet (8 to 11 meters). Clutch sizes are not well known but data suggests usually two eggs are laid.

CONSERVATION

This is one of the more common raptors in Mexico, and appears to thrive in modified landscapes such as agricultural areas and alongside roadways. It has suffered from highway mortality.

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Red-shouldered Hawk

Buteo lineatus

GENERAL DESCRIPTION

The Red-shouldered Hawk is a buteo of eastern North America, with an isolated population along the West Coast. It is a woodland hawk, hunting beneath the canopy of northeastern forest or southern hardwood swamp. The Red-shouldered Hawk is larger than the Broad-winged Hawk which frequents forested edge, and smaller than the more aggressive Red-tailed Hawk which requires a semi-open forest or a patchwork of openings and clearings. The Red-tailed Hawk will drive out Red-shouldered Hawks from areas where the two species come into contact. Thus, the Red-shouldered Hawk has suffered population declines as forested land across the eastern United States and southeastern Canada becomes more fragmented due to human development.

The Red-shouldered Hawk is an attractive hawk, showing pale crescent shaped "windows" near the tips of its wings. The nominate race, *Buteo lineatus lineatus*, is patterned with rufous on underparts, shoulders, and wing linings. Its primaries and secondaries are boldly checkered with black-and-white, and its tail is black with white bands, making this species relatively easy to identify in its adult plumage. It drops onto its prey from elevated perches and also flaps and glides in direct accipiter-like attacks.

SIZE

The Red-shouldered Hawk is a medium-sized to large buteo. Females are slightly larger and heavier than males. Lengths range between 19 and 24 inches (48 and 61 centimeters) for females and 17 and 23 inches (43 and 58 centimeters) for males. Wingspans average 133 inches (339 centimeters) for females and 126 inches (321 centimeters) for males. Weights average about 1.5 pounds (700 grams) for females and about 1.2 pounds (550 grams) for males. Size decreases toward the south and the west of this species' range.

MORPHS

There are no color morphs for the Red-shouldered Hawk but full albinism has been reported.

SPECIFIC DESCRIPTION

Eastern (*lineatus*) Adult - Perched

- brown head and back
- rufous barred underparts with short dark streaks or blotches on chest and belly
- rufous shoulders
- remainder of upper wing surface black-and-white checkered
- tail has broad black bands and three to four narrow white bands (narrowest of all races)
- dark brown eyes

Eastern (*lineatus*) Immature - Perched

- brown head and back
- buffy to light brown line above eye and dark moustache usually present
- buffy underparts broadly streaked with dark brown
- brown shoulders
- brown tail with narrow buffy bands, rufous colored at base

- gray-brown eyes

Eastern (lineatus) Adult - Flight

- appears to have long wings and tail
- rufous barred underparts contrast with white undertail coverts
- underwings two toned with rufous wing linings and black and white barred flight feathers
- both wing surfaces show a "window" or "crescent" of white barring near base of outer primaries; visible from above and below
- black-and-white banded tail (three to four white bands)
- flaps like an accipiter

Eastern (lineatus) Immature - Flight

- appears to have long wings and tail
- brown above and creamy below
- streaked underparts, concentrated in chest region
- generally pale underwing; rusty buff linings and palely barred flight feathers. Has most faintly barred flight feathers of all five races
- tawny colored panel, "window", or "crescent" at base of outer primaries; visible from above and below
- under side of tail gray and white tail bands except for rufous inner tail bands
- flaps like an accipiter

SIMILAR SPECIES

The Northern Goshawk and the Cooper's Hawk are superficially similar but are accipiters, with short wings and long, slender tails. The immature Red-tailed Hawk is similar to the Red-shouldered Hawk immature but it almost always has dark patagial marks on the leading edge of the inner wing. Generally, immature Red-tailed Hawks have very narrow dark bands on their tails while immature Red-shouldered Hawks have very narrow gray bands. The adult Broad-winged Hawk is much smaller (crow-sized) than a Red-shouldered Hawk. However, the two species can be hard to tell apart. A Broad-winged Hawk's tail bands are of equal width, while a Red-shouldered Hawk has wider black bands and narrow white ones. The adult Red-shouldered Hawk shows a rufous shoulder. Immature Broad-winged Hawks can be very difficult to tell from immature Red-shouldered. The upper tail surface on the Broad-winged Hawk immature is light with dark bands while that of the Red-shouldered is dark with light bands.

OTHER NAMES

The Red-shouldered Hawk is often referred to as the Red-bellied Hawk.

Most of the other common names for this species refer to its subspecies. Usually these are named according to where they are found. These include: (1) "Eastern" or "Northern" Red-shouldered Hawk (*B. l. lineatus*), (2) "Gulf Coast" or "Florida" Red-shouldered Hawk (*B. l. alleni*), (3) "Florida" or "Keys" Red-shouldered Hawk (*B. l. extimus*), (4) "Texas" Red-shouldered Hawk (*B. l. texanus*), and (5) "California", "Western", or "Red-bellied" Red-shouldered Hawk.

The California race (*elegans*) was formerly considered a separate species.

ETYMOLOGY

The scientific name *Buteo lineatus* translates into "hawk or falcon" (*Buteo* - Latin) that is "striped" (*lineatus* - Latin).

MYTHOLOGY

There is no mythology recorded for this species in North America.

RANGE

The Red-shouldered Hawk breeds, and is present year-round, from extreme southwestern Oregon south along the coast of California to Baja, California. In the East it is primarily a summer visitant in northern parts of its range from central Minnesota, southern Ontario, southern Quebec, and southern New Brunswick south to the vicinity of the Great Lakes and northern West Virginia. South of this area and throughout the rest of the United States, and west to eastern Kansas, eastern Oklahoma, and eastern Texas, it may be present year-round. Nonbreeding birds occur annually in extreme southern Texas.

The distribution of this subspecies in North America is as follows:

(1) "Eastern" Red-shouldered Hawk (*Buteo lineatus lineatus*)

- breeds in southeastern Canada and the eastern United States south to Texas, central Arkansas, southern Tennessee, southern North Carolina, and central South Carolina.

It should be pointed out that there is much overlap in the distribution of the subspecies and that the ranges discussed above are generalized.

MIGRATION

The Red-shouldered Hawk usually migrates only from the northern-most parts of its eastern North American range which includes central Minnesota, northern Wisconsin, northern Michigan, southern Ontario, southern Quebec, New York, eastern Pennsylvania, Vermont, New Hampshire, Maine, and New Brunswick. Immatures move southward from September through December while adults migrate from October into December. Fall migration peaks in late October to early November in the northern states. This species migrates along ridges inland and the coast. Coastal numbers are often higher. Fall migration has been observed as far south as Louisiana and Florida. Spring migration peaks from late February through early April across much of its northern range.

The Red-shouldered Hawk has been termed a middle-distance partial migrant travelling 480 to 2400 miles (300 to 1500 kilometers) in a season. Migrants usually fly alone or sometimes in small, loose flocks. The Red-shouldered Hawk avoids wide water crossings. Migrants use soaring, flapping and intermittent gliding-flapping. Along the coast, in spring, migration is strongest when there is a southeast wind.

BEHAVIOR

The Red-shouldered Hawk has a flight like that of an accipiter, with three to five quick wing beats followed by a glide. During the glide the wings are bowed downward. This species also soars with wings held flat and pressed forward. It does not hover.

The Red-shouldered Hawk is a diurnal hunter of the forest. Most hunting is done from a perch in the forest canopy from which it drops onto prey below. In one California study, all hunting attempts (over 250 began from a perch. Perch heights in Missouri ranged from 6.8 to 12.9 feet (2.1 to 4.0 m) above ground and included fences, hay piles, and trees. The

Broad-winged Hawk also hunts from a perch, but usually one located at the edge of forest openings. The Red-shouldered Hawk drops onto small mammals within 290 feet (90 meters) of its perch. It also makes accipiter-like direct flights at birds attracted to bird feeders or watering places. It also courses like a Northern Harrier low over open ground to surprise its prey. It may also hunt small mammals, reptiles, and amphibians on foot, and may fly out of the forest to seize prey from the water's surface.

This species may occupy the same territory for life, although this needs more study. Pairs often use the same nest tree year after year. If disturbed a pair will change its nest site within the same territory. Home range size in eastern North America varies from 268 to 837 acres (109 to 339 hectares) during breeding season. Home ranges average smaller for females than males. The postbreeding home range is larger, with males again holding larger ranges. The male's home range usually includes all of the female's home range within his boundaries. Winter range size may be determined by the availability of food. The Red-shouldered Hawk is normally solitary or in pairs during breeding season. Even in migration it rarely forms flocks.

The Red-shouldered Hawk will defend its home range against Broad-winged Hawks, Red-tailed Hawks, Golden Eagles, Prairie Falcons, Barred Owls, and Great Horned Owls. Avian intruders near nests are chased and sometimes attacked. The Red-shouldered Hawk and the American Crow will attempt to rob each other and may jointly mob a Great Horned Owl in the hawk's territory. It is also known to rob Great Horned Owl nests. When a human is near a nest, the nesting bird may quietly leave or perch nearby and call. It may also circle, calling, overhead or even stoop at the person and attempt to strike. Aggression toward nest intruders increases from incubation through the nestling stage.

The courtship period may be as short as 18 days. The courtship display involves high-circling with both male and female circling with wings and tails wide spread. Both sexes call. They soar close to one another and then swing away. One may soar high and dive toward the other. The male also performs a sky-dance. He soars upward and calls. When the female appears, he dives steeply several times. Each dive is checked and followed by a wide spiral and a rapid ascent before the nest dive. In Massachusetts, migrant birds appeared to be paired when they arrived on territory. Copulation involves the female soliciting by crouching across a branch, drooping her wings and uttering a twittering call. The male performs the sky-dance with one of his dives taking him to the female's back. After copulation both birds may perch in the same tree.

The oldest Red-shouldered Hawk was a banded bird recovered at 19 years, 11 months. Average survival was 25.6 months for birds banded between 1955 and 1979. Locally, Great Horned Owl predation of nesting adults and/or their eggs and young can be quite heavy. In New York 33 percent of nine nests were lost to Great Horned Owls. In other areas, however, nest predation is not a major factor. Raccoons can also be nest predators. Other causes of mortality include trapping, shooting, and collision with vehicles. In California, the introduced grasses *Bromus diandrus*, *B. rubens*, *Hordeum jubatum*, and *Avena barbata* may become lodged in the eyes of Red-shouldered Hawks causing the birds to become blind and starve or collide with wires. Winter starvation of an immature has also been reported. Insecticides, including DDT and dieldrin, mercury, and other chemicals have been found in eggs and tissue, but eggshell thinning was less severe than for several other raptors. The relationship between chemical contamination and reproductive failure in the Red-shouldered Hawk remains unclear.

ADAPTATIONS

The Red-shouldered Hawks of southern California seem to have adapted much better to human development than this species has done elsewhere. It has adopted the introduced

eucalyptus tree (various species) as a nesting tree and is often found in well forested residential areas.

Nesting Red-shouldered Hawks studied in Florida and California show an interesting adaptation between the size of prey brought to the nest and the distance from the nest the prey was caught. Small prey, like insects, are caught close to the nest tree while larger prey were brought in from both close and far distances. Such a strategy makes sense since the energy costs of transporting tiny prey from long distances could well exceed any benefits gained.

HABITAT

In eastern North America the Red-shouldered Hawk breeds in extensive riparian forests, bottomland hardwood forests, flooded deciduous swamps, and mixed upland forest. It inhabits forest with mature to old-growth trees forming the canopy with variable understory. The subcanopy is generally open, creating a parklike look to favored habitat. Some water body is usually present. Western birds breed in riparian and oak woodlands and also eucalyptus groves in residential areas. In Florida, it generally uses open country for foraging more commonly than in other races. In winter, this species frequents lowland woods near water. Individuals may appear in open country more often than during breeding season. Its year round habitat selection appears to be adaptable to what is available. Generally elevated perches, woodland, and water are required.

VOICE

The Red-shouldered Hawk has seven or eight vocalizations. The "kee-aah" call is common, usually given five to 12 times a session to announce territory or alarm. "Kee-wee" is a variant with the accent on the second syllable. "Kip" calls are given during exciting or stressful situations. The "keyyip" call is also an excited call. "Kee-ann-errr" is a drawn out three syllable call given by displaying adults. It may become "kee-yeer" or change again to "kendrick." "Kee" is a soft call given by an incubating or brooding female. Females have lower-pitched voices than males. Vocalizations are given during displays, copulation, at enemies and when disturbed at the nest.

FOODS

The Red-shouldered Hawk takes a wide variety of prey, depending upon season, region, and local conditions. For example, in Iowa, during a drought, 92 percent of all prey brought to three nests were mammals but the next year when the same forest was flooded 85 percent were amphibians and arthropods. Studies from various parts of its breeding range show major regional differences in percentages of types of food taken. Generally over the hawk's entire range, small mammals, frogs, toads, and snakes make up the bulk of its diet. However, birds, crayfish, and insects are food items of seasonal and regional importance. Occasionally it will eat carrion and also caches and retrieves food items near the nest.

Mammals taken include chipmunks (particularly the eastern chipmunk - *Tamias striatus* in the eastern range), voles (particularly the Meadow Vole - *Microtus pennsylvanicus*), as key items, and shrews, as well as opossum, skunks, rabbits, and muskrats (the latter four may have been young individuals or carrion). Birds as large as Ruffed Grouse and American Black Duck have been taken but usually avian prey is grackle-sized or smaller, and in Wisconsin commonly included House Sparrows and European Starlings taken accipiter-style from near bird feeders. Reptile prey includes several species of snakes including colubrid snakes, as well as small lizards and young turtles. Amphibians include frogs and toads. A few small fish are taken. Crayfish are important prey in certain parts of the range. Insects can also become important as food, especially grasshoppers and crickets. Centipedes, worms, and snails are

also eaten.

PELLETS

There is no information about pellet formation in this species for North America. An extra nest in a territory may be used as a plucking post or feeding platform.

NESTING

In the northeast, the nest site is usually a large tree in a mature deciduous or mixed stand. The nest is usually located between 20 and 60 feet (6.2 and 18.6 meters) up but may range from 10 to 200 feet (3.1 to 62 meters) high, but below the canopy, usually in the crotch of the main trunk. In conifers, the nest is usually built against the main trunk where a whorl of branches meets the trunk. Birds in southern Florida sometimes nest in cabbage palmetto or live oaks. In California, eucalyptus trees are preferred. One ground nest in Florida was reported. Nests are generally located near some body of water like a stream, swamp, lake or pond. It is not known which birds select the nest site, but nests are commonly reused for several years.

The nest is a tidy structure, unlike the straggly nest of a Broad-winged Hawk. It is generally smaller than a Red-tailed Hawk's nest, measuring 17.7 to 23.6 inches (45 to 60 centimeters) in outside diameter, 7.9 to 11.8 inches (20 to 30 centimeters) in height, about 7.9 inches (20 centimeters) for a cavity diameter, and 2.0 to 29.5 inches (5 to 75 centimeters) for a cavity depth. The exterior is composed of dead and green sticks, leaves, bark, Spanish moss (in the south), lichens, and live conifer sprigs. The inner cavity is lined with inner bark, mosses, lichens, and green sprigs. The sexes work together on a new nest and to refurbish an old one. Building and refurbishing can take four to five weeks at the beginning of the breeding season; however, after nest failure, a pair can build a nest in less than seven days. Sprigs of living vegetation, often hemlock in the northeast, are laid in nests early in the season and may act as a signal that the nest is claimed. A pair may have a second nest in its territory, used some years as an alternative. Alternative nests are also used as plucking posts and feeding platforms.

The eggs are short elliptical in shape and are white or faint bluish covered with variable brown and lavender blotches and markings. Egg measurements (for the nominate race *lineatus*) average 2.1 inches (54.7 millimeters) long by 1.7 inches (43.9 millimeters) wide.

The clutch ranges from two to four, averaging three eggs. The female does most of the incubating while the male delivers prey. Incubation last about 33 days per egg. Nestlings weigh about 1.2 ounces (35 grams) at birth and 1.2 pounds (534 grams) at fledging. The young are brooded almost constantly during the first seven days. Juvenal flight feathers begin to appear at seven to 10 days, followed by scapulars, wing coverts and contour plumage. The back is fully feathered first, and then the sides of the breast. The young are able to walk (on toes) and stand at 23 to 25 days. The young begin exploring nearby branches at 35 to 42 days, fledging during this time. The female may resume hunting late in the nestling period.

Post-nest care has been little studied, but two California broods were fed by their parents eight weeks after fledging and were independent at 14 to 16 weeks. These young began successful hunting by seven to eight weeks, catching mostly insects. By 10 to 13 weeks the young are catching reptiles, amphibians, and mammals.

The Red-shouldered Hawk is single-brooded but will lay a replacement clutch.

CONSERVATION

The Red-shouldered Hawk is sensitive to human disturbance around the nest. In California, logging and the taking of young by falconers caused nest failure. In New Jersey, there may be a retreat of Red-shouldered Hawks from human activity into more remote areas. However, in some other areas of its range the species is reported as tolerant of human activities around the nest site.

Substantial declines in the population of this species have occurred this century. The clearing and subsequent fragmentation of formerly contiguous forests create habitat more favorable to the Great Horned Owl and the larger and more aggressive Red-tailed Hawk, the Red-shouldered Hawk's main competitor. Even selective thinning of forests in Wisconsin and Ontario favored either the Red-tailed Hawk or the Great Horned Owl over the Red-shouldered Hawk, reducing the bird's population.

The single most effective management strategy is probably the retention of large, contiguous blocks of unbroken forest. At this time it is not clear whether any clearing or openings should be provided for the Red-shouldered Hawk or not.

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Red-shouldered Hawk - California

Buteo lineatus

GENERAL DESCRIPTION

The Red-shouldered Hawk is a buteo of eastern North America, with an isolated population along the West Coast. It is a woodland hawk, hunting beneath the canopy of northeastern forest or southern hardwood swamp. The Red-shouldered Hawk is larger than the Broad-winged Hawk which frequents forested edge, and smaller than the more aggressive Red-tailed Hawk which requires a semi-open forest or a patchwork of openings and clearings. The Red-tailed Hawk will drive out Red-shouldered Hawks from areas where the two species come into contact. Thus, the Red-shouldered Hawk has suffered population declines as forested land across the eastern United States and southeastern Canada becomes more fragmented due to human development.

The Red-shouldered Hawk is an attractive hawk, showing pale crescent shaped "windows" near the tips of its wings. The nominate race, *Buteo lineatus lineatus*, is patterned with rufous on underparts, shoulders, and wing linings. Its primaries and secondaries are boldly checkered with black-and-white, and its tail is black with white bands, making this species relatively easy to identify in its adult plumage. It drops onto its prey from elevated perches and also flaps and glides in direct accipiter-like attacks.

SIZE

The Red-shouldered Hawk is a medium-sized to large buteo. Females are slightly larger and heavier than males. Lengths range between 19 and 24 inches (48 and 61 centimeters) for females and 17 and 23 inches (43 and 58 centimeters) for males. Wingspans average 133 inches (339 centimeters) for females and 126 inches (321 centimeters) for males. Weights average about 1.5 pounds (700 grams) for females and about 1.2 pounds (550 grams) for males. Size decreases toward the south and the west of this species' range.

MORPHS

There are no color morphs for the Red-shouldered Hawk but full albinism has been reported.

SPECIFIC DESCRIPTION

California (*elegans*) Adult - Perched

- smallest and brightest colored race
- solid rufous breast
- brighter shoulder patch
- no dark streaks on underparts
- two to three wider white tail bands than in "Eastern"

California (*elegans*) Immature - Perched

- heavily barred underparts
- white "windows" or "crescents" at base of outer primary feathers
- black-and-white tail like in adult
- tail is adult-like with narrow white bands on brown tail

California (elegans) Adult - Flight

- bright rufous barred under parts
- solid dark rufous chest
- darkest rufous wing linings of any race
- broad white bands across tail; widest of all races
- white crescent primary feather "windows"

California (elegans) Immature - Flight

- underparts heavily barred with brown
- wing linings rufous like an adult "Eastern"
- "windows" or "crescents"
- narrow white tail bands contrasty like an adult

SIMILAR SPECIES

The Northern Goshawk and the Cooper's Hawk are superficially similar but are accipiters, with short wings and long, slender tails. The immature Red-tailed Hawk is similar to the Red-shouldered Hawk immature but it almost always has dark patagial marks on the leading edge of the inner wing. Generally, immature Red-tailed Hawks have very narrow dark bands on their tails while immature Red-shouldered Hawks have very narrow gray bands. The adult Broad-winged Hawk is much smaller (crow-sized) than a Red-shouldered Hawk. However, the two species can be hard to tell apart. A Broad-winged Hawk's tail bands are of equal width, while a Red-shouldered Hawk has wider black bands and narrow white ones. The adult Red-shouldered Hawk shows a rufous shoulder. Immature Broad-winged Hawks can be very difficult to tell from immature Red-shouldered. The upper tail surface on the Broad-winged Hawk immature is light with dark bands while that of the Red-shouldered is dark with light bands.

OTHER NAMES

The Red-shouldered Hawk is often referred to as the Red-bellied Hawk.

Most of the other common names for this species refer to its subspecies. Usually these are named according to where they are found. These include: (1) "Eastern" or "Northern" Red-shouldered Hawk (*B. l. lineatus*), (2) "Gulf Coast" or "Florida" Red-shouldered Hawk (*B. l. alleni*), (3) "Florida" or "Keys" Red-shouldered Hawk (*B. l. extimus*), (4) "Texas" Red-shouldered Hawk (*B. l. texanus*), and (5) "California", "Western", or "Red-bellied" Red-shouldered Hawk.

The California race (*elegans*) was formerly considered a separate species.

ETYMOLOGY

The scientific name *Buteo lineatus* translates into "hawk or falcon" (*Buteo* - Latin) that is "striped" (*lineatus* - Latin).

MYTHOLOGY

There is no mythology recorded for this species in North America.

RANGE

The Red-shouldered Hawk breeds, and is present year-round, from extreme

southwestern Oregon south along the coast of California to Baja, California. In the East it is primarily a summer visitant in northern parts of its range from central Minnesota, southern Ontario, southern Quebec, and southern New Brunswick south to the vicinity of the Great Lakes and northern West Virginia. South of this area and throughout the rest of the United States, and west to eastern Kansas, eastern Oklahoma, and eastern Texas, it may be present year-round. Nonbreeding birds occur annually in extreme southern Texas.

The distribution of this subspecies in North America is as follows:

(1) "California" Red-shouldered Hawk (*Buteo lineatus elegans*)

- resident from southwestern coastal Oregon south along the coast of California to Baja, California

It should be pointed out that there is much overlap in the distribution of the subspecies and that the ranges discussed above are generalized.

MIGRATION

The Red-shouldered Hawk usually migrates only from the northern-most parts of its eastern North American range which includes central Minnesota, northern Wisconsin, northern Michigan, southern Ontario, southern Quebec, New York, eastern Pennsylvania, Vermont, New Hampshire, Maine, and New Brunswick. Immatures move southward from September through December while adults migrate from October into December. Fall migration peaks in late October to early November in the northern states. This species migrates along ridges inland and the coast. Coastal numbers are often higher. Fall migration has been observed as far south as Louisiana and Florida. Spring migration peaks from late February through early April across much of its northern range.

The Red-shouldered Hawk has been termed a middle-distance partial migrant travelling 480 to 2400 miles (300 to 1500 kilometers) in a season. Migrants usually fly alone or sometimes in small, loose flocks. The Red-shouldered Hawk avoids wide water crossings. Migrants use soaring, flapping and intermittent gliding-flapping. Along the coast, in spring, migration is strongest when there is a southeast wind.

BEHAVIOR

The Red-shouldered Hawk has a flight like that of an accipiter, with three to five quick wing beats followed by a glide. During the glide the wings are bowed downward. This species also soars with wings held flat and pressed forward. It does not hover.

The Red-shouldered Hawk is a diurnal hunter of the forest. Most hunting is done from a perch in the forest canopy from which it drops onto prey below. In one California study, all hunting attempts (over 250 began from a perch. Perch heights in Missouri ranged from 6.8 to 12.9 feet (2.1 to 4.0 m) above ground and included fences, hay piles, and trees. The Broad-winged Hawk also hunts from a perch, but usually one located at the edge of forest openings. The Red-shouldered Hawk drops onto small mammals within 290 feet (90 meters) of its perch. It also makes accipiter-like direct flights at birds attracted to bird feeders or watering places. It also courses like a Northern Harrier low over open ground to surprise its prey. It may also hunt small mammals, reptiles, and amphibians on foot, and may fly out of the forest to seize prey from the water's surface.

This species may occupy the same territory for life, although this needs more study. Pairs often use the same nest tree year after year. If disturbed a pair will change its nest site within the same territory. Home range size in eastern North America varies from 268 to 837

acres (109 to 339 hectares) during breeding season. Home ranges average smaller for females than males. The postbreeding home range is larger, with males again holding larger ranges. The male's home range usually includes all of the female's home range within his boundaries. Winter range size may be determined by the availability of food. The Red-shouldered Hawk is normally solitary or in pairs during breeding season. Even in migration it rarely forms flocks.

The Red-shouldered Hawk will defend its home range against Broad-winged Hawks, Red-tailed Hawks, Golden Eagles, Prairie Falcons, Barred Owls, and Great Horned Owls. Avian intruders near nests are chased and sometimes attacked. The Red-shouldered Hawk and the American Crow will attempt to rob each other and may jointly mob a Great Horned Owl in the hawk's territory. It is also known to rob Great Horned Owl nests. When a human is near a nest, the nesting bird may quietly leave or perch nearby and call. It may also circle, calling, overhead or even stoop at the person and attempt to strike. Aggression toward nest intruders increases from incubation through the nestling stage.

The courtship period may be as short as 18 days. The courtship display involves high-circling with both male and female circling with wings and tails wide spread. Both sexes call. They soar close to one another and then swing away. One may soar high and dive toward the other. The male also performs a sky-dance. He soars upward and calls. When the female appears, he dives steeply several times. Each dive is checked and followed by a wide spiral and a rapid ascent before the nest dive. In Massachusetts, migrant birds appeared to be paired when they arrived on territory. Copulation involves the female soliciting by crouching across a branch, drooping her wings and uttering a twittering call. The male performs the sky-dance with one of his dives taking him to the female's back. After copulation both birds may perch in the same tree.

The oldest Red-shouldered Hawk was a banded bird recovered at 19 years, 11 months. Average survival was 25.6 months for birds banded between 1955 and 1979. Locally, Great Horned Owl predation of nesting adults and/or their eggs and young can be quite heavy. In New York 33 percent of nine nests were lost to Great Horned Owls. In other areas, however, nest predation is not a major factor. Raccoons can also be nest predators. Other causes of mortality include trapping, shooting, and collision with vehicles. In California, the introduced grasses *Bromus diandrus*, *B. rubens*, *Hordeum jubatum*, and *Avena barbata* may become lodged in the eyes of Red-shouldered Hawks causing the birds to become blind and starve or collide with wires. Winter starvation of an immature has also been reported. Insecticides, including DDT and dieldrin, mercury, and other chemicals have been found in eggs and tissue, but eggshell thinning was less severe than for several other raptors. The relationship between chemical contamination and reproductive failure in the Red-shouldered Hawk remains unclear.

ADAPTATIONS

The Red-shouldered Hawks of southern California seem to have adapted much better to human development than this species has done elsewhere. It has adopted the introduced eucalyptus tree (various species) as a nesting tree and is often found in well forested residential areas.

Nesting Red-shouldered Hawks studied in Florida and California show an interesting adaptation between the size of prey brought to the nest and the distance from the nest the prey was caught. Small prey, like insects, are caught close to the nest tree while larger prey were brought in from both close and far distances. Such a strategy makes sense since the energy costs of transporting tiny prey from long distances could well exceed any benefits gained.

HABITAT

In eastern North America the Red-shouldered Hawk breeds in extensive riparian forests, bottomland hardwood forests, flooded deciduous swamps, and mixed upland forest. It inhabits forest with mature to old-growth trees forming the canopy with variable understory. The subcanopy is generally open, creating a parklike look to favored habitat. Some water body is usually present. Western birds breed in riparian and oak woodlands and also eucalyptus groves in residential areas. In Florida, it generally uses open country for foraging more commonly than in other races. In winter, this species frequents lowland woods near water. Individuals may appear in open country more often than during breeding season. Its year round habitat selection appears to be adaptable to what is available. Generally elevated perches, woodland, and water are required.

VOICE

The Red-shouldered Hawk has seven or eight vocalizations. The "kee-aah" call is common, usually given five to 12 times a session to announce territory or alarm. "Kee-wee" is a variant with the accent on the second syllable. "Kip" calls are given during exciting or stressful situations. The "keeyip" call is also an excited call. "Kee-ann-errr" is a drawn out three syllable call given by displaying adults. It may become "kee-yeer" or change again to "kendrick." "Kee" is a soft call given by an incubating or brooding female. Females have lower-pitched voices than males. Vocalizations are given during displays, copulation, at enemies and when disturbed at the nest.

FOODS

The Red-shouldered Hawk takes a wide variety of prey, depending upon season, region, and local conditions. For example, in Iowa, during a drought, 92 percent of all prey brought to three nests were mammals but the next year when the same forest was flooded 85 percent were amphibians and arthropods. Studies from various parts of its breeding range show major regional differences in percentages of types of food taken. Generally over the hawk's entire range, small mammals, frogs, toads, and snakes make up the bulk of its diet. However, birds, crayfish, and insects are food items of seasonal and regional importance. Occasionally it will eat carrion and also caches and retrieves food items near the nest.

Mammals taken include chipmunks (particularly the eastern chipmunk - *Tamias striatus* in the eastern range), voles (particularly the Meadow Vole - *Microtus pennsylvanicus*), as key items, and shrews, as well as opossum, skunks, rabbits, and muskrats (the latter four may have been young individuals or carrion). Birds as large as Ruffed Grouse and American Black Duck have been taken but usually avian prey is grackle-sized or smaller, and in Wisconsin commonly included House Sparrows and European Starlings taken accipiter-style from near bird feeders. Reptile prey includes several species of snakes including colubrid snakes, as well as small lizards and young turtles. Amphibians include frogs and toads. A few small fish are taken. Crayfish are important prey in certain parts of the range. Insects can also become important as food, especially grasshoppers and crickets. Centipedes, worms, and snails are also eaten.

PELLETS

There is no information about pellet formation in this species for North America. An extra nest in a territory may be used as a plucking post or feeding platform.

NESTING

In the northeast, the nest site is usually a large tree in a mature deciduous or mixed

stand. The nest is usually located between 20 and 60 feet (6.2 and 18.6 meters) up but may range from 10 to 200 feet (3.1 to 62 meters) high, but below the canopy, usually in the crotch of the main trunk. In conifers, the nest is usually built against the main trunk where a whorl of branches meets the trunk. Birds in southern Florida sometimes nest in cabbage palmetto or live oaks. In California, eucalyptus trees are preferred. One ground nest in Florida was reported. Nests are generally located near some body of water like a stream, swamp, lake or pond. It is not known which birds select the nest site, but nests are commonly reused for several years.

The nest is a tidy structure, unlike the straggly nest of a Broad-winged Hawk. It is generally smaller than a Red-tailed Hawk's nest, measuring 17.7 to 23.6 inches (45 to 60 centimeters) in outside diameter, 7.9 to 11.8 inches (20 to 30 centimeters) in height, about 7.9 inches (20 centimeters) for a cavity diameter, and 2.0 to 29.5 inches (5 to 75 centimeters) for a cavity depth. The exterior is composed of dead and green sticks, leaves, bark, Spanish moss (in the south), lichens, and live conifer sprigs. The inner cavity is lined with inner bark, mosses, lichens, and green sprigs. The sexes work together on a new nest and to refurbish an old one. Building and refurbishing can take four to five weeks at the beginning of the breeding season; however, after nest failure, a pair can build a nest in less than seven days. Sprigs of living vegetation, often hemlock in the northeast, are laid in nests early in the season and may act as a signal that the nest is claimed. A pair may have a second nest in its territory, used some years as an alternative. Alternative nests are also used as plucking posts and feeding platforms.

The eggs are short elliptical in shape and are white or faint bluish covered with variable brown and lavender blotches and markings. Egg measurements (for the nominate race *lineatus*) average 2.1 inches (54.7 millimeters) long by 1.7 inches (43.9 millimeters) wide.

The clutch ranges from two to four, averaging three eggs. The female does most of the incubating while the male delivers prey. Incubation last about 33 days per egg. Nestlings weigh about 1.2 ounces (35 grams) at birth and 1.2 pounds (534 grams) at fledging. The young are brooded almost constantly during the first seven days. Juvenal flight feathers begin to appear at seven to 10 days, followed by scapulars, wing coverts and contour plumage. The back is fully feathered first, and then the sides of the breast. The young are able to walk (on toes) and stand at 23 to 25 days. The young begin exploring nearby branches at 35 to 42 days, fledging during this time. The female may resume hunting late in the nestling period.

Post-nest care has been little studied, but two California broods were fed by their parents eight weeks after fledging and were independent at 14 to 16 weeks. These young began successful hunting by seven to eight weeks, catching mostly insects. By 10 to 13 weeks the young are catching reptiles, amphibians, and mammals.

The Red-shouldered Hawk is single-brooded but will lay a replacement clutch.

CONSERVATION

The Red-shouldered Hawk is sensitive to human disturbance around the nest. In California, logging and the taking of young by falconers caused nest failure. In New Jersey, there may be a retreat of Red-shouldered Hawks from human activity into more remote areas. However, in some other areas of its range the species is reported as tolerant of human activities around the nest site.

Substantial declines in the population of this species have occurred this century. The clearing and subsequent fragmentation of formerly contiguous forests create habitat more favorable to the Great Horned Owl and the larger and more aggressive Red-tailed Hawk, the

Red-shouldered Hawk's main competitor. Even selective thinning of forests in Wisconsin and Ontario favored either the Red-tailed Hawk or the Great Horned Owl over the Red-shouldered Hawk, reducing the bird's population.

The single most effective management strategy is probably the retention of large, contiguous blocks of unbroken forest. At this time it is not clear whether any clearing or openings should be provided for the Red-shouldered Hawk or not.

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MORPHS

There are no color morphs for the Red-shouldered Hawk but full albinism has been reported.

SPECIFIC DESCRIPTION

Florida (extimus) Adult - Perched

- the palest of all races, most are paler than "Gulf Coast" adult with which it integrates
- pale head

Florida (extimus) Immature - Perched

- like immature "Eastern", "Texas", or "Gulf Coast", but less heavily marked
- variably spotted or streaked underparts
- least likely to have rufous on inner tail bands
- secondaries more barred with white than "Eastern"

Florida (extimus) Adult - Flight

- black-and-white banded tail and banded flight feathers contrast with pale head and

underparts

Florida (*extimus*) Immature - Flight

- like immature "Eastern", "Texas", or "Gulf Coast"
- least likely to have rufous inner tail band
- outer primary feathers frequently barred and tawny colored panel, or "window"

SIMILAR SPECIES

The Northern Goshawk and the Cooper's Hawk are superficially similar but are accipiters, with short wings and long, slender tails. The immature Red-tailed Hawk is similar to the Red-shouldered Hawk immature but it almost always has dark patagial marks on the leading edge of the inner wing. Generally, immature Red-tailed Hawks have very narrow dark bands on their tails while immature Red-shouldered Hawks have very narrow gray bands. The adult Broad-winged Hawk is much smaller (crow-sized) than a Red-shouldered Hawk. However, the two species can be hard to tell apart. A Broad-winged Hawk's tail bands are of equal width, while a Red-shouldered Hawk has wider black bands and narrow white ones. The adult Red-shouldered Hawk shows a rufous shoulder. Immature Broad-winged Hawks can be very difficult to tell from immature Red-shouldered Hawks. The upper tail surface on the Broad-winged Hawk immature is light with dark bands while that of the Red-shouldered is dark with light bands.

OTHER NAMES

The Red-shouldered Hawk is often referred to as the Red-bellied Hawk.

Most of the other common names for this species refer to its subspecies. Usually these are named according to where they are found. These include: (1) "Eastern" or "Northern" Red-shouldered Hawk (*B. l. lineatus*), (2) "Gulf Coast" or "Florida" Red-shouldered Hawk (*B. l. alleni*), (3) "Florida" or "Keys" Red-shouldered Hawk (*B. l. extimus*), (4) "Texas" Red-shouldered Hawk (*B. l. texanus*), and (5) "California", "Western", or "Red-bellied" Red-shouldered Hawk.

The California race (*elegans*) was formerly considered a separate species.

ETYMOLOGY

The scientific name *Buteo lineatus* translates into "hawk or falcon" (*Buteo* - Latin) that is "striped" (*lineatus* - Latin).

MYTHOLOGY

There is no mythology recorded for this species in North America.

RANGE

The Red-shouldered Hawk breeds, and is present year-round, from extreme southwestern Oregon south along the coast of California to Baja, California. In the East it is primarily a summer visitant in northern parts of its range from central Minnesota, southern Ontario, southern Quebec, and southern New Brunswick south to the vicinity of the Great Lakes and northern West Virginia. South of this area and throughout the rest of the United States, and west to eastern Kansas, eastern Oklahoma, and eastern Texas, it may be present year-round. Nonbreeding birds occur annually in extreme southern Texas.

The distribution of this subspecies in North America is as follows:

(1) "Florida" Red-shouldered Hawk (*Buteo lineatus extimus*)

-resident in extreme southern Florida and the Keys.

It should be pointed out that there is much overlap in the distribution of the subspecies and that the ranges discussed above are generalized.

MIGRATION

The Red-shouldered Hawk usually migrates only from the northern-most parts of its eastern North American range which includes central Minnesota, northern Wisconsin, northern Michigan, southern Ontario, southern Quebec, New York, eastern Pennsylvania, Vermont, New Hampshire, Maine, and New Brunswick. Immatures move southward from September through December while adults migrate from October into December. Fall migration peaks in late October to early November in the northern states. This species migrates along ridges inland and the coast. Coastal numbers are often higher. Fall migration has been observed as far south as Louisiana and Florida. Spring migration peaks from late February through early April across much of its northern range.

The Red-shouldered Hawk has been termed a middle-distance partial migrant travelling 480 to 2400 miles (300 to 1500 kilometers) in a season. Migrants usually fly alone or sometimes in small, loose flocks. The Red-shouldered Hawk avoids wide water crossings. Migrants use soaring, flapping and intermittent gliding-flapping. Along the coast, in spring, migration is strongest when there is a southeast wind.

BEHAVIOR

The Red-shouldered Hawk has a flight like that of an accipiter, with three to five quick wing beats followed by a glide. During the glide the wings are bowed downward. This species also soars with wings held flat and pressed forward. It does not hover.

The Red-shouldered Hawk is a diurnal hunter of the forest. Most hunting is done from a perch in the forest canopy from which it drops onto prey below. In one California study, all hunting attempts (over 250 began from a perch. Perch heights in Missouri ranged from 6.8 to 12.9 feet (2.1 to 4.0 m) above ground and included fences, hay piles, and trees. The Broad-winged Hawk also hunts from a perch, but usually one located at the edge of forest openings. The Red-shouldered Hawk drops onto small mammals within 290 feet (90 meters) of its perch. It also makes accipiter-like direct flights at birds attracted to bird feeders or watering places. It also courses like a Northern Harrier low over open ground to surprise its prey. It may also hunt small mammals, reptiles, and amphibians on foot, and may fly out of the forest to seize prey from the water's surface.

This species may occupy the same territory for life, although this needs more study. Pairs often use the same nest tree year after year. If disturbed a pair will change its nest site within the same territory. Home range size in eastern North America varies from 268 to 837 acres (109 to 339 hectares) during breeding season. Home ranges average smaller for females than males. The postbreeding home range is larger, with males again holding larger ranges. The male's home range usually includes all of the female's home range within his boundaries. Winter range size may be determined by the availability of food. The Red-shouldered Hawk is normally solitary or in pairs during breeding season. Even in migration it rarely forms flocks.

The Red-shouldered Hawk will defend its home range against Broad-winged Hawks, Red-

tailed Hawks, Golden Eagles, Prairie Falcons, Barred Owls, and Great Horned Owls. Avian intruders near nests are chased and sometimes attacked. The Red-shouldered Hawk and the American Crow will attempt to rob each other and may jointly mob a Great Horned Owl in the hawk's territory. It is also known to rob Great Horned Owl nests. When a human is near a nest, the nesting bird may quietly leave or perch nearby and call. It may also circle, calling, overhead or even stoop at the person and attempt to strike. Aggression toward nest intruders increases from incubation through the nestling stage.

The courtship period may be as short as 18 days. The courtship display involves high-circling with both male and female circling with wings and tails wide spread. Both sexes call. They soar close to one another and then swing away. One may soar high and dive toward the other. The male also performs a sky-dance. He soars upward and calls. When the female appears, he dives steeply several times. Each dive is checked and followed by a wide spiral and a rapid ascent before the nest dive. In Massachusetts, migrant birds appeared to be paired when they arrived on territory. Copulation involves the female soliciting by crouching across a branch, drooping her wings and uttering a twittering call. The male performs the sky-dance with one of his dives taking him to the female's back. After copulation both birds may perch in the same tree.

The oldest Red-shouldered Hawk was a banded bird recovered at 19 years, 11 months. Average survival was 25.6 months for birds banded between 1955 and 1979. Locally, Great Horned Owl predation of nesting adults and/or their eggs and young can be quite heavy. In New York 33 percent of nine nests were lost to Great Horned Owls. In other areas, however, nest predation is not a major factor. Raccoons can also be nest predators. Other causes of mortality include trapping, shooting, and collision with vehicles. In California, the introduced grasses *Bromus diandrus*, *B. rubens*, *Hordeum jubatum*, and *Avena barbata* may become lodged in the eyes of Red-shouldered Hawks causing the birds to become blind and starve or collide with wires. Winter starvation of an immature has also been reported. Insecticides, including DDT and dieldrin, mercury, and other chemicals have been found in eggs and tissue, but eggshell thinning was less severe than for several other raptors. The relationship between chemical contamination and reproductive failure in the Red-shouldered Hawk remains unclear.

ADAPTATIONS

The Red-shouldered Hawks of southern California seem to have adapted much better to human development than this species has done elsewhere. It has adopted the introduced eucalyptus tree (various species) as a nesting tree and is often found in well forested residential areas.

Nesting Red-shouldered Hawks studied in Florida and California show an interesting adaptation between the size of prey brought to the nest and the distance from the nest the prey was caught. Small prey, like insects, are caught close to the nest tree while larger prey were brought in from both close and far distances. Such a strategy makes sense since the energy costs of transporting tiny prey from long distances could well exceed any benefits gained.

HABITAT

In eastern North America the Red-shouldered Hawk breeds in extensive riparian forests, bottomland hardwood forests, flooded deciduous swamps, and mixed upland forest. It inhabits forest with mature to old-growth trees forming the canopy with variable understory. The subcanopy is generally open, creating a parklike look to favored habitat. Some water body is usually present. Western birds breed in riparian and oak woodlands and also eucalyptus groves in residential areas. In Florida, it generally uses open country for foraging

more commonly than in other races. In winter, this species frequents lowland woods near water. Individuals may appear in open country more often than during breeding season. Its year round habitat selection appears to be adaptable to what is available. Generally elevated perches, woodland, and water are required.

VOICE

The Red-shouldered Hawk has seven or eight vocalizations. The "kee-aah" call is common, usually given five to 12 times a session to announce territory or alarm. "Kee-wee" is a variant with the accent on the second syllable. "Kip" calls are given during exciting or stressful situations. The "keyip" call is also an excited call. "Kee-ann-errrr" is a drawn out three syllable call given by displaying adults. It may become "kee-yeer" or change again to "kendrick." "Kee" is a soft call given by an incubating or brooding female. Females have lower-pitched voices than males. Vocalizations are given during displays, copulation, at enemies and when disturbed at the nest.

FOODS

The Red-shouldered Hawk takes a wide variety of prey, depending upon season, region, and local conditions. For example, in Iowa, during a drought, 92 percent of all prey brought to three nests were mammals but the next year when the same forest was flooded 85 percent were amphibians and arthropods. Studies from various parts of its breeding range show major regional differences in percentages of types of food taken. Generally over the hawk's entire range, small mammals, frogs, toads, and snakes make up the bulk of its diet. However, birds, crayfish, and insects are food items of seasonal and regional importance. Occasionally it will eat carrion and also caches and retrieves food items near the nest.

Mammals taken include chipmunks (particularly the eastern chipmunk - *Tamias striatus* in the eastern range), voles (particularly the Meadow Vole - *Microtus pennsylvanicus*), as key items, and shrews, as well as opossum, skunks, rabbits, and muskrats (the latter four may have been young individuals or carrion). Birds as large as Ruffed Grouse and American Black Duck have been taken but usually avian prey is grackle-sized or smaller, and in Wisconsin commonly included House Sparrows and European Starlings taken accipiter-style from near bird feeders. Reptile prey includes several species of snakes including colubrid snakes, as well as small lizards and young turtles. Amphibians include frogs and toads. A few small fish are taken. Crayfish are important prey in certain parts of the range. Insects can also become important as food, especially grasshoppers and crickets. Centipedes, worms, and snails are also eaten.

PELLETS

There is no information about pellet formation in this species for North America. An extra nest in a territory may be used as a plucking post or feeding platform.

NESTING

In the northeast, the nest site is usually a large tree in a mature deciduous or mixed stand. The nest is usually located between 20 and 60 feet (6.2 and 18.6 meters) up but may range from 10 to 200 feet (3.1 to 62 meters) high, but below the canopy, usually in the crotch of the main trunk. In conifers, the nest is usually built against the main trunk where a whorl of branches meets the trunk. Birds in southern Florida sometimes nest in cabbage palmetto or live oaks. In California, eucalyptus trees are preferred. One ground nest in Florida was reported. Nests are generally located near some body of water like a stream, swamp, lake or pond. It is not known which birds select the nest site, but nests are commonly reused for several years.

The nest is a tidy structure, unlike the straggly nest of a Broad-winged Hawk. It is generally smaller than a Red-tailed Hawk's nest, measuring 17.7 to 23.6 inches (45 to 60 centimeters) in outside diameter, 7.9 to 11.8 inches (20 to 30 centimeters) in height, about 7.9 inches (20 centimeters) for a cavity diameter, and 2.0 to 29.5 inches (5 to 75 centimeters) for a cavity depth. The exterior is composed of dead and green sticks, leaves, bark, Spanish moss (in the south), lichens, and live conifer sprigs. The inner cavity is lined with inner bark, mosses, lichens, and green sprigs. The sexes work together on a new nest and to refurbish an old one. Building and refurbishing can take four to five weeks at the beginning of the breeding season; however, after nest failure, a pair can build a nest in less than seven days. Sprigs of living vegetation, often hemlock in the northeast, are laid in nests early in the season and may act as a signal that the nest is claimed. A pair may have a second nest in its territory, used some years as an alternative. Alternative nests are also used as plucking posts and feeding platforms.

The eggs are short elliptical in shape and are white or faint bluish covered with variable brown and lavender blotches and markings. Egg measurements (for the nominate race *lineatus*) average 2.1 inches (54.7 millimeters) long by 1.7 inches (43.9 millimeters) wide.

The clutch ranges from two to four, averaging three eggs. The female does most of the incubating while the male delivers prey. Incubation last about 33 days per egg. Nestlings weigh about 1.2 ounces (35 grams) at birth and 1.2 pounds (534 grams) at fledging. The young are brooded almost constantly during the first seven days. Juvenal flight feathers begin to appear at seven to 10 days, followed by scapulars, wing coverts and contour plumage. The back is fully feathered first, and then the sides of the breast. The young are able to walk (on toes) and stand at 23 to 25 days. The young begin exploring nearby branches at 35 to 42 days, fledging during this time. The female may resume hunting late in the nestling period.

Post-nest care has been little studied, but two California broods were fed by their parents eight weeks after fledging and were independent at 14 to 16 weeks. These young began successful hunting by seven to eight weeks, catching mostly insects. By 10 to 13 weeks the young are catching reptiles, amphibians, and mammals.

The Red-shouldered Hawk is single-brooded but will lay a replacement clutch.

CONSERVATION

The Red-shouldered Hawk is sensitive to human disturbance around the nest. In California, logging and the taking of young by falconers caused nest failure. In New Jersey, there may be a retreat of Red-shouldered Hawks from human activity into more remote areas. However, in some other areas of its range the species is reported as tolerant of human activities around the nest site.

Substantial declines in the population of this species have occurred this century. The clearing and subsequent fragmentation of formerly contiguous forests create habitat more favorable to the Great Horned Owl and the larger and more aggressive Red-tailed Hawk, the Red-shouldered Hawk's main competitor. Even selective thinning of forests in Wisconsin and Ontario favored either the Red-tailed Hawk or the Great Horned Owl over the Red-shouldered Hawk, reducing the bird's population.

The single most effective management strategy is probably the retention of large, contiguous blocks of unbroken forest. At this time it is not clear whether any clearing or openings should be provided for the Red-shouldered Hawk or not.

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Red-shouldered Hawk - Gulf Coast

Buteo lineatus

GENERAL DESCRIPTION

The Red-shouldered Hawk is a buteo of eastern North America, with an isolated population along the West Coast. It is a woodland hawk, hunting beneath the canopy of northeastern forest or southern hardwood swamp. The Red-shouldered Hawk is larger than the Broad-winged Hawk which frequents forested edge, and smaller than the more aggressive Red-tailed Hawk which requires a semi-open forest or a patchwork of openings and clearings. The Red-tailed Hawk will drive out Red-shouldered Hawks from areas where the two species come into contact. Thus, the Red-shouldered Hawk has suffered population declines as forested land across the eastern United States and southeastern Canada becomes more fragmented due to human development.

The Red-shouldered Hawk is an attractive hawk, showing pale crescent shaped "windows" near the tips of its wings. The nominate race, *Buteo lineatus lineatus*, is patterned with rufous on underparts, shoulders, and wing linings. Its primaries and secondaries are boldly checkered with black-and-white, and its tail is black with white bands, making this species relatively easy to identify in its adult plumage. It drops onto its prey from elevated perches and also flaps and glides in direct accipiter-like attacks.

SIZE

The Red-shouldered Hawk is a medium-sized to large buteo. Females are slightly larger and heavier than males. Lengths range between 19 and 24 inches (48 and 61 centimeters) for females and 17 and 23 inches (43 and 58 centimeters) for males. Wingspans average 133 inches (339 centimeters) for females and 126 inches (321 centimeters) for males. Weights average about 1.5 pounds (700 grams) for females and about 1.2 pounds (550 grams) for males. Size decreases toward the south and the west of this species' range.

MORPHS

There are no color morphs for the Red-shouldered Hawk but full albinism has been reported.

SPECIFIC DESCRIPTION

Gulf Coast (*alleni*) Adult - Perched

- smaller than "Eastern"
- like "Eastern", head still fairly dark, but paler than "Eastern" with back and washed out rufous underparts
- fewer dark streaks on under parts

Gulf Coast (*alleni*) Immature - Perched

- smaller than "Eastern"
- like "Eastern" immature but underparts quite barred, not streaked
- usually barred leg feathers
- tail with fewer dark bands and little or no rufous wash

Gulf Coast (*alleni*) Adult - Flight

- lacks dark streaks on under parts
- smaller than "Eastern"
- like "Eastern" adult but paler underparts
- white crescent panels, or "windows", on primary feathers

Gulf Coast (*alleni*) Immature - Flight

- smaller than "Eastern"
- like "Eastern" immature but underparts more barred
- tawny crescent panels, or "windows", on primary feathers

SIMILAR SPECIES

The Northern Goshawk and the Cooper's Hawk are superficially similar but are accipiters, with short wings and long, slender tails. The immature Red-tailed Hawk is similar to the Red-shouldered Hawk immature but it almost always has dark patagial marks on the leading edge of the inner wing. Generally, immature Red-tailed Hawks have very narrow dark bands on their tails while immature Red-shouldered Hawks have very narrow gray bands. The adult Broad-winged Hawk is much smaller (crow-sized) than a Red-shouldered Hawk. However, the two species can be hard to tell apart. A Broad-winged Hawk's tail bands are of equal width, while a Red-shouldered Hawk has wider black bands and narrow white ones. The adult Red-shouldered Hawk shows a rufous shoulder. Immature Broad-winged Hawks can be very difficult to tell from immature Red-shouldered. The upper tail surface on the Broad-winged Hawk immature is light with dark bands while that of the Red-shouldered is dark with light bands.

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MYTHOLOGY

There is no mythology recorded for this species in North America.

RANGE

The Red-shouldered Hawk breeds, and is present year-round, from extreme southwestern Oregon south along the coast of California to Baja, California. In the East it is primarily a summer visitant in northern parts of its range from central Minnesota, southern Ontario, southern Quebec, and southern New Brunswick south to the vicinity of the Great

Lakes and northern West Virginia. South of this area and throughout the rest of the United States, and west to eastern Kansas, eastern Oklahoma, and eastern Texas, it may be present year-round. Nonbreeding birds occur annually in extreme southern Texas.

The distribution of this subspecies in North America is as follows:

(1) "Gulf Coast" Red-shouldered Hawk (*Buteo lineatus alleni*)

- breeds, and present year-round, from southeastern Oklahoma, central Arkansas, southern Tennessee, southern North Carolina, central South Carolina, south through eastern Texas and Florida except the southern portions.

It should be pointed out that there is much overlap in the distribution of the subspecies and that the ranges discussed above are generalized.

MIGRATION

The Red-shouldered Hawk usually migrates only from the northern-most parts of its eastern North American range which includes central Minnesota, northern Wisconsin, northern Michigan, southern Ontario, southern Quebec, New York, eastern Pennsylvania, Vermont, New Hampshire, Maine, and New Brunswick. Immatures move southward from September through December while adults migrate from October into December. Fall migration peaks in late October to early November in the northern states. This species migrates along ridges inland and the coast. Coastal numbers are often higher. Fall migration has been observed as far south as Louisiana and Florida. Spring migration peaks from late February through early April across much of its northern range.

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In eastern North America the Red-shouldered Hawk breeds in extensive riparian forests, bottomland hardwood forests, flooded deciduous swamps, and mixed upland forest. It inhabits forest with mature to old-growth trees forming the canopy with variable understory. The subcanopy is generally open, creating a parklike look to favored habitat. Some water body is usually present. Western birds breed in riparian and oak woodlands and also eucalyptus groves in residential areas. In Florida, it generally uses open country for foraging more commonly than in other races. In winter, this species frequents lowland woods near water. Individuals may appear in open country more often than during breeding season. Its year round habitat selection appears to be adaptable to what is available. Generally elevated perches, woodland, and water are required.

VOICE

The Red-shouldered Hawk has seven or eight vocalizations. The "kee-aah" call is common, usually given five to 12 times a session to announce territory or alarm. "Kee-wee" is a variant with the accent on the second syllable. "Kip" calls are given during exciting or stressful situations. The "keyip" call is also an excited call. "Kee-ann-errr" is a drawn out three syllable call given by displaying adults. It may become "kee-yeer" or change again to "kendrick." "Kee" is a soft call given by an incubating or brooding female. Females have lower-pitched voices than males. Vocalizations are given during displays, copulation, at enemies and when disturbed at the nest.

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The Red-shouldered Hawk takes a wide variety of prey, depending upon season, region, and local conditions. For example, in Iowa, during a drought, 92 percent of all prey brought to three nests were mammals but the next year when the same forest was flooded 85 percent were amphibians and arthropods. Studies from various parts of its breeding range show major regional differences in percentages of types of food taken. Generally over the hawk's entire range, small mammals, frogs, toads, and snakes make up the bulk of its diet. However, birds, crayfish, and insects are food items of seasonal and regional importance. Occasionally it will eat carrion and also caches and retrieves food items near the nest.

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The Red-shouldered Hawk is single-brooded but will lay a replacement clutch.

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Red-shouldered Hawk - Eastern

Buteo lineatus

GENERAL DESCRIPTION

The Red-shouldered Hawk is a buteo of eastern North America, with an isolated population along the West Coast. It is a woodland hawk, hunting beneath the canopy of northeastern forest or southern hardwood swamp. The Red-shouldered Hawk is larger than the Broad-winged Hawk which frequents forested edge, and smaller than the more aggressive Red-tailed Hawk which requires a semi-open forest or a patchwork of openings and clearings. The Red-tailed Hawk will drive out Red-shouldered Hawks from areas where the two species come into contact. Thus, the Red-shouldered Hawk has suffered population declines as forested land across the eastern United States and southeastern Canada becomes more fragmented due to human development.

The Red-shouldered Hawk is an attractive hawk, showing pale crescent shaped "windows" near the tips of its wings. The nominate race, *Buteo lineatus lineatus*, is patterned with rufous on underparts, shoulders, and wing linings. Its primaries and secondaries are boldly checkered with black-and-white, and its tail is black with white bands, making this species relatively easy to identify in its adult plumage. It drops onto its prey from elevated perches and also flaps and glides in direct accipiter-like attacks.

SIZE

The Red-shouldered Hawk is a medium-sized to large buteo. Females are slightly larger and heavier than males. Lengths range between 19 and 24 inches (48 and 61 centimeters) for females and 17 and 23 inches (43 and 58 centimeters) for males. Wingspans average 133 inches (339 centimeters) for females and 126 inches (321 centimeters) for males. Weights average about 1.5 pounds (700 grams) for females and about 1.2 pounds (550 grams) for males. Size decreases toward the south and the west of this species' range.

MORPHS

There are no color morphs for the Red-shouldered Hawk but full albinism has been reported.

SPECIFIC DESCRIPTION

Eastern (*lineatus*) Adult - Perched

- brown head and back
- rufous barred underparts with short dark streaks or blotches on chest and belly
- rufous shoulders
- remainder of upper wing surface black-and-white checkered
- tail has broad black bands and three to four narrow white bands (narrowest of all races)
- dark brown eyes

Eastern (*lineatus*) Immature - Perched

- brown head and back
- buffy to light brown line above eye and dark moustache usually present
- buffy underparts broadly streaked with dark brown
- brown shoulders
- brown tail with narrow buffy bands, rufous colored at base

- gray-brown eyes

Eastern (lineatus) Adult - Flight

- appears to have long wings and tail
- rufous barred underparts contrast with white undertail coverts
- underwings two toned with rufous wing linings and black and white barred flight feathers
- both wing surfaces show a "window" or "crescent" of white barring near base of outer primaries; visible from above and below
- black-and-white banded tail (three to four white bands)
- flaps like an accipiter

Eastern (lineatus) Immature - Flight

- appears to have long wings and tail
- brown above and creamy below
- streaked underparts, concentrated in chest region
- generally pale underwing; rusty buff linings and palely barred flight feathers. Has most faintly barred flight feathers of all five races
- tawny colored panel, "window", or "crescent" at base of outer primaries; visible from above and below
- under side of tail gray and white tail bands except for rufous inner tail bands
- flaps like an accipiter

SIMILAR SPECIES

The Northern Goshawk and the Cooper's Hawk are superficially similar but are accipiters, with short wings and long, slender tails. The immature Red-tailed Hawk is similar to the Red-shouldered Hawk immature but it almost always has dark patagial marks on the leading edge of the inner wing. Generally, immature Red-tailed Hawks have very narrow dark bands on their tails while immature Red-shouldered Hawks have very narrow gray bands. The adult Broad-winged Hawk is much smaller (crow-sized) than a Red-shouldered Hawk. However, the two species can be hard to tell apart. A Broad-winged Hawk's tail bands are of equal width, while a Red-shouldered Hawk has wider black bands and narrow white ones. The adult Red-shouldered Hawk shows a rufous shoulder. Immature Broad-winged Hawks can be very difficult to tell from immature Red-shouldered. The upper tail surface on the Broad-winged Hawk immature is light with dark bands while that of the Red-shouldered is dark with light bands.

OTHER NAMES

The Red-shouldered Hawk is often referred to as the Red-bellied Hawk.

Most of the other common names for this species refer to its subspecies. Usually these are named according to where they are found. These include: (1) "Eastern" or "Northern" Red-shouldered Hawk (*B. l. lineatus*), (2) "Gulf Coast" or "Florida" Red-shouldered Hawk (*B. l. alleni*), (3) "Florida" or "Keys" Red-shouldered Hawk (*B. l. extimus*), (4) "Texas" Red-shouldered Hawk (*B. l. texanus*), and (5) "California", "Western", or "Red-bellied" Red-shouldered Hawk.

The California race (*elegans*) was formerly considered a separate species.

ETYMOLOGY

The scientific name *Buteo lineatus* translates into "hawk or falcon" (*Buteo* - Latin) that is "striped" (*lineatus* - Latin).

MYTHOLOGY

There is no mythology recorded for this species in North America.

RANGE

The Red-shouldered Hawk breeds, and is present year-round, from extreme southwestern Oregon south along the coast of California to Baja, California. In the East it is primarily a summer visitant in northern parts of its range from central Minnesota, southern Ontario, southern Quebec, and southern New Brunswick south to the vicinity of the Great Lakes and northern West Virginia. South of this area and throughout the rest of the United States, and west to eastern Kansas, eastern Oklahoma, and eastern Texas, it may be present year-round. Nonbreeding birds occur annually in extreme southern Texas.

The distribution of this subspecies in North America is as follows:

(1) "Eastern" Red-shouldered Hawk (*Buteo lineatus lineatus*)

- breeds in southeastern Canada and the eastern United States south to Texas, central Arkansas, southern Tennessee, southern North Carolina, and central South Carolina.

It should be pointed out that there is much overlap in the distribution of the subspecies and that the ranges discussed above are generalized.

MIGRATION

The Red-shouldered Hawk usually migrates only from the northern-most parts of its eastern North American range which includes central Minnesota, northern Wisconsin, northern Michigan, southern Ontario, southern Quebec, New York, eastern Pennsylvania, Vermont, New Hampshire, Maine, and New Brunswick. Immatures move southward from September through December while adults migrate from October into December. Fall migration peaks in late October to early November in the northern states. This species migrates along ridges inland and the coast. Coastal numbers are often higher. Fall migration has been observed as far south as Louisiana and Florida. Spring migration peaks from late February through early April across much of its northern range.

The Red-shouldered Hawk has been termed a middle-distance partial migrant travelling 480 to 2400 miles (300 to 1500 kilometers) in a season. Migrants usually fly alone or sometimes in small, loose flocks. The Red-shouldered Hawk avoids wide water crossings. Migrants use soaring, flapping and intermittent gliding-flapping. Along the coast, in spring, migration is strongest when there is a southeast wind.

BEHAVIOR

The Red-shouldered Hawk has a flight like that of an accipiter, with three to five quick wing beats followed by a glide. During the glide the wings are bowed downward. This species also soars with wings held flat and pressed forward. It does not hover.

The Red-shouldered Hawk is a diurnal hunter of the forest. Most hunting is done from a perch in the forest canopy from which it drops onto prey below. In one California study, all hunting attempts (over 250 began from a perch. Perch heights in Missouri ranged from 6.8 to 12.9 feet (2.1 to 4.0 m) above ground and included fences, hay piles, and trees. The

Broad-winged Hawk also hunts from a perch, but usually one located at the edge of forest openings. The Red-shouldered Hawk drops onto small mammals within 290 feet (90 meters) of its perch. It also makes accipiter-like direct flights at birds attracted to bird feeders or watering places. It also courses like a Northern Harrier low over open ground to surprise its prey. It may also hunt small mammals, reptiles, and amphibians on foot, and may fly out of the forest to seize prey from the water's surface.

This species may occupy the same territory for life, although this needs more study. Pairs often use the same nest tree year after year. If disturbed a pair will change its nest site within the same territory. Home range size in eastern North America varies from 268 to 837 acres (109 to 339 hectares) during breeding season. Home ranges average smaller for females than males. The postbreeding home range is larger, with males again holding larger ranges. The male's home range usually includes all of the female's home range within his boundaries. Winter range size may be determined by the availability of food. The Red-shouldered Hawk is normally solitary or in pairs during breeding season. Even in migration it rarely forms flocks.

The Red-shouldered Hawk will defend its home range against Broad-winged Hawks, Red-tailed Hawks, Golden Eagles, Prairie Falcons, Barred Owls, and Great Horned Owls. Avian intruders near nests are chased and sometimes attacked. The Red-shouldered Hawk and the American Crow will attempt to rob each other and may jointly mob a Great Horned Owl in the hawk's territory. It is also known to rob Great Horned Owl nests. When a human is near a nest, the nesting bird may quietly leave or perch nearby and call. It may also circle, calling, overhead or even stoop at the person and attempt to strike. Aggression toward nest intruders increases from incubation through the nestling stage.

The courtship period may be as short as 18 days. The courtship display involves high-circling with both male and female circling with wings and tails wide spread. Both sexes call. They soar close to one another and then swing away. One may soar high and dive toward the other. The male also performs a sky-dance. He soars upward and calls. When the female appears, he dives steeply several times. Each dive is checked and followed by a wide spiral and a rapid ascent before the nest dive. In Massachusetts, migrant birds appeared to be paired when they arrived on territory. Copulation involves the female soliciting by crouching across a branch, drooping her wings and uttering a twittering call. The male performs the sky-dance with one of his dives taking him to the female's back. After copulation both birds may perch in the same tree.

The oldest Red-shouldered Hawk was a banded bird recovered at 19 years, 11 months. Average survival was 25.6 months for birds banded between 1955 and 1979. Locally, Great Horned Owl predation of nesting adults and/or their eggs and young can be quite heavy. In New York 33 percent of nine nests were lost to Great Horned Owls. In other areas, however, nest predation is not a major factor. Raccoons can also be nest predators. Other causes of mortality include trapping, shooting, and collision with vehicles. In California, the introduced grasses *Bromus diandrus*, *B. rubens*, *Hordeum jubatum*, and *Avena barbata* may become lodged in the eyes of Red-shouldered Hawks causing the birds to become blind and starve or collide with wires. Winter starvation of an immature has also been reported. Insecticides, including DDT and dieldrin, mercury, and other chemicals have been found in eggs and tissue, but eggshell thinning was less severe than for several other raptors. The relationship between chemical contamination and reproductive failure in the Red-shouldered Hawk remains unclear.

ADAPTATIONS

The Red-shouldered Hawks of southern California seem to have adapted much better to human development than this species has done elsewhere. It has adopted the introduced

eucalyptus tree (various species) as a nesting tree and is often found in well forested residential areas.

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Red-shouldered Hawk - Texas

Buteo lineatus

GENERAL DESCRIPTION

The Red-shouldered Hawk is a buteo of eastern North America, with an isolated population along the West Coast. It is a woodland hawk, hunting beneath the canopy of northeastern forest or southern hardwood swamp. The Red-shouldered Hawk is larger than the Broad-winged Hawk which frequents forested edge, and smaller than the more aggressive Red-tailed Hawk which requires a semi-open forest or a patchwork of openings and clearings. The Red-tailed Hawk will drive out Red-shouldered Hawks from areas where the two species come into contact. Thus, the Red-shouldered Hawk has suffered population declines as forested land across the eastern United States and southeastern Canada becomes more fragmented due to human development.

The Red-shouldered Hawk is an attractive hawk, showing pale crescent shaped "windows" near the tips of its wings. The nominate race, *Buteo lineatus lineatus*, is patterned with rufous on underparts, shoulders, and wing linings. Its primaries and secondaries are boldly checkered with black-and-white, and its tail is black with white bands, making this species relatively easy to identify in its adult plumage. It drops onto its prey from elevated perches and also flaps and glides in direct accipiter-like attacks.

SIZE

The Red-shouldered Hawk is a medium-sized to large buteo. Females are slightly larger and heavier than males. Lengths range between 19 and 24 inches (48 and 61 centimeters) for females and 17 and 23 inches (43 and 58 centimeters) for males. Wingspans average 133 inches (339 centimeters) for females and 126 inches (321 centimeters) for males. Weights average about 1.5 pounds (700 grams) for females and about 1.2 pounds (550 grams) for males. Size decreases toward the south and the west of this species' range.

MORPHS

There are no color morphs for the Red-shouldered Hawk but full albinism has been reported.

SPECIFIC DESCRIPTION

Texas (*texanus*) Adult - Perched

- like adult "Eastern" (and "Gulf Coast") but smaller and usually lacks streaks on chest and is more brightly colored
- white tail bands usually wider than in "Eastern"

Texas (*texanus*) Immature - Perched

- probably inseparable from "Gulf Coast" birds
- five to six dark tail bands with rufous wash on inner bands
- ventral barring very similar to "Gulf Coast" and "Florida" than to "Eastern"

Texas (*texanus*) Adult - Flight

- like adult "Eastern" but usually lacks streaks on chest and is more brightly colored

- white tail bands usually wider than in "Eastern"
- white primary feather "window" crescents

Texas (*texanus*) Immature - Flight

- probably inseparable from immature "Florida" birds
- tawny-colored primary feather "window" crescents

SIMILAR SPECIES

The Northern Goshawk and the Cooper's Hawk are superficially similar but are accipiters, with short wings and long, slender tails. The immature Red-tailed Hawk is similar to the Red-shouldered Hawk immature but it almost always has dark patagial marks on the leading edge of the inner wing. Generally, immature Red-tailed Hawks have very narrow dark bands on their tails while immature Red-shouldered Hawks have very narrow gray bands. The adult Broad-winged Hawk is much smaller (crow-sized) than a Red-shouldered Hawk. However, the two species can be hard to tell apart. A Broad-winged Hawk's tail bands are of equal width, while a Red-shouldered Hawk has wider black bands and narrow white ones. The adult Red-shouldered Hawk shows a rufous shoulder. Immature Broad-winged Hawks can be very difficult to tell from immature Red-shouldered Hawks. The upper tail surface on the Broad-winged Hawk immature is light with dark bands while that of the Red-shouldered is dark with light bands.

OTHER NAMES

The Red-shouldered Hawk is often referred to as the Red-bellied Hawk.

Most of the other common names for this species refer to its subspecies. Usually these are named according to where they are found. These include: (1) "Eastern" or "Northern" Red-shouldered Hawk (*B. l. lineatus*), (2) "Gulf Coast" or "Florida" Red-shouldered Hawk (*B. l. alleni*), (3) "Florida" or "Keys" Red-shouldered Hawk (*B. l. extimus*), (4) "Texas" Red-shouldered Hawk (*B. l. texanus*), and (5) "California", "Western", or "Red-bellied" Red-shouldered Hawk.

The California race (*elegans*) was formerly considered a separate species.

ETYMOLOGY

The scientific name *Buteo lineatus* translates into "hawk or falcon" (*Buteo* - Latin) that is "striped" (*lineatus* - Latin).

MYTHOLOGY

There is no mythology recorded for this species in North America.

RANGE

The Red-shouldered Hawk breeds, and is present year-round, from extreme southwestern Oregon south along the coast of California to Baja, California. In the East it is primarily a summer visitant in northern parts of its range from central Minnesota, southern Ontario, southern Quebec, and southern New Brunswick south to the vicinity of the Great Lakes and northern West Virginia. South of this area and throughout the rest of the United States, and west to eastern Kansas, eastern Oklahoma, and eastern Texas, it may be present year-round. Nonbreeding birds occur annually in extreme southern Texas.

The distribution of this subspecies in North America is as follows:

(1) "Texas" Red-shouldered Hawk (*Buteo lineatus texanus*) r

- resident only in a central portion of Texas

It should be pointed out that there is much overlap in the distribution of the subspecies and that the ranges discussed above are generalized.

MIGRATION

The Red-shouldered Hawk usually migrates only from the northern-most parts of its eastern North American range which includes central Minnesota, northern Wisconsin, northern Michigan, southern Ontario, southern Quebec, New York, eastern Pennsylvania, Vermont, New Hampshire, Maine, and New Brunswick. Immatures move southward from September through December while adults migrate from October into December. Fall migration peaks in late October to early November in the northern states. This species migrates along ridges inland and the coast. Coastal numbers are often higher. Fall migration has been observed as far south as Louisiana and Florida. Spring migration peaks from late February through early April across much of its northern range.

The Red-shouldered Hawk has been termed a middle-distance partial migrant travelling 480 to 2400 miles (300 to 1500 kilometers) in a season. Migrants usually fly alone or sometimes in small, loose flocks. The Red-shouldered Hawk avoids wide water crossings. Migrants use soaring, flapping and intermittent gliding-flapping. Along the coast, in spring, migration is strongest when there is a southeast wind.

BEHAVIOR

The Red-shouldered Hawk has a flight like that of an accipiter, with three to five quick wing beats followed by a glide. During the glide the wings are bowed downward. This species also soars with wings held flat and pressed forward. It does not hover.

The Red-shouldered Hawk is a diurnal hunter of the forest. Most hunting is done from a perch in the forest canopy from which it drops onto prey below. In one California study, all hunting attempts (over 250 began from a perch. Perch heights in Missouri ranged from 6.8 to 12.9 feet (2.1 to 4.0 m) above ground and included fences, hay piles, and trees. The Broad-winged Hawk also hunts from a perch, but usually one located at the edge of forest openings. The Red-shouldered Hawk drops onto small mammals within 290 feet (90 meters) of its perch. It also makes accipiter-like direct flights at birds attracted to bird feeders or watering places. It also courses like a Northern Harrier low over open ground to surprise its prey. It may also hunt small mammals, reptiles, and amphibians on foot, and may fly out of the forest to seize prey from the water's surface.

This species may occupy the same territory for life, although this needs more study. Pairs often use the same nest tree year after year. If disturbed a pair will change its nest site within the same territory. Home range size in eastern North America varies from 268 to 837 acres (109 to 339 hectares) during breeding season. Home ranges average smaller for females than males. The postbreeding home range is larger, with males again holding larger ranges. The male's home range usually includes all of the female's home range within his boundaries. Winter range size may be determined by the availability of food. The Red-shouldered Hawk is normally solitary or in pairs during breeding season. Even in migration it rarely forms flocks.

The Red-shouldered Hawk will defend its home range against Broad-winged Hawks, Red-

tailed Hawks, Golden Eagles, Prairie Falcons, Barred Owls, and Great Horned Owls. Avian intruders near nests are chased and sometimes attacked. The Red-shouldered Hawk and the American Crow will attempt to rob each other and may jointly mob a Great Horned Owl in the hawk's territory. It is also known to rob Great Horned Owl nests. When a human is near a nest, the nesting bird may quietly leave or perch nearby and call. It may also circle, calling, overhead or even stoop at the person and attempt to strike. Aggression toward nest intruders increases from incubation through the nestling stage.

The courtship period may be as short as 18 days. The courtship display involves high-circling with both male and female circling with wings and tails wide spread. Both sexes call. They soar close to one another and then swing away. One may soar high and dive toward the other. The male also performs a sky-dance. He soars upward and calls. When the female appears, he dives steeply several times. Each dive is checked and followed by a wide spiral and a rapid ascent before the nest dive. In Massachusetts, migrant birds appeared to be paired when they arrived on territory. Copulation involves the female soliciting by crouching across a branch, drooping her wings and uttering a twittering call. The male performs the sky-dance with one of his dives taking him to the female's back. After copulation both birds may perch in the same tree.

The oldest Red-shouldered Hawk was a banded bird recovered at 19 years, 11 months. Average survival was 25.6 months for birds banded between 1955 and 1979. Locally, Great Horned Owl predation of nesting adults and/or their eggs and young can be quite heavy. In New York 33 percent of nine nests were lost to Great Horned Owls. In other areas, however, nest predation is not a major factor. Raccoons can also be nest predators. Other causes of mortality include trapping, shooting, and collision with vehicles. In California, the introduced grasses *Bromus diandrus*, *B. rubens*, *Hordeum jubatum*, and *Avena barbata* may become lodged in the eyes of Red-shouldered Hawks causing the birds to become blind and starve or collide with wires. Winter starvation of an immature has also been reported. Insecticides, including DDT and dieldrin, mercury, and other chemicals have been found in eggs and tissue, but eggshell thinning was less severe than for several other raptors. The relationship between chemical contamination and reproductive failure in the Red-shouldered Hawk remains unclear.

ADAPTATIONS

The Red-shouldered Hawks of southern California seem to have adapted much better to human development than this species has done elsewhere. It has adopted the introduced eucalyptus tree (various species) as a nesting tree and is often found in well forested residential areas.

Nesting Red-shouldered Hawks studied in Florida and California show an interesting adaptation between the size of prey brought to the nest and the distance from the nest the prey was caught. Small prey, like insects, are caught close to the nest tree while larger prey were brought in from both close and far distances. Such a strategy makes sense since the energy costs of transporting tiny prey from long distances could well exceed any benefits gained.

HABITAT

In eastern North America the Red-shouldered Hawk breeds in extensive riparian forests, bottomland hardwood forests, flooded deciduous swamps, and mixed upland forest. It inhabits forest with mature to old-growth trees forming the canopy with variable understory. The subcanopy is generally open, creating a parklike look to favored habitat. Some water body is usually present. Western birds breed in riparian and oak woodlands and also eucalyptus groves in residential areas. In Florida, it generally uses open country for foraging

more commonly than in other races. In winter, this species frequents lowland woods near water. Individuals may appear in open country more often than during breeding season. Its year round habitat selection appears to be adaptable to what is available. Generally elevated perches, woodland, and water are required.

VOICE

The Red-shouldered Hawk has seven or eight vocalizations. The "kee-aah" call is common, usually given five to 12 times a session to announce territory or alarm. "Kee-wee" is a variant with the accent on the second syllable. "Kip" calls are given during exciting or stressful situations. The "keyip" call is also an excited call. "Kee-ann-errr" is a drawn out three syllable call given by displaying adults. It may become "kee-yeer" or change again to "kendrick." "Kee" is a soft call given by an incubating or brooding female. Females have lower-pitched voices than males. Vocalizations are given during displays, copulation, at enemies and when disturbed at the nest.

FOODS

The Red-shouldered Hawk takes a wide variety of prey, depending upon season, region, and local conditions. For example, in Iowa, during a drought, 92 percent of all prey brought to three nests were mammals but the next year when the same forest was flooded 85 percent were amphibians and arthropods. Studies from various parts of its breeding range show major regional differences in percentages of types of food taken. Generally over the hawk's entire range, small mammals, frogs, toads, and snakes make up the bulk of its diet. However, birds, crayfish, and insects are food items of seasonal and regional importance. Occasionally it will eat carrion and also caches and retrieves food items near the nest.

Mammals taken include chipmunks (particularly the eastern chipmunk - *Tamias striatus* in the eastern range), voles (particularly the Meadow Vole - *Microtus pennsylvanicus*), as key items, and shrews, as well as opossum, skunks, rabbits, and muskrats (the latter four may have been young individuals or carrion). Birds as large as Ruffed Grouse and American Black Duck have been taken but usually avian prey is grackle-sized or smaller, and in Wisconsin commonly included House Sparrows and European Starlings taken accipiter-style from near bird feeders. Reptile prey includes several species of snakes including colubrid snakes, as well as small lizards and young turtles. Amphibians include frogs and toads. A few small fish are taken. Crayfish are important prey in certain parts of the range. Insects can also become important as food, especially grasshoppers and crickets. Centipedes, worms, and snails are also eaten.

PELLETS

There is no information about pellet formation in this species for North America. An extra nest in a territory may be used as a plucking post or feeding platform.

NESTING

In the northeast, the nest site is usually a large tree in a mature deciduous or mixed stand. The nest is usually located between 20 and 60 feet (6.2 and 18.6 meters) up but may range from 10 to 200 feet (3.1 to 62 meters) high, but below the canopy, usually in the crotch of the main trunk. In conifers, the nest is usually built against the main trunk where a whorl of branches meets the trunk. Birds in southern Florida sometimes nest in cabbage palmetto or live oaks. In California, eucalyptus trees are preferred. One ground nest in Florida was reported. Nests are generally located near some body of water like a stream, swamp, lake or pond. It is not known which birds select the nest site, but nests are commonly reused for several years.

The nest is a tidy structure, unlike the straggly nest of a Broad-winged Hawk. It is generally smaller than a Red-tailed Hawk's nest, measuring 17.7 to 23.6 inches (45 to 60 centimeters) in outside diameter, 7.9 to 11.8 inches (20 to 30 centimeters) in height, about 7.9 inches (20 centimeters) for a cavity diameter, and 2.0 to 29.5 inches (5 to 75 centimeters) for a cavity depth. The exterior is composed of dead and green sticks, leaves, bark, Spanish moss (in the south), lichens, and live conifer sprigs. The inner cavity is lined with inner bark, mosses, lichens, and green sprigs. The sexes work together on a new nest and to refurbish an old one. Building and refurbishing can take four to five weeks at the beginning of the breeding season; however, after nest failure, a pair can build a nest in less than seven days. Sprigs of living vegetation, often hemlock in the northeast, are laid in nests early in the season and may act as a signal that the nest is claimed. A pair may have a second nest in its territory, used some years as an alternative. Alternative nests are also used as plucking posts and feeding platforms.

The eggs are short elliptical in shape and are white or faint bluish covered with variable brown and lavender blotches and markings. Egg measurements (for the nominate race *lineatus*) average 2.1 inches (54.7 millimeters) long by 1.7 inches (43.9 millimeters) wide.

The clutch ranges from two to four, averaging three eggs. The female does most of the incubating while the male delivers prey. Incubation last about 33 days per egg. Nestlings weigh about 1.2 ounces (35 grams) at birth and 1.2 pounds (534 grams) at fledging. The young are brooded almost constantly during the first seven days. Juvenal flight feathers begin to appear at seven to 10 days, followed by scapulars, wing coverts and contour plumage. The back is fully feathered first, and then the sides of the breast. The young are able to walk (on toes) and stand at 23 to 25 days. The young begin exploring nearby branches at 35 to 42 days, fledging during this time. The female may resume hunting late in the nestling period.

Post-nest care has been little studied, but two California broods were fed by their parents eight weeks after fledging and were independent at 14 to 16 weeks. These young began successful hunting by seven to eight weeks, catching mostly insects. By 10 to 13 weeks the young are catching reptiles, amphibians, and mammals.

The Red-shouldered Hawk is single-brooded but will lay a replacement clutch.

CONSERVATION

The Red-shouldered Hawk is sensitive to human disturbance around the nest. In California, logging and the taking of young by falconers caused nest failure. In New Jersey, there may be a retreat of Red-shouldered Hawks from human activity into more remote areas. However, in some other areas of its range the species is reported as tolerant of human activities around the nest site.

Substantial declines in the population of this species have occurred this century. The clearing and subsequent fragmentation of formerly contiguous forests create habitat more favorable to the Great Horned Owl and the larger and more aggressive Red-tailed Hawk, the Red-shouldered Hawk's main competitor. Even selective thinning of forests in Wisconsin and Ontario favored either the Red-tailed Hawk or the Great Horned Owl over the Red-shouldered Hawk, reducing the bird's population.

The single most effective management strategy is probably the retention of large, contiguous blocks of unbroken forest. At this time it is not clear whether any clearing or openings should be provided for the Red-shouldered Hawk or not.

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Broad-winged Hawk

Buteo platypterus

GENERAL DESCRIPTION

The Broad-winged Hawk is one of very few raptors to be a true long distance migrant. Each fall, the Broad-winged Hawks that breed in the forests of Canada and the eastern United States migrate to their Central or South American wintering grounds, a distance of 3,500 to 4,500 miles (5,600 to 7,200 kilometers). Returning in the spring makes for a round trip of between 7,000 and 9,000 miles (11,200 and 14,400 kilometers) a year. Because the hawks are unable to glide over large bodies of water like the Gulf of Mexico, virtually all of North America's Broad-winged Hawks must pass through Panama, where in 1994, up to 1,400,000 individuals were estimated.

On its breeding grounds the Broad-winged Hawk is a quiet woodland hawk, one of the smallest North America buteos, usually identified by its pale underwings, rufous barred underparts and black and white banded tail.

SIZE

The Broad-winged Hawk is a small to medium-sized buteo, about the size of a crow. Male and female length and wingspan measurements overlap considerably. The average length is 15 inches (38 centimeters) and average wingspan is 34 inches (86 centimeters). Females are heavier with an average weight of 1.0 pound (440 grams) while males average 0.8 pounds (357 grams).

MORPHS

There is a very rare dark morph which occurs most frequently in west-central Alberta and northeastern British Columbia, in the extreme northwest portion of the Broad-winged Hawk's range in North America. Isolated records of dark-morph birds have also occurred throughout its eastern and southern range, but only during migration.

SPECIFIC DESCRIPTION

Adult Light-morph - Perched

- brown head with greenish-yellow or yellow cere
- upperparts uniformly dark brown
- underparts creamy white with variable rufous barring
- rufous often forms solid color on chest, with more obvious barring below
- folded tail with one bright creamy band flanked by two broad black bands
- wing tips reach mid-point of tail

Immature Light-morph - Perched

- light stripe over eye and dark mustache mark
- streaks most evident on side of face, throat, and breast
- upperparts dark brown with light feather edges
- underparts white with brown streaks made up of large brown spots
- light brown-gray tail with darker bands; subterminal band the widest.

Adult Light-morph - Flight

- light underwings with wide dark border on primary tips and dark trailing edge; appear white and unmarked
- wings somewhat pointed
- tail strongly banded with three dark and two light broad bands

Immature Light-morph - Flight

- dark mustache on light face
- pale underwing with wide dusky border (trailing edge) and dark primary tips; appear light and unmarked
- streaked underparts
- somewhat pointed wings
- short broad tail with several dark bands; band near tip of tail twice as large as other bands

SIMILAR SPECIES

The Broad-winged Hawk is superficially similar to both the Sharp-shinned and the Cooper's Hawk, especially from the front. However, they are accipiters characterized as long, slim hawks with comparatively short wings and are very differently shaped than the chunky, crow-sized Broad-winged Hawk. They also show much paler chests and much more heavily barred flight feathers than a Broad-winged Hawk does. In adult plumage, all accipiters have gray or gray-blue backs and wings, while the Broad-winged Hawk has a dark brown back and wings. Immature Broad-winged Hawks can be confused with immature accipiters, including Northern Goshawks, but are much chunkier with long, broad wings and equal width tail bands.

Both a dark morph Gyrfalcon and a dark Peregrine Falcon (immature "Peale's" Peregrine) are about the same size but do not show the broad tail (narrow at the base and wider at the tip unless folded) of a Broad-winged Hawk. Both falcons have generally dark tails, possibly with one or two very thin bands as opposed to the banded tails of adult and immature Broad-wings.

The adult Broad-winged Hawk's tail bands of equal width eliminate confusion with other buteos including the dark-morph Ferruginous Hawk (unbanded all light tail), the dark morph adult "Harlan's" Hawk (a whitish tail marbled with dusk), the dark-morph immature Red-tailed Hawk (many narrow tail bands - subterminal band no wider than others), the dark morph Red-tailed Hawk (red tail), the immature dark-morph Rough-legged Hawk (very broad tail band) and the immature dark morph White-tailed Hawk (pale tail with many very narrow gray bands). The Broad-winged Hawk's generally light underwing with the dark edges, or the dark morph's two-toned underwing with dark edges is distinctive from the dark-morph Swainson's Hawk's underwing (no pale flight feathers and two-toned effect often reversed).

Species most similar to the Broad-winged Hawk are the Red-shouldered Hawk, the Gray Hawk, and the dark-morph Short-tailed Hawk. Compared to a light-morph Broad-winged Hawk, the Red-shouldered Hawk shows distinctive white crescents at the base of the primaries in flight and a red shoulder when seen from above. The immature Broad-winged Hawk can be hard to tell from an immature Red-shouldered Hawk. The immature Red-shouldered Hawk has tawny crescent wing panels, or "windows", and the upper tail surface is dark with light bands while the immature Broad-winged Hawk's is light with dark bands. The adult Gray Hawk has gray barred underparts and gray flecked wing linings, not the rufous barring of the Broad-winged Hawk's underparts and the brown flecked wing linings. The Gray Hawk also shows a white crescent at the base of the uppertail which the Broad-wing does not have. The immature Gray Hawk also shows a white crescent at the base of its

uppertail surface. The dark morph adult Short-tailed Hawk is very similar to both the adult and the immature dark morph Broad-winged Hawk but shows secondaries (on the underwing) that have a dusky gray background, causing the white background of the primaries to stand out as an isolated white circle. The adult dark morph Broad-winged Hawk has dark tail bands of equal width. The Short-tailed Hawk shows one broad subterminal band and two to three narrower bands. The immature dark Short-tailed Hawk has small white spots over its lower belly while the dark immature Broad-winged Hawk is generally dark below, perhaps showing a few very thin rufous streaks.

OTHER NAMES

The Broad-winged Hawk is also known as the Broadwing.

ETYMOLOGY

The scientific name *Buteo platypterus* is translated as "hawk or falcon" (*Buteo* - Latin) that has a "broad" (*platys* - Greek) "wing" (*pteron* - Greek).

MYTHOLOGY

There has been no mythology recorded for this species in North America.

RANGE

The Broad-winged Hawk is primarily a summer visitant, and breeder, in North America. It breeds in a narrow band from northeastern British Columbia, east through west-central Alberta, central Saskatchewan, southern Manitoba, southern Ontario, southern Quebec, New Brunswick, and Nova Scotia south through eastern Minnesota, central Iowa, eastern Kansas, eastern Oklahoma, and eastern Texas, east to northern Florida and the Atlantic coast. Some immatures winter irregularly and in small numbers along coastal Texas and the Gulf Coast to southern Florida.

The Broad-winged Hawk is highly migratory, wintering from Guatemala south through Central America to Peru and Brazil.

There are six recognized subspecies of this hawk, only one of which is found in North America, namely *Buteo platypterus platypterus*. The remaining five races occur in the Caribbean.

The Broad-winged Hawk is also resident on the Greater and Lesser Antilles, including Cuba, Puerto Rico, Antigua, Dominica, Martinique, St. Lucia, Barbados, St. Vincent, the Grenadines, Grenada, Tobago, and occasionally Trinidad.

MIGRATION

The Broad-winged Hawk is highly migratory. It winters in extreme southern Central America to southern Brazil. In eastern and central Canada, the Broad-winged Hawk arrives in April to May. The return flights take place in September and October, funneling through the Isthmus of Panama. Certain ridges, narrow water crossings, and other geographical features concentrate spectacular waves of migrants at points along their spring or fall routes, like Hawk Mountain in Pennsylvania, Hawk Ridge, Duluth in Minnesota, Whitefish Point in Michigan, Hawk Cliff in Ontario, Corpus Christi in Texas, Cape May Point in New Jersey, and Veracruz in Mexico.

The Broad-winged Hawk uses a specific migration "strategy". With widespread wings and

tail it rides thermals to get aloft. Then with set wings and folded tail it glides in its direction of migration, pushed by the wind. Updrafts and favorable winds are associated with weather patterns that reoccur every few days. Weather typically occurs over a broad front, sending waves of migrating Broad-winged Hawks simultaneously over large areas. This type of soar-then-glide flight enables the hawks to make major sections of their journey with very little flapping, and thus little energy expenditure.

The surface of a large water body absorbs heat and does not create thermals; thus Broad-winged hawks are unable to soar across large lakes or wide ocean crossings. The Great Lakes pose a formidable barrier, congregating Broad-winged Hawks at four narrow crossings. The general pattern of migration in eastern North America involves these four "lanes" of hawks diverging from the Great Lakes' crossings, plus a wide lane travelling the updrafts of the Appalachian ridges, and another between the Mississippi River and the eastern edge of the Great Plains. The inability to cross wide water also explains why Broad-winged Hawks fly down Central America and do not cross the Gulf of Mexico.

Broad-winged Hawks do not act as true flock members. Favorable air and weather conditions happen to concentrate birds in certain areas. Birds typically migrate at a maximum height of 1300 to 2000 yards (1209 to 1860 meters) elevation. Because they depend upon weather, flights do not occur every day. On a flight day the air warms and thermals become strong. However when conditions are unfavorable, birds will stay in the woods, sometimes hunting and occasionally continuing in low flight short distances in the general direction of migration .

BEHAVIOR

The Broad-winged Hawk has been described as "tame" though the word "quiet" better describes its lifestyle as an inconspicuous hunt-and-perch predator. Human interference during nest building can cause adults to abandon the nest. However, once the nest is established the female Broad-winged Hawk can be aggressive toward intruders, even striking them. On most occasions, the incubating bird quietly leaves the nest when approached and perches nearby or circles overhead.

The Broad-winged Hawk uses the "sit" or "perch" and wait method of hunting, perching on a utility pole, wire or tree along a forest edge such as a forest roadcut, the shore of a creek or lake, or the edge of a clearing. The bird sights its prey on the ground, pushes off from its perch, and, after an initial series of rapid wing beats, typically glides until impact with the prey. It may mantle (stand with wings spread) over the prey for several minutes looking around before "footing" its prey. It may consume the prey on the ground or, as is typical for adults, carry it to a perch before feeding. Less common hunting methods include perching close (or even standing on the shore) to an amphibian breeding pond and seizing frogs as they breed, or cruising through the forest generally below tree-top level in a search for slow moving prey. Insects are also taken from a perch and in flight.

The pair bond may be long-term, though more study is needed. The members of a pair likely separate after breeding and do not reunite until returning to the breeding area. In one study, a pair from the previous season reunited within 0.3 miles (0.5 kilometers) of their former nesting home range. Adults appear to return to the same territory yearly, though they will nest in different parts of it from one breeding season to the next. The territory should contain forest, open areas, and a waterbody or wetland. Home range and territory size are not known. The species is generally solitary until migration when it commonly associates in flocks.

Broad-winged Hawks wintering in extreme southern Florida were often noisily harassed by American Kestrels trying, usually unsuccessfully, to evict the hawk from the kestrel's

territory. The Broad-winged Hawk will defend its breeding territories against Red-tailed Hawks, Red-shouldered Hawks, and Northern Harriers. Occasionally, it will nest peacefully in proximity with another hawk's nest such as the Sharp-shinned Hawk, Cooper's Hawk, and Red-tailed Hawk.

Pair-formation and courtship displays are poorly known and apparently do not last very long as this species usually begins nest building and egg laying soon after spring arrival. High-circling is an advertising display that begins upon arrival at the breeding area. It involves one or two birds calling and circling over the forest. One bird may sideslip or dive downward upon another bird and almost make contact. The "sky-dance" involves a bird ascending in widening circles, calling, and soaring until nearly out of sight, then descending in long sweeps and curves. Also, other displays such as "tumbling", (the undulating-flight when a bird flies high undulating and the wings are flapped stiffly), and the "pigeon-flight" (which is characterized by deep wing beats followed by a glide with wings upheld in a V) have been described by other authors. The most common courtship vocalization is the two-noted whistle.

The oldest known wild bird lived 14 years and four months. Nests often fail due to predation. Half the nest failures in one New York study were due to predation by Great Horned Owls. Young Broad-winged Hawks suffer a high mortality rate; the average life expectancy in one study of 37 records was only one year. Hazards during migration include water crossings. Small numbers are found on the Dry Tortugas [tiny islands 60 miles (96 kilometers) west of Key West, Florida], each spring and, particularly, fall. Although capable of flight, these birds usually fail to find thermals that they could soar back to the mainland. Birds wintering in extreme southern Florida suffer significant mortality from collisions with automobiles.

ADAPTATIONS

Although flocks of Broad-winged Hawks are seen during migration, the species has no real flock attachment and is free to follow its own flight plan. This behavioral characteristic enables Broad-winged Hawks to take advantage of local weather conditions to suit its own needs.

The Broad-winged Hawk's rufous and brown coloration acts as camouflage within its usual wooded environment.

This species may lay larger clutches in seasons of greater prey abundance as was shown in one western New York State study.

HABITAT

The Broad-winged Hawk is a bird of deciduous or mixed forest edge. It occasionally frequents coniferous forests too. It will breed in both small woodlands of a few acres but seems to prefer much larger tracts of continuous forest. It has been found nesting in aspen groves (Alberta and Minnesota), oak-aspen stands (Minnesota), yellow birch (New York) and even pine plantations (New York). Important elements in the habitat include proximity to edge such as forest openings and woodland roads for foraging, and proximity to water such as marshes, streams, ponds, or lakes for breeding. Perches, such as trees and utility poles along forest edge, are also needed.

VOICE

The Broad-winged Hawk's most common vocalization is a two note whistle. The first note is short and slightly higher pitched than the longer, plaintive second note. It is commonly

transcribed as "Pee-w-e-e-e-e" or "Kill-e-e-e-e". The male has a slightly higher voice than the female. This call is heard when intruders approach the nest or when the birds circle over their territory.

A "whining" is given when the male brings food for the female. During copulation the male makes a wheezy two-toned whistle transcribed as "whee-ooou." Tiny nestlings peep and hungry fledglings give a piercing whistle somewhat similar to the adult "peewee" call.

FOODS

The Broad-winged Hawk eats small mammals, birds, reptiles, amphibians, occasionally fishes and many invertebrates. It consumes a wide variety of small mammals including squirrels, chipmunks, voles, red-backed voles, mice, jumping mice, rats, young hares, young rabbits, long-tailed weasels, moles, shrews, and bats. Birds taken include many species of flicker or jay-sized birds and smaller birds including Rose-breasted Grosbeak, Fox Sparrow, White-throated Sparrow, Ovenbird, and other warblers. The young of larger birds, like Ruffed Grouse, are also taken. Fledglings or nestlings of many small woodland birds are also taken. Other species include Pileated Woodpecker and Northern Saw-whet Owl. Reptiles include at least 11 species of snakes, four species of lizards and young Snapping Turtles. Amphibians include three species of frogs, a tree frog, and American toads. One unidentified fish was reported for one bird in Connecticut. Invertebrates include at least 30 species including cicadas, grasshoppers, locusts, crickets, dragonflies, moths larvae, caterpillars, centipedes, crayfish, fiddler crabs, and earthworms.

The Broad-winged Hawk takes advantage of regionally abundant prey, eating young Ruffed Grouse and young Snowshoe Hares in central Alberta where reptiles are scarce, and taking 29 young Snapping Turtles in Oklahoma. It is also an opportunist. One hawk was seen to strike a pole supporting a bluebird box. When the bluebird stuck its head outside the box, the hawk, perched atop the box, seized the bird and pulled it out.

PELLETS

There is no information available on the pellets of this species in North America.

NESTING

The Broad-winged Hawk typically nests in deciduous forest where the nest is generally placed in a main crotch of the trunk, generally in the lower third of the forest canopy. It may build its own nest or refurbish an old raptor, crow, or squirrel nest. If an old nest is used, at least two years elapse between the first nesting and the second. A typical nest constructed from scratch is small (smaller than both Red-shouldered and Cooper's Hawks) and loosely made of twigs and sticks. The inside is lined with bark and lichen. Sprigs of greenery are brought to the nest frequently, throughout the incubation and into the nestling stage. Construction, which can be intermittent, can take two to five weeks.

The clutch ranges from two to five eggs with an average of two or three. The egg is short elliptical in shape and varies in color with a background of white, cream, or pale bluish and variably heavy dots or patches of shades of brown. The egg averages 1.9 inches (48.9 millimeters) in length and 1.5 inches (39.3 millimeters) in width. Clutch-size increases from the southern to the northern parts of its range.

The female incubates 28 to 31 days while the male hunts. Upon hearing the approaching male's food transfer call, the female leaves the nest to join him. While she feeds off the nest, the male will briefly cover the eggs. After incubation the male may deliver food directly to the nest but only the female tears the prey apart and feeds the young. Extra food may be

cached. The young start to show emerging primaries and secondaries at nine to 12 days. The young begin to walk out onto nearby branches at 29 to 31 days. They begin sustained horizontal flight during their fifth or sixth week. At about six weeks the young begin flying toward approaching parents with food. Although they receive food from their parents until seven or eight weeks old, they start hunting independently almost as soon as they fledge and are capable of capturing prey at 54 days. The Broad-winged Hawk is single-brooded and it is not known if it will lay a replacement clutch.

CONSERVATION

Early in the twentieth century migrating flocks of Broad-winged Hawks were the traditional targets of hunters who killed the birds as vermin and in some cases as food. The toll from shooting was heavy, particularly in places like Hawk Mountain, Pennsylvania, where streams of migrant Broad-winged Hawks congregated. Hundreds were often shot in a day. Conservationists, like the late Maurice Broun who established Hawk Mountain as a refuge, helped turn public opinion around. Today Broad-winged Hawk populations appear large and stable, possibly because the species tolerates discontinuous woodland both on its breeding and wintering grounds. It also apparently has not suffered from pesticide contamination like many other birds of prey. A loose estimate of more than a million birds has been made for the total North American population.

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Broad-winged Hawk - light

Buteo platypterus

GENERAL DESCRIPTION

The Broad-winged Hawk is one of very few raptors to be a true long distance migrant. Each fall, the Broad-winged Hawks that breed in the forests of Canada and the eastern United States migrate to their Central or South American wintering grounds, a distance of 3,500 to 4,500 miles (5,600 to 7,200 kilometers). Returning in the spring makes for a round trip of between 7,000 and 9,000 miles (11,200 and 14,400 kilometers) a year. Because the hawks are unable to glide over large bodies of water like the Gulf of Mexico, virtually all of North America's Broad-winged Hawks must pass through Panama, where in 1994, up to 1,400,000 individuals were estimated.

On its breeding grounds the Broad-winged Hawk is a quiet woodland hawk, one of the smallest North America buteos, usually identified by its pale underwings, rufous barred underparts and black and white banded tail.

SIZE

The Broad-winged Hawk is a small to medium-sized buteo, about the size of a crow. Male and female length and wingspan measurements overlap considerably. The average length is 15 inches (38 centimeters) and average wingspan is 34 inches (86 centimeters). Females are heavier with an average weight of 1.0 pound (440 grams) while males average 0.8 pounds (357 grams).

MORPHS

There is a very rare dark morph which occurs most frequently in west-central Alberta and northeastern British Columbia, in the extreme northwest portion of the Broad-winged Hawk's range in North America. Isolated records of dark-morph birds have also occurred throughout its eastern and southern range, but only during migration.

SPECIFIC DESCRIPTION

Adult Light-morph - Perched

- brown head with greenish-yellow or yellow cere
- upperparts uniformly dark brown
- underparts creamy white with variable rufous barring
- rufous often forms solid color on chest, with more obvious barring below
- folded tail with one bright creamy band flanked by two broad black bands
- wing tips reach mid-point of tail

Immature Light-morph - Perched

- light stripe over eye and dark mustache mark
- streaks most evident on side of face, throat, and breast
- upperparts dark brown with light feather edges
- underparts white with brown streaks made up of large brown spots
- light brown-gray tail with darker bands; subterminal band the widest.

Adult Light-morph - Flight

- light underwings with wide dark border on primary tips and dark trailing edge; appear white and unmarked
- wings somewhat pointed
- tail strongly banded with three dark and two light broad bands

Immature Light-morph - Flight

- dark mustache on light face
- pale underwing with wide dusky border (trailing edge) and dark primary tips; appear light and unmarked
- streaked underparts
- somewhat pointed wings
- short broad tail with several dark bands; band near tip of tail twice as large as other bands

SIMILAR SPECIES

The Broad-winged Hawk is superficially similar to both the Sharp-shinned and the Cooper's Hawk, especially from the front. However, they are accipiters characterized as long, slim hawks with comparatively short wings and are very differently shaped than the chunky, crow-sized Broad-winged Hawk. They also show much paler chests and much more heavily barred flight feathers than a Broad-winged Hawk does. In adult plumage, all accipiters have gray or gray-blue backs and wings, while the Broad-winged Hawk has a dark brown back and wings. Immature Broad-winged Hawks can be confused with immature accipiters, including Northern Goshawks, but are much chunkier with long, broad wings and equal width tail bands.

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The Broad-winged Hawk's rufous and brown coloration acts as camouflage within its usual wooded environment.

This species may lay larger clutches in seasons of greater prey abundance as was shown in one western New York State study.

HABITAT

The Broad-winged Hawk is a bird of deciduous or mixed forest edge. It occasionally frequents coniferous forests too. It will breed in both small woodlands of a few acres but seems to prefer much larger tracts of continuous forest. It has been found nesting in aspen groves (Alberta and Minnesota), oak-aspen stands (Minnesota), yellow birch (New York) and even pine plantations (New York). Important elements in the habitat include proximity to edge such as forest openings and woodland roads for foraging, and proximity to water such as marshes, streams, ponds, or lakes for breeding. Perches, such as trees and utility poles along forest edge, are also needed.

VOICE

The Broad-winged Hawk's most common vocalization is a two note whistle. The first note is short and slightly higher pitched than the longer, plaintive second note. It is commonly

transcribed as "Pee-w-e-e-e-e" or "Kill-e-e-e-e". The male has a slightly higher voice than the female. This call is heard when intruders approach the nest or when the birds circle over their territory.

A "whining" is given when the male brings food for the female. During copulation the male makes a wheezy two-toned whistle transcribed as "whee-ooou." Tiny nestlings peep and hungry fledglings give a piercing whistle somewhat similar to the adult "peewee" call.

FOODS

The Broad-winged Hawk eats small mammals, birds, reptiles, amphibians, occasionally fishes and many invertebrates. It consumes a wide variety of small mammals including squirrels, chipmunks, voles, red-backed voles, mice, jumping mice, rats, young hares, young rabbits, long-tailed weasels, moles, shrews, and bats. Birds taken include many species of flicker or jay-sized birds and smaller birds including Rose-breasted Grosbeak, Fox Sparrow, White-throated Sparrow, Ovenbird, and other warblers. The young of larger birds, like Ruffed Grouse, are also taken. Fledglings or nestlings of many small woodland birds are also taken. Other species include Pileated Woodpecker and Northern Saw-whet Owl. Reptiles include at least 11 species of snakes, four species of lizards and young Snapping Turtles. Amphibians include three species of frogs, a tree frog, and American toads. One unidentified fish was reported for one bird in Connecticut. Invertebrates include at least 30 species including cicadas, grasshoppers, locusts, crickets, dragonflies, moths larvae, caterpillars, centipedes, crayfish, fiddler crabs, and earthworms.

The Broad-winged Hawk takes advantage of regionally abundant prey, eating young Ruffed Grouse and young Snowshoe Hares in central Alberta where reptiles are scarce, and taking 29 young Snapping Turtles in Oklahoma. It is also an opportunist. One hawk was seen to strike a pole supporting a bluebird box. When the bluebird stuck its head outside the box, the hawk, perched atop the box, seized the bird and pulled it out.

PELLETS

There is no information available on the pellets of this species in North America.

NESTING

The Broad-winged Hawk typically nests in deciduous forest where the nest is generally placed in a main crotch of the trunk, generally in the lower third of the forest canopy. It may build its own nest or refurbish an old raptor, crow, or squirrel nest. If an old nest is used, at least two years elapse between the first nesting and the second. A typical nest constructed from scratch is small (smaller than both Red-shouldered and Cooper's Hawks) and loosely made of twigs and sticks. The inside is lined with bark and lichen. Sprigs of greenery are brought to the nest frequently, throughout the incubation and into the nestling stage. Construction, which can be intermittent, can take two to five weeks.

The clutch ranges from two to five eggs with an average of two or three. The egg is short elliptical in shape and varies in color with a background of white, cream, or pale bluish and variably heavy dots or patches of shades of brown. The egg averages 1.9 inches (48.9 millimeters) in length and 1.5 inches (39.3 millimeters) in width. Clutch-size increases from the southern to the northern parts of its range.

The female incubates 28 to 31 days while the male hunts. Upon hearing the approaching male's food transfer call, the female leaves the nest to join him. While she feeds off the nest, the male will briefly cover the eggs. After incubation the male may deliver food directly to the nest but only the female tears the prey apart and feeds the young. Extra food may be

cached. The young start to show emerging primaries and secondaries at nine to 12 days. The young begin to walk out onto nearby branches at 29 to 31 days. They begin sustained horizontal flight during their fifth or sixth week. At about six weeks the young begin flying toward approaching parents with food. Although they receive food from their parents until seven or eight weeks old, they start hunting independently almost as soon as they fledge and are capable of capturing prey at 54 days. The Broad-winged Hawk is single-brooded and it is not known if it will lay a replacement clutch.

CONSERVATION

Early in the twentieth century migrating flocks of Broad-winged Hawks were the traditional targets of hunters who killed the birds as vermin and in some cases as food. The toll from shooting was heavy, particularly in places like Hawk Mountain, Pennsylvania, where streams of migrant Broad-winged Hawks congregated. Hundreds were often shot in a day. Conservationists, like the late Maurice Broun who established Hawk Mountain as a refuge, helped turn public opinion around. Today Broad-winged Hawk populations appear large and stable, possibly because the species tolerates discontinuous woodland both on its breeding and wintering grounds. It also apparently has not suffered from pesticide contamination like many other birds of prey. A loose estimate of more than a million birds has been made for the total North American population.

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Broad-winged Hawk - dark

Buteo platypterus

GENERAL DESCRIPTION

The Broad-winged Hawk is one of very few raptors to be a true long distance migrant. Each fall, the Broad-winged Hawks that breed in the forests of Canada and the eastern United States migrate to their Central or South American wintering grounds, a distance of 3,500 to 4,500 miles (5,600 to 7,200 kilometers). Returning in the spring makes for a round trip of between 7,000 and 9,000 miles (11,200 and 14,400 kilometers) a year. Because the hawks are unable to glide over large bodies of water like the Gulf of Mexico, virtually all of North America's Broad-winged Hawks must pass through Panama, where in 1994, up to 1,400,000 individuals were estimated.

On its breeding grounds the Broad-winged Hawk is a quiet woodland hawk, one of the smallest North America buteos, usually identified by its pale underwings, rufous barred underparts and black and white banded tail.

SIZE

The Broad-winged Hawk is a small to medium-sized buteo, about the size of a crow. Male and female length and wingspan measurements overlap considerably. The average length is 15 inches (38 centimeters) and average wingspan is 34 inches (86 centimeters). Females are heavier with an average weight of 1.0 pound (440 grams) while males average 0.8 pounds (357 grams).

MORPHS

There is a very rare dark morph which occurs most frequently in west-central Alberta and northeastern British Columbia, in the extreme northwest portion of the Broad-winged Hawk's range in North America. Isolated records of dark-morph birds have also occurred throughout its eastern and southern range, but only during migration.

SPECIFIC DESCRIPTION

Adult Dark-morph - Perched

- dark brown body
- about the size of a crow
- folded tail shows one broad white band flanked by broad black bands

Immature Dark-morph - Perched

- dark body, sometimes with tawny rufous streaks on breast and belly
- about the size of a crow
- folded tail shows gray background with several dark bands
- subterminal band the widest

Adult Dark-morph - Flight

- crow-sized buteo
- all dark body
- two-toned underwing: pale flight feathers contrast with dark wing linings

- dark primary tips and dark trailing edge to underwing
- somewhat pointed wings with dark tips
- strongly banded black and white tail

Immature Dark-morph - Flight

- all dark body; may show faintly lighter streaks on chest
- two-toned underwing with dark wing linings and pale flight feathers
- tips of primaries and trailing edge of underwing are dark
- short broad tail with several dark bands

SIMILAR SPECIES

The Broad-winged Hawk is superficially similar to both the Sharp-shinned and the Cooper's Hawk, especially from the front. However, they are accipiters characterized as long, slim hawks with comparatively short wings and are very differently shaped than the chunky, crow-sized Broad-winged Hawk. They also show much paler chests and much more heavily barred flight feathers than a Broad-winged Hawk does. In adult plumage, all accipiters have gray or gray-blue backs and wings, while the Broad-winged Hawk has a dark brown back and wings. Immature Broad-winged Hawks can be confused with immature accipiters, including Northern Goshawks, but are much chunkier with long, broad wings and equal width tail bands.

Both a dark morph Gyrfalcon and a dark Peregrine Falcon (immature "Peale's" Peregrine) are about the same size but do not show the broad tail (narrow at the base and wider at the tip unless folded) of a Broad-winged Hawk. Both falcons have generally dark tails, possibly with one or two very thin bands as opposed to the banded tails of adult and immature Broad-wings.

The adult Broad-winged Hawk's tail bands of equal width eliminate confusion with other buteos including the dark-morph Ferruginous Hawk (unbanded all light tail), the dark morph adult "Harlan's" Hawk (a whitish tail marbled with dusk), the dark-morph immature Red-tailed Hawk (many narrow tail bands - subterminal band no wider than others), the dark morph Red-tailed Hawk (red tail), the immature dark-morph Rough-legged Hawk (very broad tail band) and the immature dark morph White-tailed Hawk (pale tail with many very narrow gray bands). The Broad-winged Hawk's generally light underwing with the dark edges, or the dark morph's two-toned underwing with dark edges is distinctive from the dark-morph Swainson's Hawk's underwing (no pale flight feathers and two-toned effect often reversed).

Species most similar to the Broad-winged Hawk are the Red-shouldered Hawk, the Gray Hawk, and the dark-morph Short-tailed Hawk. Compared to a light-morph Broad-winged Hawk, the Red-shouldered Hawk shows distinctive white crescents at the base of the primaries in flight and a red shoulder when seen from above. The immature Broad-winged Hawk can be hard to tell from an immature Red-shouldered Hawk. The immature Red-shouldered Hawk has tawny crescent wing panels, or "windows", and the upper tail surface is dark with light bands while the immature Broad-winged Hawk's is light with dark bands. The adult Gray Hawk has gray barred underparts and gray flecked wing linings, not the rufous barring of the Broad-winged Hawk's underparts and the brown flecked wing linings. The Gray Hawk also shows a white crescent at the base of the uppertail which the Broad-wing does not have. The immature Gray Hawk also shows a white crescent at the base of its uppertail surface. The dark morph adult Short-tailed Hawk is very similar to both the adult and the immature dark morph Broad-winged Hawk but shows secondaries (on the underwing) that have a dusky gray background, causing the white background of the primaries to stand out as an isolated white circle. The adult dark morph Broad-winged Hawk has dark tail bands of equal width. The Short-tailed Hawk shows one broad subterminal band

and two to three narrower bands. The immature dark Short-tailed Hawk has small white spots over its lower belly while the dark immature Broad-winged Hawk is generally dark below, perhaps showing a few very thin rufous streaks.

OTHER NAMES

The Broad-winged Hawk is also known as the Broadwing.

ETYMOLOGY

The scientific name *Buteo platypterus* is translated as "hawk or falcon" (*Buteo* - Latin) that has a "broad" (*platys* - Greek) "wing" (*pteron* - Greek).

MYTHOLOGY

There has been no mythology recorded for this species in North America.

RANGE

The Broad-winged Hawk is primarily a summer visitant, and breeder, in North America. It breeds in a narrow band from northeastern British Columbia, east through west-central Alberta, central Saskatchewan, southern Manitoba, southern Ontario, southern Quebec, New Brunswick, and Nova Scotia south through eastern Minnesota, central Iowa, eastern Kansas, eastern Oklahoma, and eastern Texas, east to northern Florida and the Atlantic coast. Some immatures winter irregularly and in small numbers along coastal Texas and the Gulf Coast to southern Florida.

The Broad-winged Hawk is highly migratory, wintering from Guatemala south through Central America to Peru and Brazil.

There are six recognized subspecies of this hawk, only one of which is found in North America, namely *Buteo platypterus platypterus*. The remaining five races occur in the Caribbean.

The Broad-winged Hawk is also resident on the Greater and Lesser Antilles, including Cuba, Puerto Rico, Antigua, Dominica, Martinique, St. Lucia, Barbados, St. Vincent, the Grenadines, Grenada, Tobago, and occasionally Trinidad.

MIGRATION

The Broad-winged Hawk is highly migratory. It winters in extreme southern Central America to southern Brazil. In eastern and central Canada, the Broad-winged Hawk arrives in April to May. The return flights take place in September and October, funneling through the Isthmus of Panama. Certain ridges, narrow water crossings, and other geographical features concentrate spectacular waves of migrants at points along their spring or fall routes, like Hawk Mountain in Pennsylvania, Hawk Ridge, Duluth in Minnesota, Whitefish Point in Michigan, Hawk Cliff in Ontario, Corpus Christi in Texas, Cape May Point in New Jersey, and Veracruz in Mexico.

The Broad-winged Hawk uses a specific migration "strategy". With widespread wings and tail it rides thermals to get aloft. Then with set wings and folded tail it glides in its direction of migration, pushed by the wind. Updrafts and favorable winds are associated with weather patterns that reoccur every few days. Weather typically occurs over a broad front, sending waves of migrating Broad-winged Hawks simultaneously over large areas. This type of soar-then-glide flight enables the hawks to make major sections of their journey with very little

flapping, and thus little energy expenditure.

The surface of a large water body absorbs heat and does not create thermals; thus Broad-winged hawks are unable to soar across large lakes or wide ocean crossings. The Great Lakes pose a formidable barrier, congregating Broad-winged Hawks at four narrow crossings. The general pattern of migration in eastern North America involves these four "lanes" of hawks diverging from the Great Lakes' crossings, plus a wide lane travelling the updrafts of the Appalachian ridges, and another between the Mississippi River and the eastern edge of the Great Plains. The inability to cross wide water also explains why Broad-winged Hawks fly down Central America and do not cross the Gulf of Mexico.

Broad-winged Hawks do not act as true flock members. Favorable air and weather conditions happen to concentrate birds in certain areas. Birds typically migrate at a maximum height of 1300 to 2000 yards (1209 to 1860 meters) elevation. Because they depend upon weather, flights do not occur every day. On a flight day the air warms and thermals become strong. However when conditions are unfavorable, birds will stay in the woods, sometimes hunting and occasionally continuing in low flight short distances in the general direction of migration .

BEHAVIOR

The Broad-winged Hawk has been described as "tame" though the word "quiet" better describes its lifestyle as an inconspicuous hunt-and-perch predator. Human interference during nest building can cause adults to abandon the nest. However, once the nest is established the female Broad-winged Hawk can be aggressive toward intruders, even striking them. On most occasions, the incubating bird quietly leaves the nest when approached and perches nearby or circles overhead.

The Broad-winged Hawk uses the "sit" or "perch" and wait method of hunting, perching on a utility pole, wire or tree along a forest edge such as a forest roadcut, the shore of a creek or lake, or the edge of a clearing. The bird sights its prey on the ground, pushes off from its perch, and, after an initial series of rapid wing beats, typically glides until impact with the prey. It may mantle (stand with wings spread) over the prey for several minutes looking around before "footing" its prey. It may consume the prey on the ground or, as is typical for adults, carry it to a perch before feeding. Less common hunting methods include perching close (or even standing on the shore) to an amphibian breeding pond and seizing frogs as they breed, or cruising through the forest generally below tree-top level in a search for slow moving prey. Insects are also taken from a perch and in flight.

The pair bond may be long-term, though more study is needed. The members of a pair likely separate after breeding and do not reunite until returning to the breeding area. In one study, a pair from the previous season reunited within 0.3 miles (0.5 kilometers) of their former nesting home range. Adults appear to return to the same territory yearly, though they will nest in different parts of it from one breeding season to the next. The territory should contain forest, open areas, and a waterbody or wetland. Home range and territory size are not known. The species is generally solitary until migration when it commonly associates in flocks.

Broad-winged Hawks wintering in extreme southern Florida were often noisily harassed by American Kestrels trying, usually unsuccessfully, to evict the hawk from the kestrel's territory. The Broad-winged Hawk will defend its breeding territories against Red-tailed Hawks, Red-shouldered Hawks, and Northern Harriers. Occasionally, it will nest peacefully in proximity with another hawk's nest such as the Sharp-shinned Hawk, Cooper's Hawk, and Red-tailed Hawk.

Pair-formation and courtship displays are poorly known and apparently do not last very long as this species usually begins nest building and egg laying soon after spring arrival. High-circling is an advertising display that begins upon arrival at the breeding area. It involves one or two birds calling and circling over the forest. One bird may sideslip or dive downward upon another bird and almost make contact. The "sky-dance" involves a bird ascending in widening circles, calling, and soaring until nearly out of sight, then descending in long sweeps and curves. Also, other displays such as "tumbling", (the undulating-flight when a bird flies high undulating and the wings are flapped stiffly), and the "pigeon-flight" (which is characterized by deep wing beats followed by a glide with wings upheld in a V) have been described by other authors. The most common courtship vocalization is the two-noted whistle.

The oldest known wild bird lived 14 years and four months. Nests often fail due to predation. Half the nest failures in one New York study were due to predation by Great Horned Owls. Young Broad-winged Hawks suffer a high mortality rate; the average life expectancy in one study of 37 records was only one year. Hazards during migration include water crossings. Small numbers are found on the Dry Tortugas [tiny islands 60 miles (96 kilometers) west of Key West, Florida], each spring and, particularly, fall. Although capable of flight, these birds usually fail to find thermals that they could soar back to the mainland. Birds wintering in extreme southern Florida suffer significant mortality from collisions with automobiles.

ADAPTATIONS

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PELLETS

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NESTING

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The clutch ranges from two to five eggs with an average of two or three. The egg is short elliptical in shape and varies in color with a background of white, cream, or pale bluish and variably heavy dots or patches of shades of brown. The egg averages 1.9 inches (48.9 millimeters) in length and 1.5 inches (39.3 millimeters) in width. Clutch-size increases from the southern to the northern parts of its range.

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CONSERVATION

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Short-tailed Hawk

Buteo brachyurus

GENERAL DESCRIPTION

The Short-tailed Hawk is a small, stocky hawk, with a short-tail and long rounded wings. It is resident in southern Florida, and from southern Mexico to South America. It is similar in size to the Broad-winged Hawk. The bird has an unusual method of flying when hunting where it "hangs" in mid air not flapping its wings. This is accomplished by riding upward directed air currents which are created along ridgetops of woodlands. Birds are the major prey item and are taken most often from tree tops. The species still occupies its historically described range despite changes to its preferred habitat; some observers feel numbers have declined. There are two morphs, a dark and a light color morph.

SIZE

A crow-sized hawk which displays reversed size dimorphism. Females are usually larger but sexes overlap in size and weight. For sexes combined it averages 16 inches (41 centimeters) long and has a wingspan that averages 37 inches (93 centimeters). The wing chord length averages 11.2 inches (28.4 centimeters) in males and 12.6 inches (32 centimeters) in females. Weights range between 12.75 and 18.25 ounces (365 to 520 grams).

MORPHS

There are two morphs, a light and a dark morph, in this species. The dorsal side is dark brown to black in both morphs, but the undersides differ. The light phase shows white from chin to tail while the dark phase is dark brown from chin to tail. In Florida the dark phase is more widespread than the light phase.

SPECIFIC DESCRIPTION

Adult (Light-morph) - Perched

- smaller hawk with white face and dark cheeks
- white forehead; outer half of lores white
- dark brown back
- all white from chin to tail; underparts unmarked
- yellow legs
- dark sub-terminal band on tail
- wingtips reach tip of tail
- beige eyes

Immature (Light-morph) - Perched

- brown back
- white forehead; outer half of lores white
- buffy plumage underneath
- lightly streaked belly band
- tail bands of equal width
- buffy white eyebrow
- pale streaks in cheeks; not solid dark
- wing tips reach tip of tail

Adult (Light-morph) - Flight

- long wings, short tail
- predominantly white underneath
- wide dark subterminal band
- white oval "window" at base of outer primary feathers
- white face

Immature (Light-morph) - Flight

- similar to adult but with some flecking on belly and flanks
- tail bands of equal width
- white oval "window" at base of outer primary feathers
- white face

SIMILAR SPECIES

Light-morph Short-tailed Hawks can be confused with immature Broad-winged Hawks. The Broad-winged Hawk has shorter wings and a substantially longer tail. The species can also be mistaken for a light-morph Swainson's Hawk and Red-shouldered Hawk. Dark-morph Short-tailed Hawks could be confused with dark-morph Red-tailed and Swainson's hawks.

OTHER NAMES

Other names used locally include "Little Black Hawk" and "Short-tailed Buzzard."

ETYMOLOGY

From the Latin Buteo means "a type of hawk or falcon" and from the Greek bracy comes "short" and urus comes "tail." Hence, "hawk with a short tail."

MYTHOLOGY

None is known for North America.

RANGE

The Short-tailed Hawk is found only in Florida within the United States. In summer, it occupies most of peninsular Florida and in winter moves south to the southern third of the peninsula and the Florida Keys.

This species also occurs in Mexico and South America.

Of the three recognized subspecies only *Buteo brachyurus fuliginosus* occurs in North America.

BEHAVIOR

The Short-tailed Hawk is unique within the genus *Buteo* in that its prey selection is primarily birds. Most buteos, with their broad wings, typically forage on small mammals, such as rodents and rabbits, as their aerodynamic design is not suited for the aerial pursuit of birds as is typical of falcons and accipiters. Although the Short-tailed Hawk has the overall body design of a *Buteo*, it has a behavioral adaptation unique to itself. By riding wind currents, which are deflected upwards at the interface between open areas and woodland, it

is able to hang motionless in the air waiting for a bird to alight atop one of the trees. When this happens, the hawk will dive on the prey. If it misses, it will not pursue, probably because the buteo body design is not suited to give chase in woodlands like the accipiter.

The Short-tailed Hawk flies actively with strong, stiff wingbeats. It soars with wings held in a slight dihedral and glides on flat wings. In the "hanging" position the hawks' head is pointed down, the wings appear stiff and flat, and the tips of the primary feathers are upturned.

The selection factor for the light and dark phases is not understood. In terms of sexual selection, there does not appear to be any assortative mating based on color of the bird, with numerous observations of like-morph and between-morph pairing. There is some evidence which might suggest that there is a heritable trait related to sex which determines color phase. Of 12 specimens known to be male, all were dark and of 11 known to be female, eight were light. More observations are needed to confirm this trend.

This species is present year-round within Florida, although there is movement for at least a portion of the population off their breeding grounds to nonbreeding grounds. Fall migration occurs in mid October and involves populations from central to north peninsula. Correspondingly, the number of Short-tailed Hawks increases in southern Florida in winter. Spring movements back to breeding grounds occurs in February and March.

There is little information pertaining to the breeding behavior of this species. As in other hawks, there is an elaborate flight pattern often called the "sky dance" where both members of the pair perform aerial acrobatics which signify ownership of a territory. The male in this species has been observed flying in an undulating fashion suggesting a roller coaster. This flight is interspersed with steep dives of rolling spirals accomplished by opening and closing the wings. The male has also been observed carrying nesting material or prey which has been interpreted as symbolic for the female, because copulation occurred after the male landed beside the female. The male calls out during copulation.

ADAPTATIONS

The Short-tailed Hawk has two adaptations unique to its buteo body design which probably allows it greater advantage for capturing birds. The first is that it is small, only about crow size. A small body size allows greater mobility and maneuverability when chasing agile birds. The other adaptation is a relatively large foot which, when one considers that it makes only one attempt on any one prey item, is probably beneficial to have as great as possible surface area to increase the probability of successful capture.

HABITAT

The Short-tailed Hawk inhabits mixed mature woodlands and savanna-type environments. Woodland type is usually Cypress but can also be mangroves, pines, and riparian hardwoods. Preferred nesting areas are where mature woodlands border lakes, swamps, and rivers and the overall landscape contains 40 to 80 percent open areas such as savannas, prairies, pastures, and marshlands.

VOICE

Most of the information on the voice of this hawk has been obtained in the vicinity of the nest site. As is common with most raptors, the Short-tailed Hawk is silent outside of the breeding season. Both the male and female respond to intruders with a squealing "keeeea" which drops off at the end. When a prey delivery is made to the female the male elicits a brief "keee." As the male approaches the nest the female calls "kleee." At times during

incubation the female will make a short circling soar over the nest and will cry "kee", "keee-e" or "kleee-e."

FOODS

Small to medium-sized birds are the primary prey for this species. In one study of prey use at seven nests, 66 birds were recorded while observations of hawks hunting detected 29 birds taken versus three rodents. The two most common birds were Eastern Meadowlark and the Red-winged Blackbird. Other prey items observed in their diet have included, lizards, snakes, frogs, and insects.

PELLETS

There are no descriptions or details available for North America.

NESTING

The preferred nesting habitat is mature woodlands adjacent to lakes, marshes, or rivers within a matrix of an open landscape. The nest is built in forks next to the trunk of a variety of trees. Nests may range between 44 and 65 feet (13.6 and 20.2 meters) from the ground and are usually found near the crown of the tree. The nest is a bulky affair and is comprised of twigs, leaves, moss, lichens, and fresh green sprigs. Sometimes they will use old abandoned heron nests.

Most eggs are laid in mid March to mid April. Usually the full clutch is two eggs but nests with one and three eggs have been found. The egg is short elliptical in shape. The ground color is dull white or pale bluish and usually unmarked although a spattering of brownish spots can be found on the shell. The eggs average 2.1 inches (52.5 millimeters) in length and 1.7 inches (42.4 millimeters) in width.

Incubation is about 34 days. Age at first flight is unknown.

CONSERVATION

An estimation of the population in Florida suggested only 500 birds in total. This is a small number and given the restricted range the population may be threatened. There is no documented evidence of this species being impacted by pesticides which is strange considering its prey base and its preference to forage in habitats associated with agriculture. The most threatening impact to this species is alteration of nesting habitat. Despite these factors there is no hard evidence to suggest that the bird has declined from its historic numbers. It may be that it always nested in low densities.

REFERENCES

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Short-tailed Hawk - light

Buteo brachyurus

GENERAL DESCRIPTION

The Short-tailed Hawk is a small, stocky hawk, with a short-tail and long rounded wings. It is resident in southern Florida, and from southern Mexico to South America. It is similar in size to the Broad-winged Hawk. The bird has an unusual method of flying when hunting where it "hangs" in mid air not flapping its wings. This is accomplished by riding upward directed air currents which are created along ridgetops of woodlands. Birds are the major prey item and are taken most often from tree tops. The species still occupies its historically described range despite changes to its preferred habitat; some observers feel numbers have declined. There are two morphs, a dark and a light color morph.

SIZE

A crow-sized hawk which displays reversed size dimorphism. Females are usually larger but sexes overlap in size and weight. For sexes combined it averages 16 inches (41 centimeters) long and has a wingspan that averages 37 inches (93 centimeters). The wing chord length averages 11.2 inches (28.4 centimeters) in males and 12.6 inches (32 centimeters) in females. Weights range between 12.75 and 18.25 ounces (365 to 520 grams).

MORPHS

There are two morphs, a light and a dark morph, in this species. The dorsal side is dark brown to black in both morphs, but the undersides differ. The light phase shows white from chin to tail while the dark phase is dark brown from chin to tail. In Florida the dark phase is more widespread than the light phase.

SPECIFIC DESCRIPTION

Adult (Light-morph) - Perched

- smaller hawk with white face and dark cheeks
- white forehead; outer half of lores white
- dark brown back
- all white from chin to tail; underparts unmarked
- yellow legs
- dark sub-terminal band on tail
- wingtips reach tip of tail
- beige eyes

Immature (Light-morph) - Perched

- brown back
- white forehead; outer half of lores white
- buffy plumage underneath
- lightly streaked belly band
- tail bands of equal width
- buffy white eyebrow
- pale streaks in cheeks; not solid dark
- wing tips reach tip of tail

Adult (Light-morph) - Flight

- long wings, short tail
- predominantly white underneath
- wide dark subterminal band
- white oval "window" at base of outer primary feathers
- white face

Immature (Light-morph) - Flight

- similar to adult but with some flecking on belly and flanks
- tail bands of equal width
- white oval "window" at base of outer primary feathers
- white face

SIMILAR SPECIES

Light-morph Short-tailed Hawks can be confused with immature Broad-winged Hawks. The Broad-winged Hawk has shorter wings and a substantially longer tail. The species can also be mistaken for a light-morph Swainson's Hawk and Red-shouldered Hawk. Dark-morph Short-tailed Hawks could be confused with dark-morph Red-tailed and Swainson's hawks.

OTHER NAMES

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From the Latin Buteo means "a type of hawk or falcon" and from the Greek bracy comes "short" and urus comes "tail." Hence, "hawk with a short tail."

MYTHOLOGY

None is known for North America.

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This species also occurs in Mexico and South America.

Of the three recognized subspecies only *Buteo brachyurus fuliginosus* occurs in North America.

BEHAVIOR

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The Short-tailed Hawk flies actively with strong, stiff wingbeats. It soars with wings held in a slight dihedral and glides on flat wings. In the "hanging" position the hawks' head is pointed down, the wings appear stiff and flat, and the tips of the primary feathers are upturned.

The selection factor for the light and dark phases is not understood. In terms of sexual selection, there does not appear to be any assortative mating based on color of the bird, with numerous observations of like-morph and between-morph pairing. There is some evidence which might suggest that there is a heritable trait related to sex which determines color phase. Of 12 specimens known to be male, all were dark and of 11 known to be female, eight were light. More observations are needed to confirm this trend.

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There is little information pertaining to the breeding behavior of this species. As in other hawks, there is an elaborate flight pattern often called the "sky dance" where both members of the pair perform aerial acrobatics which signify ownership of a territory. The male in this species has been observed flying in an undulating fashion suggesting a roller coaster. This flight is interspersed with steep dives of rolling spirals accomplished by opening and closing the wings. The male has also been observed carrying nesting material or prey which has been interpreted as symbolic for the female, because copulation occurred after the male landed beside the female. The male calls out during copulation.

ADAPTATIONS

The Short-tailed Hawk has two adaptations unique to its buteo body design which probably allows it greater advantage for capturing birds. The first is that it is small, only about crow size. A small body size allows greater mobility and maneuverability when chasing agile birds. The other adaptation is a relatively large foot which, when one considers that it makes only one attempt on any one prey item, is probably beneficial to have as great as possible surface area to increase the probability of successful capture.

HABITAT

The Short-tailed Hawk inhabits mixed mature woodlands and savanna-type environments. Woodland type is usually Cypress but can also be mangroves, pines, and riparian hardwoods. Preferred nesting areas are where mature woodlands border lakes, swamps, and rivers and the overall landscape contains 40 to 80 percent open areas such as savannas, prairies, pastures, and marshlands.

VOICE

Most of the information on the voice of this hawk has been obtained in the vicinity of the nest site. As is common with most raptors, the Short-tailed Hawk is silent outside of the breeding season. Both the male and female respond to intruders with a squealing "keeeea" which drops off at the end. When a prey delivery is made to the female the male elicits a brief "keee." As the male approaches the nest the female calls "kleee." At times during

incubation the female will make a short circling soar over the nest and will cry "kee", "keee-e" or "kleee-e."

FOODS

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PELLETS

There are no descriptions or details available for North America.

NESTING

The preferred nesting habitat is mature woodlands adjacent to lakes, marshes, or rivers within a matrix of an open landscape. The nest is built in forks next to the trunk of a variety of trees. Nests may range between 44 and 65 feet (13.6 and 20.2 meters) from the ground and are usually found near the crown of the tree. The nest is a bulky affair and is comprised of twigs, leaves, moss, lichens, and fresh green sprigs. Sometimes they will use old abandoned heron nests.

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Incubation is about 34 days. Age at first flight is unknown.

CONSERVATION

An estimation of the population in Florida suggested only 500 birds in total. This is a small number and given the restricted range the population may be threatened. There is no documented evidence of this species being impacted by pesticides which is strange considering its prey base and its preference to forage in habitats associated with agriculture. The most threatening impact to this species is alteration of nesting habitat. Despite these factors there is no hard evidence to suggest that the bird has declined from its historic numbers. It may be that it always nested in low densities.

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Short-tailed Hawk - dark

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MORPHS

There are two morphs, a light and a dark morph, in this species. The dorsal side is dark brown to black in both morphs, but the undersides differ. The light phase shows white from chin to tail while the dark phase is dark brown from chin to tail. In Florida the dark phase is more widespread than the light phase.

SPECIFIC DESCRIPTION

Adult (Dark-morph) - Perched

- dark brown from chin to tail
- white forehead; outer half of lores white
- wingtips reach tip of tail
- dark brown eyes
- wide dark subterminal tail band

Immature (Dark-morph) - Perched

- primarily dark brown, with white flecking, only on belly
- all-dark bib on breast
- white forehead; outer half of lores white
- wing tips reach tip of tail

Adult (Dark-morph) - Flight

- all-dark body
- white oval area on outer primaries
- dark subterminal band on tail
- white face

Immature (Dark-morph) - Flight

- wing lining is dark with white flecking contrasting with white of primaries and secondaries
- tail bands of equal width
- white face
- dark bib on breast
- white mottled, or streaked, belly

SIMILAR SPECIES

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Swainson's Hawk

Buteo swainsoni

GENERAL DESCRIPTION

The Swainson's Hawk is slightly smaller than the average Red-tailed Hawk and generally has slimmer wings than many other buteos. In flight, the Swainson's Hawk shows a distinctive soaring style, holding its wings above the horizon in a shallow V and teetering in flight a little like a Turkey Vulture. The long, slim, pointed wings are diagnostic when they show the two-toned effect of pale wing linings and dark flight feathers. No other buteo shows such consistently dark flight feathers. The White-tailed and Swainson's hawk are the only two North American buteos to have a subadult plumage.

The Swainson's Hawk is a common bird of the western plains breeding in shelter belts, riparian growth, and in isolated prairie trees. It is also common along the edge of the plains where it meets the aspen parklands. It is one of the most highly migratory of all North American hawks, leaving its breeding grounds to winter in southern South America. In a life span of seven or eight years, a Swainson's Hawk might cover as many as 150,000 miles (24,000 kilometers) during its migrations north and south.

SIZE

The Swainson's Hawk is a large buteo. Females are larger than males but measurements overlap considerably. Lengths average 20 to 22 inches (51 to 56 centimeters) for females and 19 to 20 inches (48 to 51 centimeters) for males. Wingspans are up to 54 inches (137 centimeters) for females and up to 49 inches (124 centimeters) for males. Weights average 2.4 pounds (1,100 grams) for females and 1.8 pounds (800 grams) for males.

MORPHS

The Swainson's Hawk displays a wide variety of colors, from completely black to white underneath. It also exhibits all degrees of intermediate colors between light birds and dark birds. Although commonly referred to as color morphs, they are really individual plumage variations, referred to here as "light-morph", "rufous-morph", and "dark-morph." This hawk is the only North American buteo with a true full continuum of plumages.

SPECIFIC DESCRIPTION

Adult Light-morph - Perched

- brown head, white throat patch, and yellow cere
- variably sized pale patch on forehead just above beak; outerl ores white
- rufous to dark brown bib or chest band
- white, creamy, or buffy belly sometimes barred, especially on flanks
- brown back and upper wing surfaces
- gray-brown tail with about six narrow dark bands and one wider subterminal band
- wing tips reach tip of tail or beyond

Immature Light-morph - Perched

- white to buffy forehead, light eyebrow line, yellow cere
- dark mustache leading to dark mass of streaks on sides of chest
- upperparts dark brown with many light feather edges

- underparts white, cream or buff with a variety of spotting and infrequent streaking, especially on flanks
- wing tips just short of, or just reach, tip of tail

Adult Light-morph - Flight

- dark chest band and pale underparts
- white chin often visible
- two-toned wings - pale wing linings and dark flight feathers
- wings are long and pointed and held in a dihedral when soaring
- gray tail with about six narrow dark bands and one wider subterminal band
- narrow pale crescent on the rump

Immature Light-morph - Flight

- lightly spotted or streaked underparts
- wings are long and pointed and held in a dihedral when soaring
- two-toned wings, but paler flight feathers than adults
- pale white, cream or buff underwing linings contrast with dark flight feathers
- gray tail with about six narrow dark bands and one wider subterminal band
- pale thin crescent on rump.

SIMILAR SPECIES

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A dark immature Peregrine Falcon shows gray spots and bars across its underwings. A dark Gyrfalcon shows spotted underwing linings and paler flight feathers than wing linings. A perched Prairie Falcon could be mistaken for an immature light-morph Swainson's Hawk but

has a large black eye, a dark patch behind the eye and its wing tips do not reach the tip of its tail.

OTHER NAMES

The Swainson's Hawk has also been known as "Black Hawk", "Brown Hawk", and "Grasshopper Hawk."

ETYMOLOGY

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No mythology has been found for this species in North America.

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southwards toward Central America where virtually the entire population funnels through the Isthmus of Panama. Concentrations over locations like Ancon Hill, Balboa, and Panama are spectacular.

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The Swainson's Hawk, Red-tailed Hawk, and Ferruginous Hawk compete for territory, and defend territories against each other. In many parts of the plains these three species nest in the same general area and exploit much the same prey base. Although diets overlap greatly, habitats may not overlap as much. In Oregon, the Swainson's Hawk selects nesting trees having a different configuration than those used by Red-tailed or Ferruginous Hawks. In southern Alberta, different nesting habitats help reduce food competition, with the Swainson's Hawk favoring areas with scattered trees or riparian borders, while Red-tailed Hawks nest in stands of tall trees, and the Ferruginous Hawk nests on the open plains. Reduced reproductive success may result from the Swainson's Hawk's nesting proximity to these two other buteos. The Swainson's Hawk is generally tolerant of people. The bird is attracted to haying, mowing, and ploughing operations. House Sparrows, European Starlings, and other small birds may nest in, or near a Swainson's Hawk's nest.

The courtship displays of the Swainson's Hawk are poorly known. One activity involves circling and diving above a potential nest site. The underwings and rump are flashed and the birds call. The display may end with one bird diving to land on the edge of the nest. Copulation occurs mainly in the morning and evening on the dead limbs of trees. The female may assume the receptive position without a prior display. During treading one of the birds calls.

The oldest wild Swainson's Hawk on record is 15 years 11 months. Swainson's Hawks die because of collisions with traffic, illegal shooting, electrocution, and even during severe prairie weather such as hailstorms. Wind storms and hail caused 30 percent nest failure in one study. When sharing a grove with nesting Great Horned Owls, hawks suffer much egg loss due to owl predation. The species also suffers from frequent, unexplained egg infertility.

ADAPTATIONS

Swainson's Hawk nestlings are exposed to hours of heat and parching sun each day and yet are unable to drink. They must obtain the moisture they need from the prey that their parents bring to the nest. This may be why adult Swainson's Hawks switch from insect to vertebrate prey for their young. Small mammals, such as young ground squirrels and young cottontails, form the bulk of the nestlings' diet.

The Swainson's Hawk has long, narrow wings for a buteo. Long wings may be an adaptation for long distance migration since a rough correlation exists between wing length and length of migration in several bird groups.

HABITAT

The Swainson's Hawk inhabits open and semi-open country in both its breeding and wintering ranges. In North America, it is found in deserts in the southwestern United States, grasslands and prairies of the intermountain states and provinces, and the grasslands of the Great Plains. The species requires trees for nesting and is found around shelter belts, abandoned farmyards, aspen grove edges, and riparian tree lines in more open country than Red-tailed Hawks but more treed country than Ferruginous Hawks, although there is habitat overlap between these three species. It favors wild prairie, hayfields, and pastures over wheat fields and alfalfa fields which may offer its prey too much cover. It requires elevated perches for hunting and a supply of small mammals such as young ground squirrels as prey for its nestlings. The breeding distribution of the Swainson's Hawk is tied very closely to the distribution of various small mammals for this reason. In Saskatchewan, for example, the distribution of Richardson's ground squirrel and the Swainson's Hawk are precisely the same.

The wintering grounds are the open pampas of southern South America where immatures nomadically follow hordes of migratory dragonflies

VOICE

Outside the breeding season, the Swainson's Hawk is a rather silent species. During summer the most common vocalization is a shrill, aggravated-sounding "kearrrrrr", weaker than the similar call of a Red-tailed Hawk. The voice of the females is lower pitched than the males. This call is given when people approach the nest and in other aggressive encounters. It may be followed by a series of whistled "tsip tsip tsip ..." Various other plaintive whistles have been reported as given by hungry or "lonely" young birds.

PELLETS

Although this species forms pellets, dimensions and a description of their appearance is not available. In Argentina, pellets of immatures following flocks of migratory dragonflies were made up of various parts of dragonfly exoskeletons.

FOODS

The Swainson's Hawk may be largely insectivorous except when nesting. Insect prey commonly taken includes grasshoppers, crickets, and locusts. Pairs bring vertebrate prey to their nestlings, relying heavily upon small mammals such as young ground squirrels (Saskatchewan) and young cottontails (southeastern New Mexico), and pocket gophers, mice, young jack rabbits, and, at least locally, small birds and other vertebrates including reptiles and amphibians. Birds taken include large birds such as Mallards, and Sage Grouse which may have been injured initially. Other unusual bird species include American Kestrel, and young Short-eared Owls. More typical in size are young Lark Buntings taken at their fledging time (Colorado). Reptiles, which can comprise large parts of a diet, include snakes such as racers, gopher snakes and striped whipsnakes, and lizards. Amphibians taken include tiger salamanders and toads. The Swainson's Hawk is an opportunistic feeder which responds quickly to local concentrations of food. Its habit of gorging on outbreaks of crickets and grasshoppers has earned it the popular name "Grasshopper Hawk".

In Argentina, flocks of immature Swainson's Hawks feed on flocks of the migratory dragonfly *Aeshna bonariensis*, nomadically following the hordes of insects and feeding mostly on the wing. Local outbreaks of locusts may also be exploited for food by one or more age-classes of birds. The immatures wintering in southern Florida apparently feed upon either insects, mice, or both, when turned up from field ploughing. They move from one freshly ploughed field to the next.

There is also some evidence that road-killed birds and animals are also consumed both on the wintering grounds and on the breeding grounds. The species commonly follows tractors and other agricultural equipment during haying or ploughing, where rodents are exposed for the hawks to capture, or insects are uncovered after crop cutting. The Swainson's Hawk is also attracted to hunt the edges of prairie wildfires.

NESTING

Swainson's Hawks appear to have a strong sense of nest site fidelity. The species is at least single-brood monogamous, with several reports of relatively long-term mate fidelity over years; an unusual occurrence in a long distance migrant. New nests may be constructed old nests refurbished, or the nests of other species, including those of Common Raven, Black-billed Magpie, and American Crow, refurbished. In one study, 50 percent of pairs built new nests each year. Construction can begin seven to 15 days after arrival and may take two weeks. In one study, males brought and arranged most nesting materials.

The Swainson's Hawk typically nests in isolated prairie trees or bushes, shelterbelts, riparian groves, or around abandoned homesteads. Occasionally, a pair will nest on the ground or on a bank or ledge. Nest trees and bushes include ponderosa pine, Douglas-fir, spruce, cottonwood, domestic poplar, aspen, elm, mesquite, willow, saguaro cactus, and soap tree yuccas. Nests are located from nine to 15 feet (2.8 to 4.7 meters) above the ground, often in the shaded canopy but near the top of the tree. Nests are flimsy structures, usually smaller than the nests of the Red-tailed Hawk, and often blow down after nesting season. Exterior diameters average about two feet (0.6 meters); nest height about one foot (0.3 meters); bowl diameter up to 8 inches (20.3 centimeters); and bowl depth about 2.5 inches (6.3 centimeters). The cup is lined with fine twigs, bark, forbs and sometimes dry dung. Green sprigs are added, particularly during the earlier stages of nesting.

Clutch size ranges from one to four eggs, but averages two to three eggs. Each egg is short elliptical or elliptical in shape and is, on average, 2.24 inches (57 millimeters) long and 1.73 inches (44 millimeters) wide. The egg is smooth with fine granulation's and the ground color is white, often tinted bluish or greenish. During incubation the shell color quickly wears to dull white. Some eggs are plain; others are lightly marked with spots and blotches of light brown. The incubation period is 34 to 35 days, with the female incubating while the male brings food. Young are fed small, mainly young mammals. Flight feathers begin to emerge on the young at nine to 11 days. High nestling mortality often occurs when the young are 15 to 30 days old and may be a function of fratricide. The young begin to leave the nest for surrounding branches at 33 to 37 days, fledging at about 38 to 46 days. The fledged young are dependent upon their parents for four to 4.5 weeks. This species has one brood a year and apparently does not lay replacement clutches.

CONSERVATION

The Swainson's Hawk has suffered population declines since the first half of the century and was Blue-Listed in the United States from 1972 to 1982. It has since been placed on the National Audubon's List of Special Concern in 1986. It is now listed by the United States Fish and Wildlife Service as a Category 3C candidate. It should be noted that the Swainson's Hawk was removed from the active Federal list because it was found to be more abundant than previously thought. The Swainson's Hawk has adapted well to grazing and pastureland and seems to be holding its own over much of its breeding range, from northern Mexico to the southern parts of the Prairie provinces. However, far western populations, like that of Oregon, and southern California, have drastically declined, often due to habitat loss or incompatible agricultural practices. A possible reason for declines in parts of its range may be agriculturally motivated reductions in populations of both ground squirrels and grasshoppers; major seasonal foods .

Although often nesting close to human activity, some Swainson's Hawks are very easily disturbed at the nest and often desert, especially early in the season. The bird is often quite tame and remains an easy target for potshooters travelling isolated prairie roads. The species may also be affected in ways yet to be understood, by some pesticides and herbicides, including those used on its wintering grounds.

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Annual Meeting of the Raptor Research Foundation, October 28-31, Boise, Idaho.

Swainson's Hawk - light

Buteo swainsoni

GENERAL DESCRIPTION

The Swainson's Hawk is slightly smaller than the average Red-tailed Hawk and generally has slimmer wings than many other buteos. In flight, the Swainson's Hawk shows a distinctive soaring style, holding its wings above the horizon in a shallow V and teetering in flight a little like a Turkey Vulture. The long, slim, pointed wings are diagnostic when they show the two-toned effect of pale wing linings and dark flight feathers. No other buteo shows such consistently dark flight feathers. The White-tailed and Swainson's hawk are the only two North American buteos to have a subadult plumage.

The Swainson's Hawk is a common bird of the western plains breeding in shelter belts, riparian growth, and in isolated prairie trees. It is also common along the edge of the plains where it meets the aspen parklands. It is one of the most highly migratory of all North American hawks, leaving its breeding grounds to winter in southern South America. In a life span of seven or eight years, a Swainson's Hawk might cover as many as 150,000 miles (24,000 kilometers) during its migrations north and south.

SIZE

The Swainson's Hawk is a large buteo. Females are larger than males but measurements overlap considerably. Lengths average 20 to 22 inches (51 to 56 centimeters) for females and 19 to 20 inches (48 to 51 centimeters) for males. Wingspans are up to 54 inches (137 centimeters) for females and up to 49 inches (124 centimeters) for males. Weights average 2.4 pounds (1,100 grams) for females and 1.8 pounds (800 grams) for males.

MORPHS

The Swainson's Hawk displays a wide variety of colors, from completely black to white underneath. It also exhibits all degrees of intermediate colors between light birds and dark birds. Although commonly referred to as color morphs, they are really individual plumage variations, referred to here as "light-morph", "rufous-morph", and "dark-morph." This hawk is the only North American buteo with a true full continuum of plumages.

SPECIFIC DESCRIPTION

Adult Light-morph - Perched

- brown head, white throat patch, and yellow cere
- variably sized pale patch on forehead just above beak; outerl ores white
- rufous to dark brown bib or chest band
- white, creamy, or buffy belly sometimes barred, especially on flanks
- brown back and upper wing surfaces
- gray-brown tail with about six narrow dark bands and one wider subterminal band
- wing tips reach tip of tail or beyond

Immature Light-morph - Perched

- white to buffy forehead, light eyebrow line, yellow cere
- dark mustache leading to dark mass of streaks on sides of chest
- upperparts dark brown with many light feather edges

- underparts white, cream or buff with a variety of spotting and infrequent streaking, especially on flanks
- wing tips just short of, or just reach, tip of tail

Adult Light-morph - Flight

- dark chest band and pale underparts
- white chin often visible
- two-toned wings - pale wing linings and dark flight feathers
- wings are long and pointed and held in a dihedral when soaring
- gray tail with about six narrow dark bands and one wider subterminal band
- narrow pale crescent on the rump

Immature Light-morph - Flight

- lightly spotted or streaked underparts
- wings are long and pointed and held in a dihedral when soaring
- two-toned wings, but paler flight feathers than adults
- pale white, cream or buff underwing linings contrast with dark flight feathers
- gray tail with about six narrow dark bands and one wider subterminal band
- pale thin crescent on rump.

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ADAPTATIONS

Swainson's Hawk nestlings are exposed to hours of heat and parching sun each day and yet are unable to drink. They must obtain the moisture they need from the prey that their parents bring to the nest. This may be why adult Swainson's Hawks switch from insect to vertebrate prey for their young. Small mammals, such as young ground squirrels and young cottontails, form the bulk of the nestlings' diet.

The Swainson's Hawk has long, narrow wings for a buteo. Long wings may be an adaptation for long distance migration since a rough correlation exists between wing length and length of migration in several bird groups.

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The Swainson's Hawk inhabits open and semi-open country in both its breeding and wintering ranges. In North America, it is found in deserts in the southwestern United States, grasslands and prairies of the intermountain states and provinces, and the grasslands of the Great Plains. The species requires trees for nesting and is found around shelter belts, abandoned farmyards, aspen grove edges, and riparian tree lines in more open country than Red-tailed Hawks but more treed country than Ferruginous Hawks, although there is habitat overlap between these three species. It favors wild prairie, hayfields, and pastures over wheat fields and alfalfa fields which may offer its prey too much cover. It requires elevated perches for hunting and a supply of small mammals such as young ground squirrels as prey for its nestlings. The breeding distribution of the Swainson's Hawk is tied very closely to the distribution of various small mammals for this reason. In Saskatchewan, for example, the distribution of Richardson's ground squirrel and the Swainson's Hawk are precisely the same.

The wintering grounds are the open pampas of southern South America where immatures nomadically follow hordes of migratory dragonflies

VOICE

Outside the breeding season, the Swainson's Hawk is a rather silent species. During summer the most common vocalization is a shrill, aggravated-sounding "kearrrrrr", weaker than the similar call of a Red-tailed Hawk. The voice of the females is lower pitched than the males. This call is given when people approach the nest and in other aggressive encounters. It may be followed by a series of whistled "tsip tsip tsip ..." Various other plaintive whistles have been reported as given by hungry or "lonely" young birds.

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Although this species forms pellets, dimensions and a description of their appearance is not available. In Argentina, pellets of immatures following flocks of migratory dragonflies were made up of various parts of dragonfly exoskeletons.

FOODS

The Swainson's Hawk may be largely insectivorous except when nesting. Insect prey commonly taken includes grasshoppers, crickets, and locusts. Pairs bring vertebrate prey to their nestlings, relying heavily upon small mammals such as young ground squirrels (Saskatchewan) and young cottontails (southeastern New Mexico), and pocket gophers, mice, young jack rabbits, and, at least locally, small birds and other vertebrates including reptiles and amphibians. Birds taken include large birds such as Mallards, and Sage Grouse which may have been injured initially. Other unusual bird species include American Kestrel, and young Short-eared Owls. More typical in size are young Lark Buntings taken at their fledging time (Colorado). Reptiles, which can comprise large parts of a diet, include snakes such as racers, gopher snakes and striped whipsnakes, and lizards. Amphibians taken include tiger salamanders and toads. The Swainson's Hawk is an opportunistic feeder which responds quickly to local concentrations of food. Its habit of gorging on outbreaks of crickets and grasshoppers has earned it the popular name "Grasshopper Hawk".

In Argentina, flocks of immature Swainson's Hawks feed on flocks of the migratory dragonfly *Aeshna bonariensis*, nomadically following the hordes of insects and feeding mostly on the wing. Local outbreaks of locusts may also be exploited for food by one or more age-classes of birds. The immatures wintering in southern Florida apparently feed upon either insects, mice, or both, when turned up from field ploughing. They move from one freshly ploughed field to the next.

There is also some evidence that road-killed birds and animals are also consumed both on the wintering grounds and on the breeding grounds. The species commonly follows tractors and other agricultural equipment during haying or ploughing, where rodents are exposed for the hawks to capture, or insects are uncovered after crop cutting. The Swainson's Hawk is also attracted to hunt the edges of prairie wildfires.

NESTING

Swainson's Hawks appear to have a strong sense of nest site fidelity. The species is at least single-brood monogamous, with several reports of relatively long-term mate fidelity over years; an unusual occurrence in a long distance migrant. New nests may be constructed old nests refurbished, or the nests of other species, including those of Common Raven, Black-billed Magpie, and American Crow, refurbished. In one study, 50 percent of pairs built new nests each year. Construction can begin seven to 15 days after arrival and may take two weeks. In one study, males brought and arranged most nesting materials.

The Swainson's Hawk typically nests in isolated prairie trees or bushes, shelterbelts, riparian groves, or around abandoned homesteads. Occasionally, a pair will nest on the ground or on a bank or ledge. Nest trees and bushes include ponderosa pine, Douglas-fir, spruce, cottonwood, domestic poplar, aspen, elm, mesquite, willow, saguaro cactus, and soap tree yuccas. Nests are located from nine to 15 feet (2.8 to 4.7 meters) above the ground, often in the shaded canopy but near the top of the tree. Nests are flimsy structures, usually smaller than the nests of the Red-tailed Hawk, and often blow down after nesting season. Exterior diameters average about two feet (0.6 meters); nest height about one foot (0.3 meters); bowl diameter up to 8 inches (20.3 centimeters); and bowl depth about 2.5 inches (6.3 centimeters). The cup is lined with fine twigs, bark, forbs and sometimes dry dung. Green sprigs are added, particularly during the earlier stages of nesting.

Clutch size ranges from one to four eggs, but averages two to three eggs. Each egg is short elliptical or elliptical in shape and is, on average, 2.24 inches (57 millimeters) long and 1.73 inches (44 millimeters) wide. The egg is smooth with fine granulation's and the ground color is white, often tinted bluish or greenish. During incubation the shell color quickly wears to dull white. Some eggs are plain; others are lightly marked with spots and blotches of light brown. The incubation period is 34 to 35 days, with the female incubating while the male brings food. Young are fed small, mainly young mammals. Flight feathers begin to emerge on the young at nine to 11 days. High nestling mortality often occurs when the young are 15 to 30 days old and may be a function of fratricide. The young begin to leave the nest for surrounding branches at 33 to 37 days, fledging at about 38 to 46 days. The fledged young are dependent upon their parents for four to 4.5 weeks. This species has one brood a year and apparently does not lay replacement clutches.

CONSERVATION

The Swainson's Hawk has suffered population declines since the first half of the century and was Blue-Listed in the United States from 1972 to 1982. It has since been placed on the National Audubon's List of Special Concern in 1986. It is now listed by the United States Fish and Wildlife Service as a Category 3C candidate. It should be noted that the Swainson's Hawk was removed from the active Federal list because it was found to be more abundant than previously thought. The Swainson's Hawk has adapted well to grazing and pastureland and seems to be holding its own over much of its breeding range, from northern Mexico to the southern parts of the Prairie provinces. However, far western populations, like that of Oregon, and southern California, have drastically declined, often due to habitat loss or incompatible agricultural practices. A possible reason for declines in parts of its range may be agriculturally motivated reductions in populations of both ground squirrels and grasshoppers; major seasonal foods .

Although often nesting close to human activity, some Swainson's Hawks are very easily disturbed at the nest and often desert, especially early in the season. The bird is often quite tame and remains an easy target for potshooters travelling isolated prairie roads. The species may also be affected in ways yet to be understood, by some pesticides and herbicides, including those used on its wintering grounds.

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Annual Meeting of the Raptor Research Foundation, October 28-31, Boise, Idaho.

Swainson's Hawk - rufous

Buteo swainsoni

GENERAL DESCRIPTION

The Swainson's Hawk is slightly smaller than the average Red-tailed Hawk and generally has slimmer wings than many other buteos. In flight, the Swainson's Hawk shows a distinctive soaring style, holding its wings above the horizon in a shallow V and teetering in flight a little like a Turkey Vulture. The long, slim, pointed wings are diagnostic when they show the two-toned effect of pale wing linings and dark flight feathers. No other buteo shows such consistently dark flight feathers. The White-tailed and Swainson's hawk are the only two North American buteos to have a subadult plumage.

The Swainson's Hawk is a common bird of the western plains breeding in shelter belts, riparian growth, and in isolated prairie trees. It is also common along the edge of the plains where it meets the aspen parklands. It is one of the most highly migratory of all North American hawks, leaving its breeding grounds to winter in southern South America. In a life span of seven or eight years, a Swainson's Hawk might cover as many as 150,000 miles (24,000 kilometers) during its migrations north and south.

SIZE

The Swainson's Hawk is a large buteo. Females are larger than males but measurements overlap considerably. Lengths average 20 to 22 inches (51 to 56 centimeters) for females and 19 to 20 inches (48 to 51 centimeters) for males. Wingspans are up to 54 inches (137 centimeters) for females and up to 49 inches (124 centimeters) for males. Weights average 2.4 pounds (1,100 grams) for females and 1.8 pounds (800 grams) for males.

MORPHS

The Swainson's Hawk displays a wide variety of colors, from completely black to white underneath. It also exhibits all degrees of intermediate colors between light birds and dark birds. Although commonly referred to as color morphs, they are really individual plumage variations, referred to here as "light-morph", "rufous-morph", and "dark-morph." This hawk is the only North American buteo with a true full continuum of plumages.

SPECIFIC DESCRIPTION

Adult Rufous-morph - Perched

- head usually like that of adult light-morph; pale forehead and pale chin; pale outer lores
- dark chest band usually present; some lack band and are all rufous below
- underparts below chest band may be unmarked rufous, or rufous and variably barred with dark gray-brown
- many rufous birds have barred thighs and flanks
- light undertail coverts contrast with dark underparts
- gray-brown tail with about six narrow dark bands and one wider subterminal band
- wing tips reach tip of tail or beyond

Immature Rufous-morph - Perched

- buffy forehead, buffy eyebrow line, yellow cere

- dark mustache widening into heavy brown streaks on side of chest and variably down underparts, generally lightest in center
- background color of underparts varies from cream-buff to light brown
- upperparts are brown with buffy feather edges
- undertail coverts are buff or pale brown
- wing tips just short of, or just reach, tip of tail

Adult Rufous-morph - Flight

- may have dark bib, or generally rufous underparts
- wings are long and pointed and held in a dihedral when soaring
- two-toned wings
- whitish to rufous underwing linings contrasting with dark flight feathers
- dark rufous "wing pits"
- white undertail coverts
- gray tail with about six narrow dark bands and one wider subterminal band
- may show narrow pale crescent on rump

Immature Rufous-morph - Flight

- very similar to immature light-morph but underwing linings are more heavily streaked, or spotted, with dark flight feathers
- wings are long and pointed and held in a dihedral when soaring
- underparts generally more heavily streaked than those of the immature light-morph
- gray tail with about six narrow dark bands and one wider subterminal band
- shows pale undertail coverts and often pale thin crescent on rump

SIMILAR SPECIES

The Swainson's Hawk is superficially similar to the other buteos, including the Red-tailed Hawk, Rough-legged Hawk, Red-shouldered Hawk, Broad-winged Hawk, White-tailed Hawk, Short-tailed Hawk, and Ferruginous Hawk; but in most adult and immature plumage variations, the Swainson's Hawk generally has diagnostic pale underwing linings contrasting with dark primaries and secondaries. The other species usually show an underwing pattern reverse to this. Some dark-morph Swainson's Hawks show completely dark underwings with no contrast between linings and flight feathers. This general darkness is again different from most other dark-morph buteos which generally show a very pale background color on the flight feathers. Also, the Swainson's Hawk has relatively long wings for its size and has narrower, more pointed wings than other buteos, held in a soar above the horizontal like a soaring Turkey Vulture. It often shows a white area at base of tail (but not as broad as the white upper tail coverts of the Northern Harrier), unlike other buteos.

Dark-morph "Harlan's" Red-tailed Hawks are quite similar to dark Swainson's Hawks but have dark undertail coverts, and a different wing shape. The Red-tailed Hawk, with light underwings, will show a dark patagial mark along the leading edge of the inner wing. The Swainson's Hawk never shows such a mark. A dark-morph Rough-legged Hawk shows dark underwing linings and light, contrasting flight feathers. A dark-morph Swainson's Hawk shows an all dark underwing, or light brownish wing linings, that contrast with the dark flight feathers. Light-morph Rough-legged Hawks show a conspicuous square black patch near the bend of each underwing, a mark not present on the Swainson's Hawk. An immature dark-morph White-tailed Hawk has the same dark body coloration and the white rump crescent as a dark Swainson's Hawk but shows a large pale chest patch and much whitish or silver in the flight feathers. Dark-morph adult and immature Short-tailed Hawks show silver on their outer primaries and have generally dark undertail coverts.

A dark immature Peregrine Falcon shows gray spots and bars across its underwings. A dark Gyrfalcon shows spotted underwing linings and paler flight feathers than wing linings. A perched Prairie Falcon could be mistaken for an immature light-morph Swainson's Hawk but has a large black eye, a dark patch behind the eye and its wing tips do not reach the tip of its tail.

OTHER NAMES

The Swainson's Hawk has also been known as "Black Hawk", "Brown Hawk", and "Grasshopper Hawk."

ETYMOLOGY

The scientific name *Buteo swainsoni* translates into "hawk or falcon" (*Buteo* - Latin) named after William Swainson (*swainsoni*).

MYTHOLOGY

No mythology has been found for this species in North America.

RANGE

The Swainson's Hawk is mainly a summer visitor to North America. It breeds locally in east-central Alaska, southwestern Yukon and Mackenzie, and locally in a narrow band through west-central British Columbia, but is more generally distributed from south-central Alberta, central Saskatchewan, southwestern Manitoba, and west and southern Minnesota south through the eastern parts of Washington and Oregon locally to the central valley of California, Arizona, New Mexico, and most of Texas. The eastern part of its range includes Minnesota, northwestern Iowa, most of Nebraska, Kansas, and Oklahoma, and all but eastern Texas. It periodically occurs in Iowa and rarely in northwestern Missouri, northern Illinois, and southwestern Wisconsin.

Small populations winter in southeastern Florida and along the Texas coast, probably having failed to find the way south around the Gulf of Mexico. Individuals reported, for example, on Christmas Bird Counts north of these areas are almost invariably mis-identified buteos of other species.

Immature Swainson's Hawks winter on the pampas of South America in Argentina, Uruguay, and southern Brazil. It is not known with certainty where most of the adults spend the winter.

There are no recognized North American subspecies.

MIGRATION

The Swainson's Hawk appears to feed during the early part of fall migration but not the later stages, although this, like many details of the species' life history, requires much more study. It is presently impossible to distinguish between late summer to early fall feeding aggregations, and the early onset of migratory assemblies, if, in fact, such a distinction exists. Some obvious migrant groups have been seen feeding; for instance, 3,000 of about 50,000 birds fed on caterpillars in a field on October 12, 1984 near Falcon, Texas. It is generally reported that Central American migrants do not feed or cast pellets. The Swainson's Hawk is probably the longest long distant migrant of any North American raptor. The flight from breeding ground to South American pampas in southern Brazil or Argentina can be as long as 14,000 miles (22,400 kilometers). Each migration can last at least two

months.

Hawks leave the breeding grounds from August to October and gradually head southwards toward Central America where virtually the entire population funnels through the Isthmus of Panama. Concentrations over locations like Ancon Hill, Balboa, and Panama are spectacular.

Fall migration begins each clear day on which a wind blows in the general direction of travel. Birds gain altitude by soaring in circles on a rising thermal and then set their wings and close their tails as they glide, slowly losing altitude until they find another thermal and rise with it. Thus, waves and small groups are strung out across the sky. By early October migrant groups are passing through Kansas and Texas.

Spring migration broadens once the birds have passed through Mexico. Migrant groups are noted in the southern states in March. The earliest Swainson's Hawks arrive in southern Canada in late March with migration peaking from mid April onwards.

BEHAVIOR

The Swainson's Hawk soars over open ground with wings held in a medium to strong dihedral. It occasionally courses low over the ground like a harrier and also hovers like a Red-tailed or Rough-legged hawk. The Swainson's Hawk commonly perches on the ground both during migration and on the breeding grounds. During migration, it typically roosts for the night on bare ground with scattered trees, a habit that distinguishes them from fellow long distance migrants such as the Broad-winged Hawk, which roosts in closed canopy woodlands.

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The Swainson's Hawk has suffered population declines since the first half of the century and was Blue-Listed in the United States from 1972 to 1982. It has since been placed on the National Audubon's List of Special Concern in 1986. It is now listed by the United States Fish and Wildlife Service as a Category 3C candidate. It should be noted that the Swainson's Hawk was removed from the active Federal list because it was found to be more abundant than previously thought. The Swainson's Hawk has adapted well to grazing and pastureland and seems to be holding its own over much of its breeding range, from northern Mexico to the southern parts of the Prairie provinces. However, far western populations, like that of Oregon, and southern California, have drastically declined, often due to habitat loss or incompatible agricultural practices. A possible reason for declines in parts of its range may be agriculturally motivated reductions in populations of both ground squirrels and grasshoppers; major seasonal foods .

Although often nesting close to human activity, some Swainson's Hawks are very easily disturbed at the nest and often desert, especially early in the season. The bird is often quite tame and remains an easy target for potshooters travelling isolated prairie roads. The species may also be affected in ways yet to be understood, by some pesticides and herbicides, including those used on its wintering grounds.

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Swainson's Hawk - dark

Buteo swainsoni

GENERAL DESCRIPTION

The Swainson's Hawk is slightly smaller than the average Red-tailed Hawk and generally has slimmer wings than many other buteos. In flight, the Swainson's Hawk shows a distinctive soaring style, holding its wings above the horizon in a shallow V and teetering in flight a little like a Turkey Vulture. The long, slim, pointed wings are diagnostic when they show the two-toned effect of pale wing linings and dark flight feathers. No other buteo shows such consistently dark flight feathers. The White-tailed and Swainson's hawk are the only two North American buteos to have a subadult plumage.

The Swainson's Hawk is a common bird of the western plains breeding in shelter belts, riparian growth, and in isolated prairie trees. It is also common along the edge of the plains where it meets the aspen parklands. It is one of the most highly migratory of all North American hawks, leaving its breeding grounds to winter in southern South America. In a life span of seven or eight years, a Swainson's Hawk might cover as many as 150,000 miles (24,000 kilometers) during its migrations north and south.

SIZE

The Swainson's Hawk is a large buteo. Females are larger than males but measurements overlap considerably. Lengths average 20 to 22 inches (51 to 56 centimeters) for females and 19 to 20 inches (48 to 51 centimeters) for males. Wingspans are up to 54 inches (137 centimeters) for females and up to 49 inches (124 centimeters) for males. Weights average 2.4 pounds (1,100 grams) for females and 1.8 pounds (800 grams) for males.

MORPHS

The Swainson's Hawk displays a wide variety of colors, from completely black to white underneath. It also exhibits all degrees of intermediate colors between light birds and dark birds. Although commonly referred to as color morphs, they are really individual plumage variations, referred to here as "light-morph", "rufous-morph", and "dark-morph." This hawk is the only North American buteo with a true full continuum of plumages.

SPECIFIC DESCRIPTION

Adult Dark-morph - Perched

- darkest birds lack the white forehead but darker intermediates may show it
- yellow cere
- uniform dark brown-black body
- undertail coverts are pale
- gray-brown tail with about six narrow dark bands and one wider subterminal band
- wing tips reach tip of tail or beyond

Immature Dark-morph - Perched

- buffy forehead, buffy eyebrow line, yellow cere
- often a pale patch on chin
- heavy streaking on underparts starting with mustache
- dark brown-black upperparts with some pale feather edges

- light undertail coverts
- wing tips reach tip of tail or beyond

Adult Dark-morph - Flight

- dark body coloration
- wings are long and pointed and held in a dihedral when soaring
- usually rufous underwing linings; rarely all dark
- buffy to white undertail coverts marked but still contrasting with body
- gray tail with about six narrow dark bands and one wider subterminal band
- does not show crescent on upper tail coverts

Immature Dark-morph - Flight

- heavily streaked on underparts
- wings are long and pointed and held in a dihedral when soaring
- underwing linings are heavily mottled with dark
- gray tail with about six narrow dark bands and one wider subterminal band
- shows pale undertail coverts and often pale thin crescent on rump

SIMILAR SPECIES

The Swainson's Hawk is superficially similar to the other buteos, including the Red-tailed Hawk, Rough-legged Hawk, Red-shouldered Hawk, Broad-winged Hawk, White-tailed Hawk, Short-tailed Hawk, and Ferruginous Hawk; but in most adult and immature plumage variations, the Swainson's Hawk generally has diagnostic pale underwing linings contrasting with dark primaries and secondaries. The other species usually show an underwing pattern reverse to this. Some dark-morph Swainson's Hawks show completely dark underwings with no contrast between linings and flight feathers. This general darkness is again different from most other dark-morph buteos which generally show a very pale background color on the flight feathers. Also, the Swainson's Hawk has relatively long wings for its size and has narrower, more pointed wings than other buteos, held in a soar above the horizontal like a soaring Turkey Vulture. It often shows a white area at base of tail (but not as broad as the white upper tail coverts of the Northern Harrier), unlike other buteos.

Dark-morph "Harlan's" Red-tailed Hawks are quite similar to dark Swainson's Hawks but have dark undertail coverts, and a different wing shape. The Red-tailed Hawk, with light underwings, will show a dark patagial mark along the leading edge of the inner wing. The Swainson's Hawk never shows such a mark. A dark-morph Rough-legged Hawk shows dark underwing linings and light, contrasting flight feathers. A dark-morph Swainson's Hawk shows an all dark underwing, or light brownish wing linings, that contrast with the dark flight feathers. Light-morph Rough-legged Hawks show a conspicuous square black patch near the bend of each underwing, a mark not present on the Swainson's Hawk. An immature dark-morph White-tailed Hawk has the same dark body coloration and the white rump crescent as a dark Swainson's Hawk but shows a large pale chest patch and much whitish or silver in the flight feathers. Dark-morph adult and immature Short-tailed Hawks show silver on their outer primaries and have generally dark undertail coverts.

A dark immature Peregrine Falcon shows gray spots and bars across its underwings. A dark Gyrfalcon shows spotted underwing linings and paler flight feathers than wing linings. A perched Prairie Falcon could be mistaken for an immature light-morph Swainson's Hawk but has a large black eye, a dark patch behind the eye and its wing tips do not reach the tip of its tail.

OTHER NAMES

The Swainson's Hawk has also been known as "Black Hawk", "Brown Hawk", and "Grasshopper Hawk."

ETYMOLOGY

The scientific name *Buteo swainsoni* translates into "hawk or falcon" (*Buteo* - Latin) named after William Swainson (*swainsoni*).

MYTHOLOGY

No mythology has been found for this species in North America.

RANGE

The Swainson's Hawk is mainly a summer visitor to North America. It breeds locally in east-central Alaska, southwestern Yukon and Mackenzie, and locally in a narrow band through west-central British Columbia, but is more generally distributed from south-central Alberta, central Saskatchewan, southwestern Manitoba, and west and southern Minnesota south through the eastern parts of Washington and Oregon locally to the central valley of California, Arizona, New Mexico, and most of Texas. The eastern part of its range includes Minnesota, northwestern Iowa, most of Nebraska, Kansas, and Oklahoma, and all but eastern Texas. It periodically occurs in Iowa and rarely in northwestern Missouri, northern Illinois, and southwestern Wisconsin.

Small populations winter in southeastern Florida and along the Texas coast, probably having failed to find the way south around the Gulf of Mexico. Individuals reported, for example, on Christmas Bird Counts north of these areas are almost invariably mis-identified buteos of other species.

Immature Swainson's Hawks winter on the pampas of South America in Argentina, Uruguay, and southern Brazil. It is not known with certainty where most of the adults spend the winter.

There are no recognized North American subspecies.

MIGRATION

The Swainson's Hawk appears to feed during the early part of fall migration but not the later stages, although this, like many details of the species' life history, requires much more study. It is presently impossible to distinguish between late summer to early fall feeding aggregations, and the early onset of migratory assemblies, if, in fact, such a distinction exists. Some obvious migrant groups have been seen feeding; for instance, 3,000 of about 50,000 birds fed on caterpillars in a field on October 12, 1984 near Falcon, Texas. It is generally reported that Central American migrants do not feed or cast pellets. The Swainson's Hawk is probably the longest long distant migrant of any North American raptor. The flight from breeding ground to South American pampas in southern Brazil or Argentina can be as long as 14,000 miles (22,400 kilometers). Each migration can last at least two months.

Hawks leave the breeding grounds from August to October and gradually head southwards toward Central America where virtually the entire population funnels through the Isthmus of Panama. Concentrations over locations like Ancon Hill, Balboa, and Panama are spectacular.

Fall migration begins each clear day on which a wind blows in the general direction of travel. Birds gain altitude by soaring in circles on a rising thermal and then set their wings and close their tails as they glide, slowly losing altitude until they find another thermal and rise with it. Thus, waves and small groups are strung out across the sky. By early October migrant groups are passing through Kansas and Texas.

Spring migration broadens once the birds have passed through Mexico. Migrant groups are noted in the southern states in March. The earliest Swainson's Hawks arrive in southern Canada in late March with migration peaking from mid April onwards.

BEHAVIOR

The Swainson's Hawk soars over open ground with wings held in a medium to strong dihedral. It occasionally courses low over the ground like a harrier and also hovers like a Red-tailed or Rough-legged hawk. The Swainson's Hawk commonly perches on the ground both during migration and on the breeding grounds. During migration, it typically roosts for the night on bare ground with scattered trees, a habit that distinguishes them from fellow long distance migrants such as the Broad-winged Hawk, which roosts in closed canopy woodlands.

The Swainson's Hawk uses several hunting strategies. It hunts insects, such as dragonflies or dobson flies while in flight, flapping little as it rides a wind current and stoops upon a fly, grabbing it with its foot and immediately transferring the prey to its bill. It uses a similar strategy to grab individual free-tailed bats from flying streams of bats in Oklahoma. Also, when dragonfly hordes are grounded by weather, the Swainson's Hawk will stand near groups sheltering from the wind and pluck at individual insects. The Swainson's Hawk closely follows both tractors and wild fires for injured or fleeing food. It will also run down insect prey on the ground. Occasionally a hawk will stand still on a dirt bank or elevated mound waiting for prey to appear. It commonly hunts from elevated perches such as telephone poles, stooping on prey when it's sighted.

The Swainson's Hawk defends its territory from other buteos. Breeding densities apparently vary from one area to the next with one pair per 2.59 square miles (6.7 square kilometers) in eastern Wyoming and one pair per 2.39 square miles (6.2 square kilometers) in Wyoming. Home range estimates have varied from 1.0 square miles (2.6 square kilometers) in Wyoming to 1.58 square miles (4.1 square kilometers) per pair in Utah. The Swainson's Hawk gathers in groups for feeding and migrating. However, in each case, such gathering is not social, but motivated by good feeding or migrating conditions.

The Swainson's Hawk, Red-tailed Hawk, and Ferruginous Hawk compete for territory, and defend territories against each other. In many parts of the plains these three species nest in the same general area and exploit much the same prey base. Although diets overlap greatly, habitats may not overlap as much. In Oregon, the Swainson's Hawk selects nesting trees having a different configuration than those used by Red-tailed or Ferruginous Hawks. In southern Alberta, different nesting habitats help reduce food competition, with the Swainson's Hawk favoring areas with scattered trees or riparian borders, while Red-tailed Hawks nest in stands of tall trees, and the Ferruginous Hawk nests on the open plains. Reduced reproductive success may result from the Swainson's Hawk's nesting proximity to these two other buteos. The Swainson's Hawk is generally tolerant of people. The bird is attracted to haying, mowing, and ploughing operations. House Sparrows, European Starlings, and other small birds may nest in, or near a Swainson's Hawk's nest.

The courtship displays of the Swainson's Hawk are poorly known. One activity involves circling and diving above a potential nest site. The underwings and rump are flashed and the birds call. The display may end with one bird diving to land on the edge of the nest.

Copulation occurs mainly in the morning and evening on the dead limbs of trees. The female may assume the receptive position without a prior display. During treading one of the birds calls.

The oldest wild Swainson's Hawk on record is 15 years 11 months. Swainson's Hawks die because of collisions with traffic, illegal shooting, electrocution, and even during severe prairie weather such as hailstorms. Wind storms and hail caused 30 percent nest failure in one study. When sharing a grove with nesting Great Horned Owls, hawks suffer much egg loss due to owl predation. The species also suffers from frequent, unexplained egg infertility.

ADAPTATIONS

Swainson's Hawk nestlings are exposed to hours of heat and parching sun each day and yet are unable to drink. They must obtain the moisture they need from the prey that their parents bring to the nest. This may be why adult Swainson's Hawks switch from insect to vertebrate prey for their young. Small mammals, such as young ground squirrels and young cottontails, form the bulk of the nestlings' diet.

The Swainson's Hawk has long, narrow wings for a buteo. Long wings may be an adaptation for long distance migration since a rough correlation exists between wing length and length of migration in several bird groups.

HABITAT

The Swainson's Hawk inhabits open and semi-open country in both its breeding and wintering ranges. In North America, it is found in deserts in the southwestern United States, grasslands and prairies of the intermountain states and provinces, and the grasslands of the Great Plains. The species requires trees for nesting and is found around shelter belts, abandoned farmyards, aspen grove edges, and riparian tree lines in more open country than Red-tailed Hawks but more treed country than Ferruginous Hawks, although there is habitat overlap between these three species. It favors wild prairie, hayfields, and pastures over wheat fields and alfalfa fields which may offer its prey too much cover. It requires elevated perches for hunting and a supply of small mammals such as young ground squirrels as prey for its nestlings. The breeding distribution of the Swainson's Hawk is tied very closely to the distribution of various small mammals for this reason. In Saskatchewan, for example, the distribution of Richardson's ground squirrel and the Swainson's Hawk are precisely the same.

The wintering grounds are the open pampas of southern South America where immatures nomadically follow hordes of migratory dragonflies

VOICE

Outside the breeding season, the Swainson's Hawk is a rather silent species. During summer the most common vocalization is a shrill, aggravated-sounding "kearrrrrr", weaker than the similar call of a Red-tailed Hawk. The voice of the females is lower pitched than the males. This call is given when people approach the nest and in other aggressive encounters. It may be followed by a series of whistled "tsip tsip tsip ..." Various other plaintive whistles have been reported as given by hungry or "lonely" young birds.

PELLETS

Although this species forms pellets, dimensions and a description of their appearance is not available. In Argentina, pellets of immatures following flocks of migratory dragonflies were made up of various parts of dragonfly exoskeletons.

FOODS

The Swainson's Hawk may be largely insectivorous except when nesting. Insect prey commonly taken includes grasshoppers, crickets, and locusts. Pairs bring vertebrate prey to their nestlings, relying heavily upon small mammals such as young ground squirrels (Saskatchewan) and young cottontails (southeastern New Mexico), and pocket gophers, mice, young jack rabbits, and, at least locally, small birds and other vertebrates including reptiles and amphibians. Birds taken include large birds such as Mallards, and Sage Grouse which may have been injured initially. Other unusual bird species include American Kestrel, and young Short-eared Owls. More typical in size are young Lark Buntings taken at their fledging time (Colorado). Reptiles, which can comprise large parts of a diet, include snakes such as racers, gopher snakes and striped whipsnakes, and lizards. Amphibians taken include tiger salamanders and toads. The Swainson's Hawk is an opportunistic feeder which responds quickly to local concentrations of food. Its habit of gorging on outbreaks of crickets and grasshoppers has earned it the popular name "Grasshopper Hawk".

In Argentina, flocks of immature Swainson's Hawks feed on flocks of the migratory dragonfly *Aeshna bonariensis*, nomadically following the hordes of insects and feeding mostly on the wing. Local outbreaks of locusts may also be exploited for food by one or more age-classes of birds. The immatures wintering in southern Florida apparently feed upon either insects, mice, or both, when turned up from field ploughing. They move from one freshly ploughed field to the next.

There is also some evidence that road-killed birds and animals are also consumed both on the wintering grounds and on the breeding grounds. The species commonly follows tractors and other agricultural equipment during haying or ploughing, where rodents are exposed for the hawks to capture, or insects are uncovered after crop cutting. The Swainson's Hawk is also attracted to hunt the edges of prairie wildfires.

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White-tailed Hawk

Buteo albicaudatus

GENERAL DESCRIPTION

The White-tailed Hawk is a rather large hawk which lives in very open (coastal prairie) to sparsely wooded but open, arid regions, rarely used by other buteos. It has successfully colonized several Caribbean islands. In flight, its dihedral wing silhouette is similar to the Swainson's Hawk but it has rather long legs and a short tail. It is a striking bird with a white breast and white tail with a black subterminal band. Plumages of the adult and immature are very different, while the patterns of the subadult are between both in appearance. All ages have long legs and brownish eyes. In flight, all ages show dark primary feathers contrasting with paler secondary feathers.

It hunts from a perch while soaring or hovering.

SIZE

The White-tailed Hawk is a large buteo that displays reverse size dimorphism. The average total length for both sexes is 23 inches (58 centimeters) with a wingspan of 50 inches (127 centimeters). The average wing chord length for males is 16.4 inches (41.7 centimeters) and for females is 16.7 inches (42.4 centimeters). An average male weighs 2.1 pounds (950 grams); females 2.4 pounds (1,100 grams). Body size decreases from temperate to tropical latitudes.

MORPHS

Throughout its range, the White-tailed Hawk has been reported to have various shades of colors. These are dark immatures and subadults that appear very black. There are no color morphs reported in the United States. Adult plumage is attained in the bird's third year of life.

SPECIFIC DESCRIPTION

Adult - Perched

- crown and sides of head and neck dark ashy gray to neutral gray
- underparts, flanks, thighs and wing linings vary from brilliant white
- iris is dull yellow to sienna or hazel
- cere pale green to yellowish or yellowish olive
- bill black at tip, bluish gray at base
- diagnostic cinnamon rufous patch on upper wing marginal
- tarsi and toes bright yellow; claws blackish
- dark primaries extend noticeably (1 inch to 1.2 inches [2.5-4.0 centimeters]) beyond tail in perched position, secondaries are paler, wings are pinched in at body
- distinct white tail with a wide black subterminal band

Subadult - Perched

- head, chin, throat, and back is black
- underparts generally darker than adult
- limited cinnamon rufous patch in the scapulars and inner wing coverts

- highly variable underparts from white to heavily streaked or barred with rufous and blackish;
- anterior breast is always white
- wings extend considerably beyond tip of tail, like the adult
- tail is grayish with dusky subterminal band; uppertail coverts are white

Immature - Perched

- sides and nape of head have tawny-buff spots, otherwise head and chin are mostly dark brown
- with some lighter streaks
- uniformly dark brown feathering on breast and abdomen
- cream to tan colored patch extends variably from throat to breast
- upperparts, including wings, are usually dark brown to blackish brown
- iris is usually dark brown as in adults and subadults
- bill black above and lighter below
- tarsi and toes flesh-colored, claws light brown
- tail is about 15 percent longer than adults
- tail is pale gray with numerous fine indistinct dark bars
- wings extend considerably beyond tip of tail

Adult - Flight

- white underparts, sometimes with fine barring
- two-toned underwing; flight feathers (primaries) darker than secondaries
- white "window" or patch near base of outer primary feathers
- white tail with wide black tail band near tip and at least five fine bands above it
- wide dark band on trailing (back) edge of wings
- dihedral wing profile when soaring closely resembling a Swainson's Hawk
- legs rather long compared to other buteos
- 10 primaries with numbers 7, 8, and 9 clearly notched

Subadult - Flight

- distinctive large white breast area
- dark brown to black head and throat
- wing linings and belly variously barred or mottled
- grayish tail with dark band near tip and narrower bands above it
- wide dark band on trailing (back) edge of wings
- underside of flight feathers barred with dark gray as in adults

Immature - Flight

- lacks wide dark border on trailing edge of wing of older ages
- bands on tail fine and narrow, more so than in other age-classes
- narrow gray band to trailing (back) edge of wings
- creamy-white area on breast, but varies in size
- same flight pattern as for adult with exception of the longer barred tail
- wings narrower, and much longer tailed than in older ages

SIMILAR SPECIES

In flight, the silhouette of the White-tailed Hawk bears resemblance to that of the

Swainson's Hawk. First year immature White-tailed Hawks are sometimes confused with Red-tailed Hawks, and some first and second-year immature White-tailed Hawks with "belly bands" resemble Red-tailed Hawks. Perched immature White-tailed Hawks can look like large, dark-morph buteos, but the wings extend far beyond the tails; in other species the wings are equal to, or shorter, than the tail.

OTHER NAMES

The White-tailed Hawk is locally referred to as the "Sennett's White-tailed Hawk", and simply "Whitetail."

ETYMOLOGY

The Latin word *Buteo* translates to "type of hawk or falcon"; the Latin prefix *albus* means "white" and the suffix *caudatus* means "tail."

MYTHOLOGY

There is no information for North America.

RANGE

In North America the White-tailed Hawk is at the northernmost limit of its tropical and subtropical range. It is present year-round only in southwestern and southern Texas. Here, it is locally distributed in suitable habitat from Brownsville to Galveston, with the greatest concentration in the Coastal Bend region.

Strays have been reported in several southern states including Louisiana, Arizona, and New Mexico.

Three subspecies of the White-tailed hawk are recognized. These are: *B. a. hypospondius* which occurs in southeastern Texas through Mexico, Central America, north Colombia, and northwestern Venezuela, *B. a. colonus* which occurs in east Colombia, Venezuela and east to Suriname and south to north Brazil, including all Caribbean island records, and *B. a. albicaudatus* which occurs in southern South America.

BEHAVIOR

The White-tailed Hawk hunts from both a perch and while in the air. Hunting from a perch begins approximately one hour after sunrise and continues as late as sunset. Hunting from the air usually occurs in the late afternoon. Kiting, and hovering, occur interchangeably at heights of 161 to 333 feet (50 to 100 meters). Feet are used to catch prey and consumption of prey begins with the cranial region. Prey delivered to nestlings invariably are missing the head, and occasionally, the neck and upper torso.

White-tailed Hawks are monogamous. In the northern hemisphere the breeding season begins as early as December, when pairs begin spending more time within the confines of their eventual breeding territory. Egg-laying may not commence for another three months. A period of four to five weeks of nest-building precedes egg-laying.

Copulation often precedes or immediately follows territorial flight displays. These displays are usually performed by the male, but have also been observed by the female or both simultaneously. It is hypothesized that intruders stimulate copulation, but the behavioral mechanism is unknown. In a territorial defence, the male typically launches off a perch and flies low to the ground 3.2 to 6.5 feet (1 to 2 meters) with strong, steady

wingbeats directly toward the intruder; it then abruptly swoops upward (slowing the rate of flapping) to a height of 65 to 97 feet (20 to 30 meters) whereupon the bird will circle back to the perch if the intruder remains motionless, or give chase if the intruder flees. Over solicitation of copulation by the female is not apparent.

During the nesting and pre-egg-laying stages, a display of grass-pulling by the male has been observed. Adults fly within 968 feet (300 meters) of the eventual nest site and land on the ground within 16 feet (5 meters) of one another, whereupon the male will bend over and tug at (but not remove) grass and forbs. After several minutes both will fly to separate perches.

Nests are often furnished with an unusually long stem or branch. One adult was observed to fly for over 0.6 miles (1 kilometer) to bring a long stick to the nest. Grass, twigs, leaves, and cow dung have all been observed to be placed on top of the eggs.

HABITAT

The breeding and nonbreeding range of the White-tailed Hawk are essentially the same. Habitat consists of open or semi-open, low elevation, humid to arid grassland, prairie, or savanna. Cultivated or fallow agricultural fields are not acceptable, however, these birds will tolerate cattle pasture which has not been overgrazed.

VOICE

This species has alarm calls which are usually described as a series of syllables, such as ke-ke-ke-ke, or kil-la, kil-la, kil-la. The first audible sounds given by young birds in the nest are believed to consist of short, sucking tsip, or tsick. Juveniles near nest-departure give a nasally begging call described as a peeeeeee-up (= meow), which is often associated with hunger. From the second year onward, males give a short, nasally honking call which seems to be associated with excitement such as the presence of food.

FOOD

The White-tailed Hawk has a broad diet consisting of small vertebrates (mammals, birds, reptiles, amphibians) and arthropods. Some animals are pocket gophers, cotton rats, shrews, the Northern Bobwhite, King Rail, Mourning Dove, western diamondback rattlesnake, Greater Roadrunner, Mallard, various lizards, crayfish, blue crab, crickets, beetles, and grasshoppers.

PELLETS

The White-tailed Hawk usually casts its pellets in the morning. Pellets are 1.18 to 1.77 inches (3 to 4.5 centimeters) in length; 0.6 to 1.18 inches (1.5 to 3 centimeters) wide; and weigh 0.1 to 0.2 ounces (3 to 5 grams).

NESTING

The White-tailed Hawk nests in open or semi-open areas of low elevation, humid to arid grassland, prairie, or savanna habitats. Within this habitat, nests are situated in an area with a commanding vista, such as at the top of a yucca tree. Nest heights average 9.8 feet (3 meters). The actual nest averages 20 inches (51 centimeters) in diameter and 21 inches (54 centimeters) high, and are composed of branches, twigs, grasses and forbs. It is described as being loosely constructed, bulky, ovoid, or elliptically shaped. Both female and male participate in nest building, which requires four to five weeks, and usually commences in January or February. Normally one brood is raised per season, however, a replacement brood may be laid if the nest is destroyed early in the season.

One to four (usually two), dull white, oval-shaped eggs are laid and incubated for 29 to 32 days. The shell is smooth or finely granulated. The ground color is white to pale bluish but becomes stained during incubation. Eggs average 2.2 inches (55.6 millimeters) in length and 1.7 inches (43.5 millimeters) in width.

The female performs most of the daytime incubation (five to eight percent by male) and 100 percent of the night incubation. Although both adults have been observed feeding young, contribution by each needs further study. Chicks have been observed to fledge the nest at 35, 47, 49 and 52 days. Immature White-tailed Hawks appear to have a period of dependency on adults which is two to three times longer than for buteos of comparable size, such as the Red-tailed Hawk. This may be due to the absence of migration for these hawks. First-year birds continue to be brought food by the adult for seven months, and one bird in Venezuela was observed to remain with the adult for 21 months.

CONSERVATION

A population decline was reported between 1947 and 1970 and was attributed to pesticide poisoning. Current data suggests that reproduction is no longer a problem. The White-tailed Hawk has also suffered due to habitat changes; encroachment of bushy habitat into prairie due to fire suppression or grazing or both have impacted foraging areas. Contrastingly, removal of woody vegetation to restore prairie has reduced available nest sites. A recent estimate put the total population at 1,040 birds, all located in Texas.

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Zone-tailed Hawk

Buteo albonotatus

GENERAL DESCRIPTION

The Zone-tailed Hawk is a blackish buteo of the American southwest. It soars over desert and grassland often with groups of Turkey Vultures and may be a mimic of that species. Like the vultures, it shows a marked dihedral in its wings and sometimes flies unsteadily like they do. Its upper surfaces are largely all black with two to three grayish bands showing on the upper tail surface. However, its underwing flight feathers are silvery and barred with black, contrasting with the solid black wing linings and solid black body and white bands on the underside of the tail.

SIZE

The Zone-tailed Hawk is a large buteo. The female is larger than the male. The average length for both sexes is 20 inches (51 centimeters). The wingspan (both sexes together) averages 51 inches (129 centimeters). Weights average 2.9 pounds (886 grams) for females and 1.4 pounds (628 grams) for males.

MORPHS

There are no light or dark color morphs or unusual plumages reported for this species.

SPECIFIC DESCRIPTION

Adult - Perched

- large all-black body, which close-up may show a gray tone
- yellow cere
- light gray facial skin and white on forehead
- wing tips reach tail tip or slightly beyond
- one wide, white band visible on underside of folded tail (other bands hidden)
- two band are gray on upper surface (top) of folded tail
- bright yellow legs

Immature - Perched

- like adult but back more brownish black
- small white spots on blackish underparts
- undertail is silvery with wide gray subterminal band, then several narrow gray bands to base
- wingtips reach tip of tail only

Adult - Flight

- all-black body
- black wing linings
- underside of flight feathers light gray with dark gray bars; appears two-toned
- black tail with one wide, white band, and one narrow, white band toward base (male), or with two narrow bands (female) on spread tail

Immature - Flight

- like adults but brownish tinge to body plumage
- body has white spots
- undertail is whitish with five to seven narrow dusky bands and one wide dusky subterminal band

SIMILAR SPECIES

The Turkey Vulture has an unbanded tail, a smaller, bare head and lacks the dark band on the trailing edge of the underwing. The Common Black-Hawk is similar but has a different shape. Its wings are very broad with undersurfaces generally dark, lacking the two-toned appearance of the Zone-tailed Hawk's underwings. In good light, one can see the barring on the flight feathers of the Common Black-Hawk, but it contrasts poorly against a dark background. The Common Black-Hawk also shows a small white patch at the base of the outer primaries and has orange-yellow, not gray facial skin. It shows one wide white band on its short black tail. This band shows on both upper and lower tail surfaces unlike the Zone-tailed Hawk which shows gray bands on the upper tail surface.

Several dark morph buteos could be confused with the Zone-tailed Hawk. The dark morph Swainson's Hawk has more pointed wings which usually show an all dark undersurface or a two-toned effect the reverse of the Zone-tailed underwings. A dark morph Broad-winged Hawk is small (crow-sized) and brown, not black. A dark morph Rough-legged Hawk could be very similar. However, it would usually show a very wide dark subterminal band, and a pale window of unbarred outer primaries. A dark morph immature Harlan's Red-tailed Hawk would be very similar to the Zone-tail but would show several dark bands of equal width on the undertail, while the immature Zone-tailed Hawk would show one wide dark subterminal band and several narrow ones.

OTHER NAMES

The Zone-tailed Hawk is also referred to as the "Band-tailed Hawk" and "Zonetail."

ETYMOLOGY

The scientific name *Buteo albonotatus* translates into "hawk or falcon" (*buteo* Latin) that is "marked with white" (*albo* Latin = white; *notatus* Latin = marked).

MYTHOLOGY

No mythology has been located for this species.

RANGE

The Zone-tailed Hawk has occurred as a vagrant across the width of extreme southern California where it has attempted to nest at least twice. It breeds regularly across the southern two thirds of Arizona, the southwest and central areas of New Mexico, and along the Texas-Mexico border north to the Glass and Chisos Mountains, Trans-Pecos Mountains, Rio Grande valley, and the Edwards Plateau. A few winter in southern Arizona and in the lower Rio Grande valley of Texas, but it is mainly considered a summer visitant to the continent.

This species also occurs throughout Mexico and much of Central America and Trinidad, and ranges south to Peru, Bolivia, Paraguay, and southeastern Brazil.

There are no currently recognized races of the Zone-tailed Hawk.

MIGRATION

In North America, the Zone-tailed Hawk is termed a partial migrant of moderate to medium distances (185 to 930 miles). Almost all of the Zone-tailed Hawks leave their breeding range in North America in September and migrate, , to Mexico or Central America. Little banding has been done and their destination is not known. The majority have departed the United States by early October. Apparently Zone-tails avoid water crossings and usually migrate alone. No general flight paths or points of concentration are known for North American birds. The birds return to their breeding grounds in late March and April.

BEHAVIOR

The Zone-tailed Hawk has two styles of flight. The first is the unsteady, rocky "vulture-like" flight with wings held up at a dihedral and tail folded. The second is a typical buteo-like soaring with flat wings and spread tail.

The Zone-tailed Hawk has at least three hunting methods. Using updrafts or thermals from canyon walls and desert slopes, it commonly soars at 50 to 500 feet (15.5 to 155 meters) with Turkey Vultures and spots its prey from a height. It continues to fly in a vulture-like manner until out of sight, then doubles back in a low stoop, using the landscape to conceal its approach until the last moment, when it surprises its prey. The Zone-tailed Hawk has also been seen to make nearly vertical stoops onto prey, and to dive shallowly with partially folded wings into a tree to capture small birds. On one occasion a Zone-tail coursed over the ground like a harrier. It does not hover or hunt from a perch.

Little is known about the size of Zone-tailed Hawk home ranges. Territories are reused year after year. The Zone-tailed Hawk is not social and normally associates only with its mate, its young and with Turkey Vultures . The Zone-tailed Hawk commonly associates as a lone bird with small groups of soaring Turkey Vultures. This may be mimicry on the part of the hawk. One Zone-tailed Hawk was attacked by an American Kestrel as it passed through the kestrel's territory. A pair of Western Kingbirds also attacked this bird. On another occasion, a Zone-tailed Hawk caught prey but was pursued by an immature Red-tailed Hawk and several Turkey Vultures. The Red-tail was able to rob the Zone-tail. Little else is known of interactions except that the Zone-tailed Hawk will vigorously defend its nest, even striking people who attempt to climb to it.

Courtship involves at least two displays. High-circling occurs when two, or sometimes three, birds soar on thermals near each other over their territory. Resident pairs will begin high-circling even on mild winter days. Sometimes one bird dives toward another. Both birds may grasp talons and tumble earthward. Calling is common during high-circling. The sky-dance involves one bird, possibly the male, diving with wrists well out from the body but primaries on the rump, and tail fully spread. The bird dives steeply, sometimes calling.

Little is known about the longevity of Zone-tailed Hawks. Causes of mortality have included random shooting, and scientific collection. The exotic nature of the Zone-tailed Hawk made it a favorite target for ornithologists' shotguns in the late 1800s and early 1900s.

ADAPTATIONS

The Zone-tailed Hawk may be an aggressive mimic of the Turkey Vulture. By closely resembling and associating in flight with Turkey Vultures, which many prey species have

come to ignore as harmless, the Zone-tailed Hawk may be able to spot prey without alarming it, and then sneak back and take it by surprise. Although only a hypothesis, there are a few points that strongly support this belief. The Zone-tailed Hawk closely resembles the Turkey Vulture. Both are blackish. Both have two-toned wings, and when the Zone-tailed Hawk flies with Turkey Vultures (which it does commonly), the hawk holds its wings up in a dihedral like those of a vulture and keeps its tail folded, also like that of a vulture.

The immature Zone-tailed Hawk is unusual in that it wears a blackish plumage much like its parents, instead of the usual brown streaked plumage of most immature buteos. This could also support the mimicry hypothesis, being a possible adaptation so that immatures can mimic Turkey Vultures too. Initial research supports the mimic hypothesis, but more study is needed.

HABITAT

The Zone-tailed Hawk inhabits arid, semi-open countryside. It prefers to nest in open deciduous woodlands along streams, pine-oak woodland or coniferous forest on steep slopes on or near cliffs, and generally shows a preference for rugged terrain, including canyons and mountains where thermals and updrafts occur. It occurs from near sea level to 8,500 feet (2635 meters). In Brewster County, Texas, it nests on north-facing slopes covered by mesquite, creosote bush, and lechuguilla. In west Texas, it nests on steep north-facing slopes with open stands of Ponderosa Pines. In the Chisos, it frequents north-facing slopes dominated by oaks and junipers. In Arizona, it has nested in steep canyons with riparian woodlands, or open pine forests on steep slopes. The Zone-tailed Hawk forages over a wide variety of plant communities including rolling paloverde-saquaro habitat, chaparral and desert grassland, and open pinyon-juniper woodlands.

VOICE

The voice of the Zone-tailed Hawk is not well known. A peevish whistle intermediate between the call of a Red-tailed Hawk and that of a Broad-winged Hawk may be the same as the drawn out, whistled "keer", or the loud descending scream described elsewhere. An exaggerated "meeeeew" is also mentioned. The Zone-tailed Hawk commonly vocalizes during courtship and when intruders appear near the nest.

FOODS

The Zone-tailed Hawk takes a wide variety of prey including small mammals, birds, reptiles, amphibians, small fishes, centipedes and insects. Mammals taken include ground squirrels, antelope squirrels, and chipmunks. Birds taken include Gambel's Quail, Horned Lark, meadowlarks, House Sparrow, and warblers. Reptiles include spiny lizards, and collared lizards. The diet can vary locally with birds numerically the single largest component (47 percent) in one Arizona study; reptiles numerically most numerous (71 percent) in a Texas study; and mammals (41 percent) in another Arizona study.

In Mexico, a Zone-tailed Hawk took nestling Roseate Spoonbills.

PELLETS

There is no information available about the dimensions and description of pellets in North America.

NESTING

The Zone-tailed Hawk nests primarily in large stick nests located in the crowns of tall old

trees (often near water); at the base of a cliff; and, in crevices or caves on cliff faces. Riparian tree species nested in are commonly cottonwoods and sycamores. Nests are also often located in montane coniferous forests. Which sex selects the site and details of nest construction are not known. Nests and/or nest sites can become traditional, with one nest in use for some 70 years. One nest measured 20 inches (51 centimeters) high, 24 inches (61 centimeters) in diameter, and had a bowl 9 inches (23 centimeters) across and 4 inches (2 centimeters) deep. It was lined with twigs bearing green leaves. Nests have been built from 15 to 75 feet (4.7 to 23.3 meters) above the ground.

Clutch sizes range from one to three eggs, but average two eggs. The egg is approximately ovate in shape and white, or bluish-white marked with lavender or yellow-brown dots. Incubation roles are not known. The incubation period may be 35 days. The nestling stage is not well known. Young first fly at 35 to 49 days.

CONSERVATION

The North American population of Zone-tailed Hawks is likely only a few thousand birds. The species is quite sparsely distributed across its southwestern range and is not common anywhere. Destruction of breeding habitat, particularly riparian woodlands, may be the most serious threat facing this species. Also, DDT contamination of Texas rivers, and the presence of DDT in lizards in Texas, is also of concern. Illegal shooting still remains a concern.

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Red-tailed Hawk

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal *buteo*, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest *buteos*, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Eastern (borealis) - Perched

HEAD

- generally brown over the sides and top giving a "hooded" appearance
- a blackish mustache mark is usually present at the sides of the chin
- chin and throat white in the center but streaked with brown on the sides
- forehead may or may not have much whitish feathering
- the lores are whitish
- the nape has cinnamon margins on the feathers
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown with a pale orangish to yellow brown on young adults

BODY

- the upper breast through to the tail is white or slightly buffy with variable amounts of dark markings.
- these markings often become extensive and form a dark "belly band"
- the flanks are often barred, always marked
- the back and upperparts are a mixture of browns, and dark browns with white markings that may form a "V"
- the scapulars and interscapular feathers margined with cinnamon-brown

WINGS

- the upper wings are similar to the back but some coverts may have whitish edgings
- the primaries are dark but some light barring may be evident and they do not reach the end of the tail in this race

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red with a narrow black band near the whitish tip

LEGS

- the legs and feet are yellow to olive yellow
- the talons are black

Immature Eastern (borealis) - Perched

HEAD

- much of the head is a medium, neutral brown, paler than adults
- the mustache mark may be obscure or absent
- the chin and throat are white as are the lores
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally
- the cere is light greenish
- the eye is dull yellow to brownish cream

BODY

- the underparts are all white from the chin to the tail
- elongated black markings form a belly band
- the back is dark brown with white mottling that can form a "V"

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark

TAIL

- from below it is a dingy brown with darker bands
- from above, the tail is grayish brown (sometimes quite rusty colored) with about nine thin, often of equal width, dark transverse bars and a white tip

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Eastern (borealis) - Flight

- this buteo has a brown head and back, light underparts and a red tail, particularly noticeable on the upper surface
- the breast and belly are white with a dark belly band that is variable in extent and may be absent. The breast appears cleanly white and unstreaked.
- the back is dark brown as are the upper surface of the wings and a whitish "V" may be noticeable
- the wings may be held in a slight dihedral when soaring
- the underwings are whitish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts may be tinged rufous and show a dark "patagial" mark on the leading edge which is distinctive
- there is usually a dark "comma" mark just beyond the wrist near the base of the primaries
- seen head on, the leading edge of the wing between the wrist and the patagial area is very white, giving the impression of aircraft landing lights coming towards the viewer
- the upper surface of the tail is rufous to deep red with a dark subterminal band and a white tip. The rufous shows on the undersurface but less intensely.

Immature Eastern (borealis) - Flight

- the head is a lighter brown than the adults but otherwise similar at a distance
- the underparts of the body are white with a darkly streaked belly band that is more distinct than in many adults
- the back is a more neutral brown with the upper surface of the wings generally similar except that the primaries, and primary coverts, are lighter than the secondaries
- the underwing pattern is similar to the adult pattern with dark patagial and comma marks but the trailing edge is lighter and narrower
- the upper surface of the tail is light brown with numerous dark transverse bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have narrower wings than adults, and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. The Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (harlani) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (krideri) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuentes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus Buteo is Latin for "buzzard" which is an early name for hawks and vultures. The species name jamaicensis is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North

American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows:

"Eastern" Red-tailed Hawk (*B. j. borealis*)

- breeds throughout eastern North America from central Manitoba, northern Ontario, and central Quebec, west to the Great Plains and south to, but excluding, Florida. Individuals of this race have been claimed to be found in Alaska.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early

September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or

around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds.

Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a

cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest

sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of

buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Eastern

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal buteo, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Krieger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest buteos, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Eastern (borealis) - Perched

HEAD

- generally brown over the sides and top giving a "hooded" appearance
- a blackish mustache mark is usually present at the sides of the chin
- chin and throat white in the center but streaked with brown on the sides
- forehead may or may not have much whitish feathering
- the lores are whitish
- the nape has cinnamon margins on the feathers
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown with a pale orangish to yellow brown on young adults

BODY

- the upper breast through to the tail is white or slightly buffy with variable amounts of dark markings.
- these markings often become extensive and form a dark "belly band"
- the flanks are often barred, always marked
- the back and upperparts are a mixture of browns, and dark browns with white markings that may form a "V"
- the scapulars and interscapular feathers margined with cinnamon-brown

WINGS

- the upper wings are similar to the back but some coverts may have whitish edgings
- the primaries are dark but some light barring may be evident and they do not reach the end of the tail in this race

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red with a narrow black band near the whitish tip

LEGS

- the legs and feet are yellow to olive yellow
- the talons are black

Immature Eastern (borealis) - Perched

HEAD

- much of the head is a medium, neutral brown, paler than adults
- the mustache mark may be obscure or absent
- the chin and throat are white as are the lores
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally
- the cere is light greenish
- the eye is dull yellow to brownish cream

BODY

- the underparts are all white from the chin to the tail
- elongated black markings form a belly band
- the back is dark brown with white mottling that can form a "V"

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark

TAIL

- from below it is a dingy brown with darker bands
- from above, the tail is grayish brown (sometimes quite rusty colored) with about nine thin, often of equal width, dark transverse bars and a white tip

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Eastern (borealis) - Flight

- this buteo has a brown head and back, light underparts and a red tail, particularly noticeable on the upper surface
- the breast and belly are white with a dark belly band that is variable in extent and may be absent. The breast appears cleanly white and unstreaked.
- the back is dark brown as are the upper surface of the wings and a whitish "V" may be noticeable
- the wings may be held in a slight dihedral when soaring
- the underwings are whitish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts may be tinged rufous and show a dark "patagial" mark on the leading edge which is distinctive
- there is usually a dark "comma" mark just beyond the wrist near the base of the primaries
- seen head on, the leading edge of the wing between the wrist and the patagial area is very white, giving the impression of aircraft landing lights coming towards the viewer
- the upper surface of the tail is rufous to deep red with a dark subterminal band and a white tip. The rufous shows on the undersurface but less intensely.

Immature Eastern (borealis) - Flight

- the head is a lighter brown than the adults but otherwise similar at a distance
- the underparts of the body are white with a darkly streaked belly band that is more distinct than in many adults
- the back is a more neutral brown with the upper surface of the wings generally similar except that the primaries, and primary coverts, are lighter than the secondaries
- the underwing pattern is similar to the adult pattern with dark patagial and comma marks but the trailing edge is lighter and narrower
- the upper surface of the tail is light brown with numerous dark transverse bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have narrower wings than adults, and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. The Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (harlani) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (krideri) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus Buteo is Latin for "buzzard" which is an early name for hawks and vultures. The species name jamaicensis is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North

American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows:

"Eastern" Red-tailed Hawk (*B. j. borealis*)

- breeds throughout eastern North America from central Manitoba, northern Ontario, and central Quebec, west to the Great Plains and south to, but excluding, Florida. Individuals of this race have been claimed to be found in Alaska.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early

September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or

around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds.

Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a

cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest

sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of

buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Western light

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal *buteo*, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest *buteos*, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Western (calurus) Light-morph - Perched

Note: The "Western" Red-tailed Hawk (calurus) is highly variable and have as many as three color morphs. The range of variation amongst individuals seems to bridge the "color morphs" due to interbreeding. The color morphs are generally referred to as light, rufous and dark but variations are legion. As well, some of the color morphs discussed under this subspecies may in fact be representative of the extremes of some other subspecies as intergrades approach one another.

The basic plumage is often described as being like the eastern Red-tail with some specific variations, so the description for the "Eastern" Red-tailed Hawk (borealis) is presented here with modifications as appropriate and as available from literature.

HEAD

- generally brown over the sides and top giving a "hooded" appearance
- a blackish mustache mark is usually present at the sides of the chin
- chin and throat white in the center but streaked with brown on the sides and often darker than in the "Eastern" Red-tailed Hawk (borealis)
- forehead may or may not have much whitish feathering
- the lores are whitish
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown with a dark pupil

BODY

- the upper breast through to the tail is more rufous than white with variable amounts of dark markings but usually more than the "Eastern" Red-tailed Hawk (borealis)
- these markings often become extensive and form a dark "belly band" that may be absent but is usually more extensive than in eastern birds
- the flanks are barred
- the back and upperparts are dark browns with white markings that may form a "V"

WINGS

- the upper wings are similar to the back but some coverts may have whitish edgings
- the primaries are dark but some light barring may be evident and they do reach the end of the tail in this race

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red often with 7 to 10 narrower dark bands and a wider black band near the whitish tip

LEGS

- the legs and feet are yellow to olive yellow
- the talons are black

Immature Western (calurus) Light-morph - Perched

Overall, the brown colors are darker than those of the "Eastern" Red-tailed Hawk (*borealis*)

HEAD

- much of the head is a medium, neutral brown paler than adults'
- the mustache mark may be obscure or absent
- the chin and throat are darkly streaked to all dark
- the lores are whitish
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally
- the cere is light greenish to olive-buff
- the iris is dull yellow to brownish cream

BODY

- the underparts are all white from the chin to the tail
- elongated black markings form a belly band
- the back is dark brown with white mottling that can form a "V"
- the leg feathering usually has brown barring

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark

TAIL

- from below it is a dingy brown
- from above, the tail is grayish brown with numerous dark transverse bars and a white tip

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Western (*calurus*) Light-morph - Flight

- this *buteo* has a brown head and back, rufous underparts and a red tail, particularly noticeable on the upper surface
- the breast and belly are rufous with a dark belly band that is variable in extent and may be absent.
- the back is brown as are the upper surface of the wings and a whitish "V" may be noticeable
- the wings may be held in a slight dihedral when soaring but more of a "U" than a "V" as in the "Eastern" Red-tailed Hawk (*borealis*)
- the underwings are whitish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts are more heavily washed with rufous and show large, dark "patagial" marks on the leading edge which is distinctive
- there is usually a dark "comma" mark just beyond the wrist near the base of the primaries
- the upper surface of the tail is rufous to deep red with a dark subterminal band and a white tip. The rufous shows on the undersurface but less intensely.

Immature Western (*calurus*) Light-morph - Flight

- the head is a lighter brown than the adults but otherwise similar at a distance
- the underparts of the body are white with a darkly streaked belly band that is more distinct than in many adults
- the back is more brown with the upper surface of the wings generally similar except that the primaries are lighter than the secondaries
- the underwing pattern is similar to the adult pattern with dark "patagial" and "comma" marks but the trailing edge is lighter and narrower
- the upper surface of the tail is light brown with numerous dark transverse bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have longer, narrower wings than adults and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. The Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (harlani) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (krideri) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-

tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Kridler's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard" which is an early name for hawks and vultures. The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieve."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Western" Red-tailed Hawk (*B. j. calurus*)

- breeds from northeastern Yukon, southwestern Mackenzie, northern Saskatchewan, and west-central Manitoba south through central Saskatchewan, southeastern Alberta, western Montana, southern Wyoming, southwest South Dakota, western Nebraska, eastern Colorado, most of New Mexico, and probably extreme southeastern Arizona.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when

hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before

being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond,

although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide

range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote,

and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The

parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Western dark

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal buteo, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest buteos, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Western (calurus) Dark-morph - Perched

Note: Some authorities may place the "Harlan's" Red-tailed Hawk (harlani) in this general category as a melanistic population of uncertain taxonomic affiliation. "Black" morphs of the "Western" Red-tailed Hawk (calurus) show some typical Red-tailed Hawk markings, such as the rufous tail, but the flight feathers are white with some barring as in typical birds.

HEAD

- dark chocolate brown overall
- chin and throat dark chocolate brown
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown

BODY

- the entire body is dark chocolate brown on the upper and under surface
- the undertail coverts are often rufous

WINGS

- the upper wings are similar to the back, being dark brown
- the primaries are dark and they do reach the end of the tail in this race

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red with a black band near the tip and seven to 11 narrow dark bands elsewhere

LEGS

- the legs and feet are yellow
- the talons are black

Immature Western (calurus) Dark-morph - Perched

HEAD

- dark chocolate brown overall
- chin and throat dark chocolate brown
- the beak is blackish at the tip and a lilac gray basally
- the cere is light yellow to olive-buff
- eye pale

BODY

- overall the body is dark brown
- the breast is all dark in the pure form. Sometimes faint rufous edges on the breast feathers can be seen.
- the back is dark brown

WINGS

- the upper coverts are dark brown
- the primaries are dark

TAIL

- from below it is a dingy brown
- from above, the tail is brown with numerous dark transverse bars and a white tip

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Western (calurus) Dark-morph - Flight

- overall, this is a dark, chocolate brown to blackish bird on the head underside and upperside
- the wings may be held in a slight dihedral when soaring
- the underwings are grayish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts are completely dark chocolate and show no patagial mark as in lighter birds
- the usually dark "comma" mark just beyond the wrist near the base of the primaries is not generally apparent
- the upper surface of the tail is rufous to deep red with a dark subterminal band. The rufous shows on the undersurface but less intensely.

Immature Western (calurus) Dark-morph - Flight

- the head and entire body appear dark except for breast mottling which may be present
- the underwing pattern is similar and is generally dark
- the flight feathers are barred with dark tips beneath and usually show a white area at the base
- the upper surface of the tail is brown with numerous dark transverse bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have longer, narrower wings than adults and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. the Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (*harlani*) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (*krideri*) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard" which is an early name for hawks and vultures. The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds.

Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution of this subspecies is as follows.

"Western" Red-tailed Hawk (*B. j. calurus*)

- breeds from northeastern Yukon, southwestern Mackenzie, northern Saskatchewan, and west-central Manitoba south through central Saskatchewan, southeastern Alberta, western Montana, southern Wyoming, southwest South Dakota, western Nebraska, eastern Colorado, most of New Mexico, and probably extreme southeastern Arizona.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some

birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter.

Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near

nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets

in some studies. Other studies have indicated the following range of dietary compositions:

Birds 4 to 58 percent
Herptiles 0 to 41 percent
Invertebrates 0 to 21 percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may

occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies

must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Western rufous

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal buteo, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest buteos, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Western (calurus) Rufous-morph - Perched

HEAD

- dark brown overall
- chin and throat dark chocolate brown
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown

BODY

- the upper body is dark brown
- the breast and undertail coverts are a rich, dark rufous and the coverts are barred with dark brown
- the wide, dark belly band is a solid, chocolate brown
- the leg feathering is rufous with dark brown barring
- lacks pale scapulars of light-morphs

WINGS

- the upper wings are similar to the back, being dark brown
- the primaries are dark and they do reach the end of the tail in this race

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red with a black band near the tip and seven to 11 narrow dark bands elsewhere

LEGS

- the legs and feet are yellow
- the talons are black

Immature Western (calurus) Rufous-morph - Perched

HEAD

- much of the head is a medium, neutral brown
- the mustache mark may be obscure or absent
- the chin and throat are darkly streaked to all dark
- the lores are whitish
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally
- the cere is light greenish to olive-buff
- the eye is dull yellow to brownish cream

BODY

- the breast is white but heavily streaked with brown
- the dark belly band is heavily mottled
- the undertail coverts are heavily barred
- the back is dark brown with white mottling
- the leg feathering has heavy brown barring

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark
- the wings are shorter than the tail

TAIL

- from below it is a dingy brown
- from above, the tail is grayish brown with numerous dark transverse bars and a white tip

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Western (calurus) Rufous-morph - Flight

- overall, this is a dark, chocolate brown to blackish bird on the head and upperside
- the underside is generally rufous save for a broad, dark belly band
- the wings may be held in a slight dihedral when soaring
- the underwings are grayish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts are completely dark rufous and may show some "patagial" mark
- the usually dark "comma" mark just beyond the wrist near the base of the primaries is not generally apparent
- the upper surface of the tail is rufous to deep red with a dark subterminal band. The rufous shows on the undersurface but less intensely. May have numerous inner bars.

Immature Western (calurus) Rufous-morph - Flight

- the head is brown like the adults and similar at a distance
- the breast is white with heavy brown streaking and the dark belly band is heavily mottled
- the back is more brown with the upper surface of the wings generally similar except that the primaries are lighter than the secondaries
- the patagial area of the underwing is heavily barred or darkish and the patagial mark is obscured
- light patches at the base of the primaries is evident on the underwing panels or "windows"
- the upper surface of the tail is light brown with numerous dark transverse bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have longer, narrower wings than adults and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. the Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (*krideri*) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (*harlani*) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (*krideri*) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuentes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard" which is an early name for hawks and vultures. The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Western" Red-tailed Hawk (*B. j. calurus*)

- breeds from northeastern Yukon, southwestern Mackenzie, northern Saskatchewan, and west-central Manitoba south through central Saskatchewan, southeastern Alberta, western Montana, southern Wyoming, southwest South Dakota, western Nebraska, eastern Colorado, most of New Mexico, and probably extreme southeastern Arizona.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a

beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of

Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of

hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwir" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwir" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds 4 to 58 percent
Herptiles 0 to 41 percent
Invertebrates 0 to 21 percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to

12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Fuertes

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal buteo, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida" , and "Fuertes", and Alaska" Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest buteos, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Fuertes (fuertesi) - Perched

In some parts of the plumage, this is a light version of the "Eastern" Red-tailed Hawk (borealis) and similar below to the "Krider's" Red-tailed Hawk (krideri). Some author's feel that the back is darker than that of the "Eastern" Red-tailed Hawk. No color morphs are reported for the "Fuertes" Red-tailed Hawk.

HEAD

- overall dark brown
- throat variable from white to dark
- the beak is bluish to black
- the cere is yellow
- the eye is brown, paler on young adults

BODY

- the underparts are white like the "Krider's" Red-tailed Hawk (krideri) with the dark belly band very much reduced or absent
- faint barring may be evident on the flanks
- the back is almost identical in color and pattern to the "Eastern" Red-tailed Hawk (borealis), but less mottling on upper wing coverts

WINGS

- generally dark brown with some white markings on the scapulars
- the primaries reach the tip of the tail in perched birds

TAIL

- the upper tail is reddish and varies from being plain to having a broad subterminal dark band or several incomplete dark bars. Typical adult has faint, or lacks, subterminal tail band.
- the underside is a washed out rufous

LEGS

- the legs and feet are yellow
- the talons are black

Immature Fuertes (fuertesi) - Perched

HEAD

- much of the head is a medium, neutral brown paler than adults'
- the mustache mark may be obscure or absent
- the chin and throat are white as are the lores
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally
- the cere is light greenish to olive-buff
- the eye is dull yellow to brownish cream

BODY

- the underparts are all white from the chin to the tail

- elongated darker markings form a belly band that tends to be heart-shaped and can cover a larger area. It may be lighter or darker.
- the back is dark brown with white mottling that can form a "V"

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark and nearly reach the tail tip

TAIL

- from below it is a dingy brown
- from above, the tail is brown and heavily barred like the "Eastern" Red-tailed Hawk (*borealis*)

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Fuertes (*fuertesi*) - Flight

- a brown headed, dark brown backed bird
- the underparts white from the breast to the tail with little or no dark belly band
- the upper tail surface is reddish with subterminal banding more or less evident
- the patagial markings on the underwings are very pronounced
- the dark primary tips and trailing edge of the wing are evident as are darker wrist marks
- they may appear longer-winged than the adult "Eastern" Red-tailed Hawk (*borealis*)

Immature Fuertes (*fuertesi*) - Flight

- the head is a lighter brown than the adults but otherwise similar at a distance
- the underparts of the body are white often with a darkly streaked belly band that is more distinct than in many adults
 - the underwing pattern is similar to the adult pattern and the patagial always shows on immature "Fuertes" Red-tailed Hawk although all immature Red-tailed Hawks show less than adults. The trailing edge is lighter and narrower than in adults.
- the upper surface of the tail is brown with numerous dark transverse bands
- immatures may appear to have narrower wings than adults and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. the Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (*krideri*) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (*harlani*) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (*krideri*) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard" which is an early name for hawks and vultures. The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of

southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Fuentes" Red-tailed Hawk (*B. j. fuertesii*)

- breeds from extreme southeastern Arizona, southern New Mexico, and southwestern Texas, and into Mexico.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some

birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter.

Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near

nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets

in some studies. Other studies have indicated the following range of dietary compositions:

Birds 4 to 58 percent
Herptiles 0 to 41 percent
Invertebrates 0 to 21 percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may

occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies

must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Harlan's light

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal buteo, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest buteos, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Harlan's (harlani) Light-morph - Perched

This plumage is reportedly quite rare and has not been adequately described in literature. It is reputedly similar to the "Kridler's" Red-tailed Hawk (kridleri), so the description is presented here with modifications made as available. Overall, birds have a stark blackish brown and white appearance.

HEAD

- variably white with dark brown streaking that may extend over the nape
- the top of the head has some streaking
- the superciliary and cheek area is white
- a dark line may extend through the eye
- the mustache mark is variable
- the chin and throat are white
- the sides of the neck lack any rufous wash
- the beak is black at the tip grading to blue at the base
- the cere is yellow
- the eye is brown

BODY

- the underparts are mostly light to all white with the belly band streaked lightly to moderately
- the blackish brown back and upper wing coverts may be heavily mottled white

WINGS

- the scapulars are mottled with white but most birds lack the pale mottling on the middle wing coverts
- the primaries are dark brown and may reach the tip of the tail

TAIL

- three variations of tail are described:

1. a dirty white to gray with a mottled and irregular dark terminal band
2. a dirty white to gray with a black subterminal band and six to eight narrow black inner bands
3. any one of the above tail patterns can have various amounts of rufous on outer part of tail, be it white, gray, or banded.

LEGS

- the legs and feet are yellow
- the talons are black

Immature Harlan's (harlani) Light-morph - Perched

Note: Overall, the plumage is similar to the adult except for some variation in the tail.

HEAD

- variably white with browner streaking that may extend over the nape
- the top of the head is white
- a dark line may extend through the eye
- the mustache mark is dark and usually visible
- the superciliary (above the eye) and cheek area are white
- the chin and throat are white
- the beak is black at the tip grading to blue at the base
- the cere is yellow green
- the eye is light

BODY

- the underparts are mostly light to all white with the belly band evident
- the brown back and upper wing coverts are less heavily mottled with white than in the "Kridler's" Hawk (krideri)

WINGS

- the coverts are mottled with white
- the primaries are brown and do not reach the tip of the tail

TAIL

- the upper surface of the tail is light brown with often very wide numerous dark transverse bands and a grayish to white tip but a rufous wash may be evident
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have longer, narrower wings than adults and the tail is longer

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Harlan's (harlani) Light-morph - Flight

- the head and underparts of the body look quite white
- dark belly band variable
- the back and upper wing coverts are blackish brown and mottled with white
- the underwing is generally whitish with strong dark patagial marks
- the primary tips are gray or black as is the trailing edge of the wing
- the upper surface of the tail shows variations of white to grayish coloration with a dark subterminal band and perhaps a series of narrow dark bands or a wash of rufous

Immature Harlan's (harlani) Light-morph - Flight

- overall, the immatures are similar to the adults
- variable belly band present
- the underwing is light and variably banded with evident dark "patagial" marks and wrist patches
- the primary tips are dark with light bands
- the tail may be brownish with wide dark bands

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. the Red-tailed Hawk does not soar with its wings in a

dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (*krideri*) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (*harlani*) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (*krideri*) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard" which is an early name for hawks and vultures. The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding

Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Harlan's" Red-tailed Hawk (*B. j. harlani*)

- breeds in the interior from west-central Alaska, southern Yukon, and northwestern British Columbia.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large

water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to

have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps

this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of

bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has

increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Harlan's dark

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal *buteo*, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest *buteos*, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Harlan's (harlani) Dark-morph - Perched

Note: Both a light and dark morph are described for "Harlan's" Red-tailed Hawk (harlani) by those who choose to recognize it as a valid subspecies and not merely a color variant of one of the western subspecies. The dark morph is the most common and a number of intergrades have been described for both morphs as well.

HEAD

- black overall
- chin and throat are black
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown

BODY

- the entire body is black on the upper and under surface
- the breast may be solid black or have white speckling or mottling
- the undertail coverts are dark with white mottling

WINGS

- the upper wings are similar to the back, being black
- the primaries are black and they do reach the end of the tail in this race

TAIL

- three variations of tail are described:

1. a dirty white to gray that is mottled with an irregular dark terminal band
2. a dirty white to gray with a black subterminal band and six to eight narrow black inner bands
3. any one of the above tail patterns can have various amounts of rufous on the outer part of the tail, be it white, gray, or banded.

LEGS

- the legs and feet are yellow
- the talons are black

Immature Harlan's (harlani) Dark-morph - Perched

HEAD

- blackish brown overall
- chin and throat dark brown
- the beak is blackish at the tip and a lilac gray basally
- the cere is light greenish to olive-buff

BODY

- the back is blackish brown
- the underparts are all black or blackish with white streaking on the breast and white

mottling on the belly

- the undertail coverts are barred black and white

WINGS

- the upper coverts are blackish brown
- the primaries are dark

TAIL

- from below it is a dingy brown
- from above, the tail brown with numerous dark transverse bars that are usually wavier than other Red-tailed Hawks
- a white tip
- wings tips do not reach the tip of the tail

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Harlan's (harlani) Dark-morph - Flight

- overall, this is a blackish bird on the head underside and upperside with white streaking on a black breast
- the wings may be held in a slight dihedral when soaring
- the underwings are grayish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts are black and show no patagial mark but they may be speckled with white
- the usually dark "comma" mark just beyond the wrist near the base of the primaries is not apparent
- the flight feathers are silvery and barred with dark and the dark tips have light cross barring when seen from beneath
- the upper surface of the tail shows variations of white to grayish coloration with a dark subterminal band and perhaps a series of narrow dark bands and may show some rufous on outer area.

Immature Harlan's (harlani) Dark-morph - Flight

- the head and entire body may be all black or appear blackish brown except for the white breast streaking and white belly mottling
- the underwing pattern is similar to the adults with blackish coverts often with white speckling
- the flight feathers are barred with dark tips beneath but the thick dark band on the trailing edge is absent
- the upper surface of the tail is brown with numerous wide dark transverse wavy bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- the undertail coverts are barred black and white
- immatures may appear to have longer, narrower wings than adults and the tail is longer
- primary feathers and primary coverts are paler than secondary feathers; pale primary panel, or "window", on underside.

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for

similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. the Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (harlani) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (krideri) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuentes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus Buteo is Latin for "buzzard" which is an early name for hawks and vultures. The species name jamaicensis is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends

from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. These are:

"Harlan's" Red-tailed Hawk (*B. j. harlani*)

- breeds in the interior from west-central Alaska, southern Yukon, and northwestern British Columbia.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. the Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental

conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwir" call. Other notes include a

series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is

not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Krider's

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal *buteo*, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Krider's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest *buteos*, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Immature Krider's (*kriderii*) - Perched

Overall, the plumage is similar to the adult except for some variation in the tail.

HEAD

- variably white with browner streaking that may extend over the nape
- the top of the head is white
- a dark line may extend through the eye
- the mustache mark is variable
- the chin and throat are white
- the beak is black at the tip grading to blue at the base
- the cere is greenish

BODY

- the underparts are mostly light to all white with the belly band evident, but much reduced
- the neutral back and upper wing coverts are heavily mottled with white

WINGS

- the coverts are mottled with white
- the primaries are brown

TAIL

- whitish tail with, on average, several narrow dark bands and sometimes with no banding on the basal half
- the tail may also resemble the eastern immature and be brownish with many horizontal dark bands

LEGS

- the legs and feet are dull to greenish yellow
- the talons are black

Adult Krider's (*kriderii*) - Flight

- similar to "Eastern" Red-tailed Hawk (*borealis*) but much lighter overall
- the head and underparts of the body look very white
- no belly band on adults
- the back and upper wing coverts are tan brown and heavily mottled with white
- the underwing is generally whitish with the dark patagial marks much reduced or absent and tend to be tan to brown in color
- the primary tips are gray or black as is the trailing edge of the wing
- the top of the tail may be whitish near the base with a rufous terminal area and a dark terminal band.

Immature Krider's (*kriderii*) - Flight

- overall, the immatures are similar to the adults

- large white wing patches are evident on the upperside of the primaries and primary greater coverts
- whitish tail on top with many more than three narrow dark bands and sometimes with no banding on the basal half
- the tail may also resemble the eastern immature and be brownish with many horizontal dark bands
- there may often be a white "U" above the base of the tail
- patagial marks are very reduced, almost absent

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. the Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (harlani) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (krideri) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus Buteo is Latin for "buzzard" which is an early name for hawks and vultures.

The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Krider's" Red-tailed Hawk (*B. j. krideri*)

- breeds in the Great Plains from southeastern Alberta, southern Saskatchewan, and southwestern Manitoba south through Montana to central Wyoming and east to northwestern South Dakota and central North Dakota. Some authorities consider this to be a color morph of either the "Western" Red-tailed Hawk (*B. j. calurus*) or The "Eastern" Red-tailed Hawk (*B.j. borealis*).

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.

2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.

3. Resident coastal birds along the British Columbia coast to Alaska.

4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of

birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little interaction has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and

hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8

centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories

may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Florida

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal buteo, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest buteos, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Florida (*umbrinus*) - Perched

Overall, this race is much like the "Eastern" Red-tailed Hawk (*borealis*) but the tail has narrow and incomplete dark bands in addition to the subterminal dark band. Color morphs are not reported. Because this race is so similar to the "Eastern" Red-tailed Hawk, and plumage descriptions are sparse in the literature, the description for the "Eastern" Red-tailed Hawk (*borealis*) is reproduced here with minor changes. The underparts are more richly colored, like a "Western" Red-tailed Hawk. The "Florida" Red-tailed Hawk is a long-winged race.

HEAD

- generally brown over the sides and top giving a "hooded" appearance
- a blackish mustache mark is usually present at the sides of the chin
- chin and throat white in the center but streaked with brown on the sides and may be darker than the "Eastern" Red-tailed Hawk (*borealis*)
- forehead may or may not have much whitish feathering
- the lores are whitish
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown with a dark pupil

BODY

- the upper breast through to the tail is white or slightly buffy with variable amounts of dark markings
- these markings often become extensive and form a dark "belly band"
- the flanks are mottled or barred
- the back and upperparts are a mixture of browns, and dark browns with white markings that may form a "V"

WINGS

- the upper wings are similar to the back but some coverts may have whitish edgings
- the primaries are dark but some light barring may be evident and they come very close to reaching the tip of the tail.

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red with narrow, incomplete, transverse black bands and a black band near the whitish tip or even multiple dark bands

LEGS

- the legs and feet are yellow to olive yellow
- the talons are black

Immature Florida (*umbrinus*) - Perched

HEAD

- much of the head is a medium brown, and darker than in the "Eastern" Red-tailed Hawk

(borealis); more similar to the "Western" Red-tailed Hawk

- the mustache mark is always seen
- the chin and throat are streaked to all dark
- the lores are light
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally
- the cere is olive-buff
- the eye is dull yellow to brownish cream

BODY

- the underparts are all white from the chin to the tail
- elongated black markings form a belly band that is often heavier than in the "Eastern"

Red-tailed Hawk (borealis)

- the back is dark brown with white mottling that can form a "V"

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark
- wings much shorter than tail

TAIL

- from below it is a dingy brown
- from above, the tail is grayish brown with about nine dark transverse bars and a white tip

LEGS

- the leg feathers are usually barred
- the legs and feet are dull to greenish yellow
- the talons are black

Adult Florida (umbrinus) - Flight

- this buteo has a brown head and back, light underparts and a red tail, particularly noticeable on the upper surface
- the breast and belly are buffy to rusty with a dark belly band that is variable in extent and always present. The breast appears cleanly buffy and unstreaked.
- the back is dark brown as are the upper surface of the wings and a whitish "V" may be noticeable
- the wings may be held in a slight dihedral when soaring
- the underwings are whitish with dark tips on the primaries extending around to form a dark trailing edge on the wing
- the coverts may be tinged rufous and show a strong dark "patagial" mark on the leading edge which is distinctive
 - seen head on, the leading edge of the wing between the wrist and the patagial area is very white, giving the impression of aircraft landing lights coming towards the viewer
- the upper surface of the tail is rufous to deep red with a dark subterminal band, a white tip, and numerous inner tail bands. The rufous shows on the undersurface but less intensely.

Immature Florida (umbrinus) - Flight

- overall, this race is more heavily marked in the immature plumage than are most individuals of the "Eastern" Red-tailed Hawk (borealis)
- the head is a lighter brown than the adults but otherwise similar at a distance
- the underparts of the body are white with a darkly streaked belly band that is more

distinct than in many adults

- the back is a more neutral brown with the upper surface of the wings generally similar except that the primaries are lighter than the secondaries
- the underwing pattern is similar to the adult pattern with dark "patagial" and "comma" marks but the trailing edge is lighter and narrower
- the upper surface of the tail is light brown with numerous dark transverse bands and a grayish to white tip
- the undertail may also show the dark transverse barring against a brownish background
- immatures may appear to have longer, narrower wings than adults and the tail is longer

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. The Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (*krideri*) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (*harlani*) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (*krideri*) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard" which is an early name for hawks and vultures. The species name *jamaicensis* is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieve."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about 50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Florida" Red-tailed Hawk (*B. j. umbrinus*)

- breeds in peninsular Florida.

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.

2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.

3. Resident coastal birds along the British Columbia coast to Alaska.

4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species,

behavioral routines are adjusted to minimize interactions. the Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season, disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward

and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic

habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary by location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds	4	to	58	percent
Herptiles	0	to	41	percent
Invertebrates	0	to	21	percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and

some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Red-tailed Hawk - Alaska

Buteo jamaicensis

GENERAL DESCRIPTION

If there is an archetypal *buteo*, then, perhaps the Red-tailed Hawk is it. This widespread hawk is a large, comparatively broad-winged soaring species that occupies a wide range of habitats. The average wingspan is about four feet (1.24 meters) and the average length is just under two feet (0.62 meters). Plumage variation is great but in very general terms. There are light-morph birds that have brown backs and red tails with whitish underparts variously marked with dark streaking, and there is another large group of dark-morph birds that are dark brown to blackish colored all over the body and upper wings with two-toned light and dark underwings and tails that vary from rufous through to whitish gray with dark bands. An enormous range in plumage variation occurs across the range of this species with intergrades and degrees of intensity resulting in perhaps the most complex raptor in North America to identify correctly at the subspecific level, and occasionally, at the species level.

The "Western" Red-tailed Hawk has light, rufous, and dark-morphs, the "Harlan's" has light but predominantly dark-morphs, the "Eastern" has only a light-morph, the "Kriger's" is a pale variant of the "Eastern" race, the "Florida", and "Fuertes", and Alaska Red-tailed Hawk all have only a light-morph.

SIZE

The Red-tailed Hawk is one of the largest *buteos*, with a wingspan ranging from 43 to 56 inches (109.2 to 142.2 centimeters) depending upon the sex, population or author you are dealing with. Females are larger than males and vary in length from 20.5 to 25 inches (52.1 to 63.5 centimeters) with wingspans up to 56 inches (142.2 centimeters). It weighs from 32 to 50 ounces (914 to 1,429 grams). Males vary in length from 18 to 22.5 inches (45.7 to 57.2 centimeters) with wingspans up to 45 inches (114.3 centimeters). It weighs from 27 to 39 ounces (771 to 1,114 grams).

Eastern birds tend to have wingspans ranging from 43 to 52 inches (109.2 to 132.1 centimeters) and average 47 inches (119.4 centimeters) while western populations range from 47 to 56 inches (119.4 to 142.2 centimeters) and average 51 inches (129.5 centimeters).

MORPHS AND MOLTS

This is a highly variable species with light, rufous, and dark-morphs. Only the "Western" Red-tailed Hawk has morphs, the rest are subspecies except the "Harlan's" Red-tailed Hawk. There is great variation due to interbreeding. The question of taxonomy in this species still appears to be confused and it is not safe to say that certain subspecies are dark while others are light, as each taxonomic grouping appears to have plumage variations that may fit into any of these color morphs. The rufous and dark-morph only breed in the West, that is west of the Rocky Mountains. Subspecies are found within a fairly specific range with overlap at the fringes.

The juvenile plumage is retained for nearly a year with the molt into adult plumage starting during the following breeding season. Molt into the adult plumage takes about 100 to 120 days and is complete by early fall of the second calendar year. Thus "adult" birds first start appearing at about 1.5 years of age.

SPECIFIC DESCRIPTION

The many variations of plumage within each subspecies result in birds that may be difficult to assign to a race on the basis of plumage. The following descriptions refer to recognizable forms, with comments about taxonomic association where appropriate. In particular, western forms may not be safely assignable to subspecies from plumage descriptions. The sexes are alike except for size, although females average larger.

Adult Alaska (alascensis) - Perched

This race is not well described and is not likely easy to separate in the field from other western variants. The colors are generally more saturated than many other western Red-tailed Hawks.

HEAD

- generally dark all over
- a blackish mustache mark is usually present at the sides of the chin
- chin and throat dark
- the beak is blackish but grades to bluish near the base
- the cere is yellow
- the eye is brown

BODY

- the upper breast through to the tail is more rufous than white with variable amounts of dark markings that are more reddish brown
- the belly band is heavy and there is much barring on the underside
- the flanks are barred
- the back is much darker than the normal "Western" Red-tailed Hawk (calurus)

WINGS

- the upper wings are similar to the back but some coverts may have whitish edgings
- the primaries are dark and the wings short so they may not reach the end of the tail in this race

TAIL

- the underside is a washed out rufous color with faint dark banding near the tip
- the upperside is rufous to deep red and heavily banded with a wider black band near the whitish tip

LEGS

- the legs and feet are yellow to olive yellow
- the talons are black

Immature Alaska (alascensis) - Perched

Note: Overall, the brown colors are darker and very heavily saturated, more than in a light-morph "Western" Red-tailed Hawk.

HEAD

- much of the head is streaked brown
- the mustache mark is present
- the chin and throat are darkly streaked to all dark
- the lores are whitish
- a whitish spot on the rear crown may be visible
- the beak is blackish at the tip and a lilac gray basally

- the cere is olive-buff
- the eye is dull yellow to brownish cream

BODY

- the breast area is lightish
- elongated black markings form an extensive belly band
- the back is dark brown with minimal white mottling
- the leg feathering has brown barring

WINGS

- the upper coverts are dark brown
- the scapulars may show buff to white markings
- the primaries are variably grayish or dark
- the wings are shorter than the tail

TAIL

- from below it is brown and evidently banded
- from above, the tail is grayish brown with numerous dark transverse bars and a white tip

LEGS

- the legs and feet are dull to greenish yellow

Adult Alaska (alascensis) - Flight

- this buteo has a brown head and back
- the rufous undersides are heavily marked and the dark belly band is extensive
- the tail is rufous with extensive, dark banding
- the underside of the wingtips are dark and this continues along the trailing edge of the wing to form a dark band
- the "patagial" marks are prominently dark

Immature Alaska (alascensis) - Flight

- the underparts of the body are darkly streaked with an extensive belly band and dark area on the upper breast and throat
- the back is brown with the upper surface of the wings generally similar except that the primaries show a light panel at the base
- the underwing pattern is similar to the adult pattern with dark "patagial" marks but the trailing edge is lighter and narrower
- the tail looks broadly banded with numerous dark bands

SIMILAR SPECIES

Depending upon age, race and color morph, the Red-tailed Hawk could be mistaken for similar variants of Swainson's, Ferruginous, Rough-legged, Red-shouldered, Broad-winged, and perhaps Short-tailed hawk. The Red-tailed Hawk does not soar with its wings in a dihedral as do the Swainson's Hawk and the wings are wider at the base, giving the bird a much stockier appearance. Assuming good views of these similar species are obtained, separation may be organized as follows:

Light-morph Adults

- the upper surface of the tail is rufous-colored, unlike any other light plumaged buteo except the Ferruginous Hawk. This latter species also has a rufous-colored back and reddish tarsal feathering that are not characteristic of any other light buteo. The Red-tailed Hawk

also has whitish underwings with black tips and dark patagial marks, unlike any other buteo. "Krider's" Red-tailed Hawk (krideri) does not have the reddish tarsal feathering of the Ferruginous Hawk.

Dark-morph Adults

- dark western or rufous morphs of the Red-tailed Hawk usually has some degree of reddish coloring in the tail which is not present in dark morphs of other buteos. The tail of "Harlan's" Red-tailed Hawk (harlani) is more variable and may have rufous near the tip or appear more blackish or narrowly dark and white banded. This latter race may also have some whitish streaking on the breast set against a generally black body, further distinguishing it from Common Black-Hawk, Zone-tailed Hawk or the dark Rough-legged Hawk.

Immatures

- immature, light-plumaged birds retain the dark "patagial" mark on the underwing that is not found on the Red-shouldered, Broad-winged, Swainson's, or White-tailed hawk. Immatures of the "Krider's" Red-tailed Hawk (krideri) have the dark "patagial" marks. Immature Red-tailed Hawks all have a distinct light panel, or "window", on the upper primary and primary greater coverts which is shared by no other buteo species. Dark-morph immature Red-tailed Hawks usually have light breast markings and many dark bands on the brown tail. The immature Zone-tailed Hawk is more blackish with white spots on the underbody and the immature Common Black-Hawk has more tawny feathering on the breast with dark streaking, dark flank patches, and a patterned head.

OTHER NAMES

The Red-tailed Hawk is also referred to as the "Eastern Red-tailed Hawk", "Florida Red-tailed Hawk", "Fuertes Red-tailed Hawk", "Harlan's Hawk", "Krider's Hawk", "Western Red-tailed Hawk", "Buzzard", "Chicken Hawk", "Gopher Hawk", "Hen Hawk", and "Redtail."

ETYMOLOGY

The genus Buteo is Latin for "buzzard" which is an early name for hawks and vultures. The species name jamaicensis is the Latin word for the locality where the first individual was described. Red-tailed clearly refers to one of the commonly seen field marks and Hawk is likely from the Teutonic word "hab" meaning to "sieze."

MYTHOLOGY

There is none documented for North America.

RANGE

The breeding range of the Red-tailed Hawk is likely the largest of all, diurnal North American raptors. It is very close, if not equal, to that of the American Kestrel. It extends from western Alaska eastward across the forested belt of northern Canada to about the middle latitudes of Quebec and onwards to include the Maritime provinces, excluding Newfoundland. Breeding continues in most habitats throughout the entire United States into south central Mexico and disjunctly into Costa Rica and Panama. On the east coast, breeding occurs south through the Bahamas to the Greater and Lesser Antilles.

Wintering birds can be found from the southern portions of the Canadian breeding range south throughout the remainder of the north and central American range.

Year-round, the Red-tailed Hawk is found from extreme southern British Columbia (about

50 degrees of latitude), southern Ontario, Quebec, and Nova Scotia with very low winter populations across the Canadian prairies. Whether these birds are truly resident or are winter replacements from northern migrant populations is not known, but from parts of southern Canada and the north-central United States south, the Red-tailed Hawk is usually considered a resident species. Southern numbers are altered by incoming wintering birds. Winter densities are quite low in Montana, the Dakotas, Minnesota, and Wyoming but numbers increase dramatically in the winter as one proceeds south, east, or west, from these states.

Twelve to 16 subspecies are listed for the world, all of which occur in North or Central America. Again, depending upon taxonomic philosophy, five to seven subspecies occur in North America. The distribution for this subspecies is as follows.

"Alaska" Red-tailed Hawk (*B. j. alascensis*)

- breeds along the Pacific coast from southeastern Alaska through British Columbia, probably including offshore islands. Some consider this to be a color morph of the "Western" Red-tailed Hawk (*B. j. calurus*).

The remaining subspecies occur in Mexico, Central America, and the Antilles.

MIGRATION

Migration can be grouped into several patterns related to the geographic origins of the individuals. These are:

1. Northern breeders that migrate south to winter essentially within the North American range of southern residents.
2. Interior birds between latitudes 43 to 48 degrees that vacate their breeding territories for shorter periods of time and move varying distances.
3. Resident coastal birds along the British Columbia coast to Alaska.
4. Southern residents that do not migrate but young birds are displaced into areas not held by territorial birds.

In the north, fall migration begins in some areas with post-nesting dispersal and some wandering before southern movements are consistent. Southern migration is underway throughout Canada during August and continues through the northern United States until mid December. The peak movements at these latitudes for northern birds are from mid September through mid November with more immatures moving during the first two months than during the last month. At Hawk Mountain, Pennsylvania, the peak movement of the Red-tailed Hawk is from October 20 to November 10, but migrants can be seen from early September to mid December.

Although the Red-tailed Hawk moves over a wide front, thousands per day can pass key topographic features that concentrate them, particularly in eastern North America. Large water bodies, such as the Great Lakes, concentrate birds and funnel them along the shore towards suitable terrestrial bypass routes or narrow water crossings. Ridges that trend in a beneficial direction such as the Appalachian Mountains, create air currents and concentrate migrant birds that can be viewed by the hundreds or thousands per day as they pass. South trending winds and storm fronts push birds ahead of them as migrants take advantage of the improved flying conditions. Over grasslands, birds take advantage of small topographic features to gain lift and they utilize thermals to gain altitude as the heat of the day

progresses. Thermals are also used to great advantage over a variety of other terrain's. In general, the Red-tailed Hawk seems to attempt to fly directly to their migration goals.

The fall dispersal of mid-latitude immatures occurs in a variety of directions with some birds even moving north. The distances traveled vary from less than 50 to over 1,000 miles (80 to 1,600 kilometers). Fledglings from these areas may return to within five miles (8 kilometers) of their nest to set up new territories.

Spring migration through the northern United States and southern Canada occurs from March through May as some migrants overfly residents already involved in their breeding cycle. Movement out of Mexico occurs during February and some migrants have arrived in southern New York state by mid February. The origins of such early migrants are uncertain and may be birds that wintered not far to the south.

BEHAVIOR

The flapping flight is relatively slow and direct. Wing beats have been calculated at 2.6 beats per second. In general, the Red-tailed Hawk flaps less than other buteos, except the Ferruginous Hawk. Ground speed has been estimated at about 40 miles per hour and air speed at 55 miles per hour (88 kilometers per hour). Soaring is a frequently-used flight strategy with the wings held, at times, in a slight dihedral. It is capable of holding motionless in the wind (kiting) with no wing beats. During migration, soaring has been reported to about 3,000 feet (4,800 kilometers) above ground. From an energy cost-benefit perspective, it has been suggested that soaring is not an efficient behavior for either hunting or thermoregulation. Other reasons for soaring include migration, exploration, territorial advertisement and courtship. Walking on the ground is slow and awkward but hopping when hunting is energetic.

Hunting strategies are versatile but may be grouped into the following 11 broad categories:

Perch and Wait

- this successful technique is used more than 80 percent of the time. Any elevated site may be used but, frequently trees, fence posts, power lines or other man-made structures are used.

Ground Pursuit

- hopping across the ground in pursuit of invertebrates is often seen in younger birds.

Flap or Glide

- maintaining an altitude of 200 feet (62 meters) or lower, the birds will quarter over the countryside much like a harrier. This style may be used closer to the ground as the hawks will dodge behind and between bushes, rocks or other obstacles to remain unseen as they approach prey.

Hovering

- using quickened wingbeats in order to maintain position, Redtails will survey the ground in search of prey.

Soaring

- it has been suggested that this is an inefficient, and ineffective, method for hunting, but stoops on potential prey are sometimes made from a high soar.

Cooperative Hunting

- mated pairs may close in on a quarry and cooperate on the kill.

Piracy - the Red-tailed Hawk has been seen robbing other raptors.

Aerial Foraging

- birds will occasionally sail in mid-air to catch large flying insects such as grasshoppers.

Accipiter Method

- often, in combination with the flap-glide flight, the Red-tailed Hawk will maneuver through stands of conifers in a goshawk-like manner.

Falcon Method

- the Red-tailed Hawk has been seen making fast stoops, like a falcon, specifically in pursuit of bats.

Carrion Eating

- the eating of freshly-killed animals is well-documented.

When swooping on prey, the wings are set into a glide pattern about 15 feet (4.7 meters) from the animal. At 10 feet (3.1 meters), the legs are extended and the final strike usually made with one foot farther ahead than the other. On impact, the bird then drops onto its "heels." The relative impact is less than that of large falcons, the Northern Goshawk or even the Cooper's Hawk. Small prey is carried to a feeding perch and may be swallowed whole. Birds are beheaded and plucked and larger mammals may be beheaded. If the prey is large, it may be partially dismembered and consumed before being taken to a feeding perch. Caching has been noted. Excess food not consumed at the nest is carried away. For the first four to five weeks, prey brought to the nest is torn into small pieces by the female before being given to the young. After this period, the nestlings tear apart their own food.

Inter-nest distances vary considerably and have been measured at slightly more than 0.5 miles (0.8 kilometers) to as much as 5 miles (8 kilometers) in one study area in Alaska. Territories may have common boundaries based upon interactions between adjacent pairs of birds. Buteos tend to have separate territories or if they do overlap with another species, behavioral routines are adjusted to minimize interactions. The Red-shouldered and Red-tailed Hawk are intolerant of each other and antagonistic with the Red-tailed Hawk being more dominant. The Red-tailed Hawk is also very antagonistic towards the Golden Eagle in California but little inter-action has been noted on other study sites. The hawk has shown aggression towards the Great Horned Owl but inter-nest distances between the two species have been recorded as close as 100 feet (31 meters). In a number of studies, where these two species attempted to nest in close proximity, the owl nests tended to be more successful. During the winter, the Red-tailed Hawk exhibits varying degrees of aggressive interaction towards each other, in attempts to maintain a winter territory. Behaviors vary from posturing, feather ruffling and eye contact through to full in-flight displays.

Most Red-tailed Hawks typically occur singly or in pairs, except during migration or around aggregated food supplies. Social interactions during these occasions seem to be minimal and the phenomena appear to be related to temporarily favorable environmental conditions as opposed to furthering social functions.

Nesting Red-tailed Hawks were shown to habituate to helicopter overflights with no apparent decrease in nesting success in one study. Other studies suggest that populations of Red-tails that have been exposed to human beings for long periods of time show less aggression towards human intruders than do populations that have had a shorter period of exposure.

The size of the home range varies with topography, habitat structure, season,

disturbance and food availability. There may be consistent differences between males and females during the non-breeding seasons. In one Wisconsin study, the mean home ranges of males varied from a summer low of 292 acres (118 hectares) to a fall high of 975 acres (395 hectares). The mean sizes for females were considerably smaller except during the winter. Other studies have shown home ranges to vary from 600 to 1,150 acres (243 to 466 hectares). The home range is defended as a territory but defense intensity may decrease with distance from the nest.

Nesting densities have been recorded as low as one pair per 18 square miles (47 square kilometers) in sub-optimal Alaskan habitat to as high as one pair per 0.5 square miles (1.3 square kilometers) in California. The average has been suggested as one pair for every 2.2 square miles (5.7 square kilometers).

The pair-bond typically is lifelong monogamy. In non-migratory birds, the bond is maintained throughout the year. In the event of a lost mate, acquisition of a new partner can occur quickly and has occurred within one day. Courtship flights include high-circling, tilting and sky-dancing. Other territorial and or courtship behaviors include high-perching, whirling flight and boundary patrol flights.

"High-circling" has been seen in all seasons and may be a precursor to a number of activities. Birds rise high above the terrestrial territory and soar in wide circles, at times joined by other birds that may be from adjacent territories. This practice is an integral part of early phases in the breeding cycle and evolves into other flight activities that are preludes to copulation.

"Tilting" is performed by males in the spring and it may serve to reinforce the pair bond, although it does not seem to be performed on territory. With wings spread, tail partly spread, legs down and talons spread, the male circles slowly while tilting first one wing and then the other in a rocking motion. This position is maintained for some time and a female is always nearby.

The "sky dance" consists of a bird rising to a high altitude, pushing the wings forward and holding the tips in tightly then plunging in a steep dive at a high rate of speed. At the bottom of the plunge, the bird checks its speed and then shoots upward at about the same angle as the dive. This is repeated in series until the bird vanishes from sight. The purpose is to designate territorial boundaries and occurs before and well into the incubation period. Whether both sexes undertake the activity is not known.

While soaring fairly high, birds will suddenly "whirl" on one wing tip and rotate in a full circle. This may serve as territorial advertisement.

Mostly, copulation occurs when the female finishes a courtship flight and lands on a perch from which she will posture by holding her back in a horizontal position and fluttering her wings. The male lands on her back and copulates for a period of five to 12 seconds. Afterwards, the pair may perch quietly or perform aerial acrobatics. The frequency and span of time over which copulation may occur seems to be unrecorded.

The oldest known wild individual was 21.5 years old and a captive bird was known to have lived 29.5 years. The average mortality rate in the first year is about 54 percent and the mean annual mortality rate is about 20 percent after that. Only about 10 percent of hatchlings may be alive at age six and about 2 percent by age 13 years. Having reached age two, birds may be expected to live four to five more years. In order to maintain a stable population, it is estimated that each pair must produce between 1.33 to 1.38 young per breeding attempt.

Mortality is due to shooting, trapping, collision with automobiles, the accidental ingestion of lead shot, poisoning from rattlesnakes, starvation of nestlings, nest predation by owls and mammals, trampling of nestlings by the parents, death of nestlings due to flies and other parasites, nestling death due to exposure, falling from the nest, human interference near nests and various diseases. Pesticide contamination has been determined but it does not seem to be the cause of any significant reproductive failures.

ADAPTATIONS

The Red-tail Hawk is an adaptable predator that is able to change to a new prey base if one source of food declines. Its numbers are not tied to a particular combination of prey species.

HABITAT

In general, the Red-tailed Hawk inhabits open areas interspersed with patches of trees or similar structural features. The degree of openness preferred in forested habitat is greater than for sympatric species such as the Broad-winged or Red-shouldered hawk. In open, grassland country, the Red-tailed Hawk prefers areas with more, and taller, perch sites than do the Ferruginous, Swainson's, or Rough-legged hawk. Habitat types include scrub desert, montane grasslands, plains, agricultural pastures, urban parklands, deciduous and coniferous woodlands and tropical rainforest. Possibly only the Peregrine Falcon shows an ability to utilize as many or more habitat types than does the Red-tail.

During the nesting season, birds may be found from sea level to at least 9,000 feet (2,790 kilometers). Birds prefer a tall tree with good aerial access. They will nest in a wide range of habitats including spruce forests, aspen stands, wooded stream valleys, woodlands in canyons, woodlots, saguaro deserts, deciduous woodlands or even arid canyonlands. Only the treeless arctic tundra has not been occupied by nesting Red-tailed Hawks.

Winter habitats may tend to be more open with upland pastures, grasslands and hardwood forests being more preferred in some regions. In general, however, the basic habitat types are similar on a year-round basis except for those birds that migrate from the more northerly boreal forests and winter in grasslands or other southern habitats.

The availability of perches is critical for this "sit and wait" type of predator. The availability of tall trees for nesting with foraging habitat nearby is important in many areas but nest sites are not always in trees if the region is generally non-forested. In this latter situation, cliff sites or other elevated locations may be used for nesting.

VOICE

The common call is a down-slurred scream given in flight or from a perch. Sometimes described as "tsee-eee-arr", it is hoarse, sibilant and may vary in pitch, reminding one of a cat scream at greater distances. The function is likely territorial. Following a territorial encounter, individuals of mated pairs will utter a loud "chwirk" call. Other notes include a series of low, raspy "hrrrr" sounds, grunting or quacking "gank" calls and hunger calls similar to those of the nestlings. During courtship, a loud "chirk-chirk-chiruk" is given but perhaps this is the "chwirk" of other authors. The young utter soft, peeping notes and as they grow, softer versions of the adult scream as well as two-syllable "klee-uck" calls are given.

FOODS

A wide range of foods is eaten with vertebrate prey ranging in size from small mice to jackrabbits (0.5 ounces to about 4.5 pounds [14.3 grams to 9.9 kilograms]). Prey items vary

be location, season, availability or even between adjacent pairs or individuals, but in general, mammals make up the bulk of most diets either in the number of prey items or biomass. Many regional studies have been completed on the Red-tailed Hawk, making generalizations less useful, but mammals have comprised from 37 to 99 percent of the diets in some studies. Other studies have indicated the following range of dietary compositions:

Birds 4 to 58 percent
Herptiles 0 to 41 percent
Invertebrates 0 to 21 percent

In eastern North America, voles, various species of mice, rats, and cottontails make up a large part of the diet with other common prey including the Ring-necked Pheasant, Northern Bobwhite, and other birds. In the western portions of the Red-tailed Hawk's range, snowshoe hares, black-tailed jackrabbits, and various species of ground squirrels, are important components. Snakes are also common in western diets along with pocket gophers, waterfowl, and small birds such as the Western Meadowlark and European Starling.

A partial list of prey species, not ordered by importance, includes red squirrel, eastern cottontail, varying hare, black-tailed jackrabbit, shrews, moles, bats, voles, mice, rats, pocket gophers, Richardson's ground squirrel, Columbian ground squirrel, other ground squirrel species, chipmunks, muskrat, domestic fowl, Ring-necked Pheasant, Northern Bobwhite, Ruffed Grouse, Gray Partridge, quails, dabbling ducks, crows, Black-billed Magpie, Screech-Owls, Burrowing Owl, shorebirds, European Starling, meadowlarks, other passerines, desert spiny lizard, yellow-bellied racer, gopher snake, garter snakes, western rattlesnake, turtles, various frogs and toads, salamanders, crayfishes, grasshoppers, centipedes, spiders, other insects, and carrion including fishes, cow, horse, sheep, jackrabbits, bobcat, coyote, and skunk.

PELLETS

They generally measure about two inches (5.1 centimeters) by 1.5 inches (3.8 centimeters) but many are smaller than this. They may be flat with one rounded side and some may have one tapered end. One pellet may represent several meals over several days or birds may eject one every one to two days, depending upon food supply.

NESTING

The nest site varies widely depending upon local topography and vegetation. In forested areas, the nest is typically placed in the upper canopy of tall trees within woodlots or other fragmented forest clumps. It may be located within large tracts of unbroken forest. The nest tree may be taller than surrounding trees or on a higher slope. The nest tends to be placed near the edges of dense stands with more open rather than closed canopies. In areas where trees are scarce or absent, cliff faces, or artificial structures providing elevation above the landscape are used. Saguaro cacti is used in some desert locations. A common trait of nest sites is an unobstructed access from above and a good view of the surrounding landscape.

Both sexes build or refurbish the nest. The main nest is generally sticks and twigs from 0.5 to nearly 1 inch (1.3 to 2.5 centimeters) in diameter. The lining may include strips of bark, greenery, catkins, herbaceous plant materials, lichens and so forth. Typically, nests are over 30 inches in diameter and more than 15 inches high. The bowl is 4 to 5 inches (10.2 to 12.7 centimeters) deep and about 14 inches wide (35.6 centimeters). Nests may be refurbished and reused in subsequent years and so may become a little larger over time. Two or more nests may be built and not used.

The clutch size varies from one to four but is usually two or three eggs. The size

averages about 2.4 by 1.9 inches (61.0 by 48.3 millimeters) with some geographic variation. The eggs are smooth and non-glossy, white, and may have a light buffy wash. They may be sparsely, or heavily-marked, with blotches that vary from reddish-brown, dark brown, or purple. These may be indistinct and combined with fine speckling. Clutch replacement may occur within three to four weeks of the loss of the first eggs and rarely, a third set may be laid. Egg-laying in the southern United States occurs as early as February but for much of the range south of the 49th parallel, March is typically the month for laying. In Canada, and the northern states, late March through early May is typical depending upon latitude and local climate, whereas in Alaska, laying occurs from April through late May.

Incubation begins before completion of the clutch or with the first egg that is laid and is undertaken by both sexes. The incubation period is variously estimated at 28 to 35 days. The female probably does the incubating at night and most of the daytime sitting as well. She will depart to hunt while the male incubates.

Hatching occurs over a two to four day period with fledging reported from 42 to 50 days but likely closer to 46 days on average. The young are active by the second day as they issue soft calls and bounce and wave their wings. By day seven, the young will peck at prey in the nest and spend less time bobbing and peeping. The young will sit up by day 15 and show aggression towards intruders at day 16. Striking with talons and wings will occur by day 21 and regular exercise and wing-stretching take place by day 30. The female will brood the young until the oldest is about 30 to 35 days old.

After about 46 days, the young leave the nest but stay close for several days. They may remain quite sedentary or chase the parents begging for food. The young stay in the vicinity of the nest for 18 to 25 days with sustained flight possible about 18 days after fledging. The parents typically supply all of the food for the first three to four weeks after fledging. Capturing of small vertebrate prey occurs at about six to seven weeks but parents may still provide food until the eighth week after fledging. Association with the parents may last for 10 weeks in southern migratory populations and up to six months in non-migratory populations. After dispersal from the nesting territory, immatures from several territories may aggregate in an immature staging area.

Cooperative breeding involving two females and one male attending a single brood has been recorded at least twice. In both cases, the male provided food to the females who in turn fed the young. Reproductive success generally, depends upon prey abundance, perch density and distribution as well as the proximity of nests to congeners. Weather and its impact on hunting may impact reproductive success.

CONSERVATION

Deforestation in eastern North America and fire suppression in some areas of the west has led to an increase in patchwork forests favored by the Red-tailed Hawk. As a result, this species has been on the increase during the past century and has replaced some species of buteos that do not respond well to these kinds of management practices. A 70 percent population increase may have occurred between the 1940s and the 1970s. This situation is not expected to prevail where large areas become completely deforested, or extensive unbroken forested areas are the norm. The wintering population in North America has increased by about 33 percent since the early 1980s, with at least 350,000 birds present.

There is no indication that chlorinated hydrocarbons or other pesticides are causing reproductive failures at any significant levels. The major threats to this species are felt to be illegal shooting, automobile collisions and direct human interference with nesting.

Continued education about the value of raptors, and other birds, will assist in the

reduction of shooting but rigorous law enforcement will also be necessary. Forest management practices must recognize the site specific nesting requirements such as the maintenance of tall nest trees with clear access and good visibility. In some areas devoid of trees, artificial structures may be provided for nesting. However, management agencies must be careful not to enhance the Red-tailed Hawk at the direct expense of other buteos that may suffer due to habitat degradation or direct competition. The Red-shouldered, Ferruginous, and Swainson's hawk are some species of concern in this regard. Although it is noteworthy that in Oregon, late-arriving Swainson's Hawks usurped parts of Red-tailed Hawks breeding territories, in about 30 percent of the cases in one study. The Red-tailed Hawk tends to abandon those parts of the territories which have fewer perch sites, but on the outer portions of the territories, aggressive Swainson's Hawks could usurp more highly desirable territory that had moderate numbers of perches. Thus, the importance of managing perch sites when these two species are occupying similar habitats cannot be over-emphasized.

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Ferruginous Hawk

Buteo regalis

GENERAL DESCRIPTION

The Ferruginous Hawk is a large, long-winged buteo of the open, arid grasslands and shrub steppe country of the interior parts of North America. It occurs in a light and dark color phase with the latter being much less common in general. Its hunting and flight behavior is suggestive of a Golden Eagle and it survives primarily on small to medium-sized mammals and less so on birds. Although flexible in choosing a nest site and exhibiting a high reproductive potential, this bird's restriction to natural grasslands on the breeding grounds and specialized predation on mammals persecuted on rangelands may make conservation a continuous concern. It is migratory in the northern parts of its range but can be found year round in the mid and southwest United States. At times it has been considered threatened, endangered, or of concern on various threatened species lists but recent population increases in local areas, coupled with conservation initiatives, have created some optimism about the bird's future.

SIZE

This is the largest of the buteos and is often mistaken for an eagle due to its size, proportions and behavior. References are inconsistent in reporting the dimensions of this hawk, but all agree that the sexes overlap and the females average larger than the males. Reported length measurements range from 20 to 26 inches (51 to 66 centimeters) with an average of 23 inches (58 centimeters); wingspans from 48 to 60 inches (122 to 152 centimeters) with an average of 56 inches (142 centimeters); and weights from 2.2 to 4.5 pounds (998 to 2,041 grams). The average weight for females from some references was 2.8 pounds (1,270 grams), and for males it was 2.3 pounds (1,043 grams). References do not distinguish genders for some measurements.

MORPHS AND MOLTS

There are two basic color morphs recognized. The adult light-morph is light-headed with rich reddish-browns and blacks on the upper body surface, and a white underbody with reddish flanks and reddish markings on the underwing surface. The adult dark morph is dark-headed with dark upperparts and an all dark belly and underparts. The underparts of the wing are two-toned, with the dark axillars and coverts contrasting with the silvery white primaries and secondaries. There is some variability within the morphs and individuals will interbreed freely. Some populations may have more dark morphs than others. Overall, it appears that dark morphs range from three to 30 percent of a population. The average for North America has been suggested at 10 percent or less of the population being comprised of dark-morph birds.

The juvenile plumage is retained throughout the first winter and into the following spring / summer. By the second fall, the bird molts directly into full adult plumage. By the second spring, most birds should have full adult plumage. Subsequent molts of the adults occur between spring and fall and their appearance remains consistent.

SPECIFIC DESCRIPTION

Adult Light-morph - Perched

Note that the male and female are essentially identical except for size.

HEAD

- variable, but often appearing pale with brown to cinnamon longitudinal streaking which may be more extensive in some birds
- top of head dark brown with rufous to creamy streaks
- the nape or back region of the head is lightish
- the side of the head is white with no dark malar stripe, but a dark streak extends behind the eye
- the side of the face can have varying amounts of reddish to brown streaking
- the throat is white
- the beak is very dark bluish
- the cere is yellow to orange yellow; a large yellow gape is evident
- the eye is light yellow

BODY

- the breast is whitish, grading into pale reddish brown on the lower sides and belly
- the abdomen, sides and flanks have wavy, rusty cross barring
- the undertail coverts are white
- the thighs and tarsal feathering are deep rufous/rusty with black cross barring
- the upperparts are dark brown with rufous markings that extend over the wing coverts so as to give an overall "ferruginous" appearance

WINGS

- the coverts are bright orange-cinnamon/rufous with dark centers
- the secondaries and inner primaries are deep gray while the outer primaries are white on the inner webs and deep gray on the outer webs
- the wing tips almost reach the tip of the tail on perched birds

TAIL

- the upper coverts are bright orange-cinnamon to rusty
- the tail feathers vary from whitish to neutral gray, washed and/or flecked with rust and gray
- the amount of gray and rufous wash varies between individuals
- the tail is unbanded

LEGS

- legs are feathered to the toes
- legs and feet are yellow and the talons are black

Immature Light-morph - Perched

HEAD

- can appear quite light, especially in the forehead area which is white with very dark streaks
- otherwise similar patterns to adults with dark streak behind the eye
- the beak is black, grading to olive-gray near the base and with a yellow gape
- the cere is yellow
- the eye is brownish-yellow

BODY

- the underparts are essentially clean white with a rufous wash extending from the throat onto the breast
- this rufous "bloom" disappears by the first fall of life
- occasional grayish-brown spotting occurs on the sides and flanks, belly often like Red-tailed Hawk

- the thigh and tarsal feathering is white and not rufous as in adults, and may be spotted with dark feathers
- the upperparts and back are dark brown with less cinnamon than in adults

WINGS

- generally the upper wing coverts are dark brown

TAIL

- medium grayish with about four transverse, darker bands and a white tip, but degree of barring may be variable
- white base to tail, inner one-third to one-quarter of tail is white
- the rufous coloring is lacking

LEGS

- legs feathered to the toes; tarsus feathering heavily spotted to dusky
- the legs and feet are dull yellow with dark talons

Adult Light-morph - Flight

- outer primaries small and black and look as if they have been "dipped in ink"
- a large buteo with a reddish upper back and inner wing coverts or "shoulders"
- it appears very long-winged, often holding them up in a dihedral
- the primaries are dark gray with conspicuous light "windows" or "panels" in the innerprimaries
- the upper surface of the tail appears whitish towards the base and rump with varying degrees of rufous coloration towards the tip, and it appears unbanded
- three prominent light areas on the upper surface stand out as two "windows" on the outer wings and a rufous rump mark
- the underwings are whitish overall with rufous markings, particularly in the patagial area, perhaps giving a smudgy appearance but less dark than Red-tailed Hawk
- dark "comma" shaped markings are prominent at the wrists
- the general underparts appear starkly white with the rufous thigh feathering forming a dark "v" mark against the light undersides

Immature Light-morph - Flight

- general upperparts are similar to the adults
- outer primaries small with gray tips
- dark area on flanks
- large legs push spotted flank feathers together and form a conspicuous dark mark
- upper tail lacks the rufous wash and the white upper tail coverts has dark spotting along the lower perimeter
- the underwings are cleanly white with few markings, but the black wrist comma is evident; the white "leggings" do not contrast with the underbelly as in adults
- the tail below is whitish with a dusky band near the tip
- upper tail is white at basal one-quarter to one-third
- has whitish panels, or "windows", on upper primary surfaces like an adult

SIMILAR SPECIES

In size and behavior, the Ferruginous Hawk is the buteo which most closely resembles the Golden Eagle, but it is smaller and differs quite dramatically in plumage in both color phases. Depending upon viewing conditions and lighting, it could be mistaken for a number of other buteos if the observer was only looking at gross patterns and ignoring size or other combinations of features. Some features of the Ferruginous Hawk similar to the same

features in other species are as follows:

dihedral wing posture,

- Swainson's Hawk, Rough-legged Hawk, and Turkey Vulture

dark body, dark underwing,

- all dark buteos

long, broad wings,

- Golden Eagle

hovering behavior,

- Osprey and Rough-legged Hawk

Some races of Red-tailed Hawk have similarities that could cause confusion. Differences occur in wing and tail patterns.

OTHER NAMES

The Ferruginous Hawk is also known as the "Ferruginous Rough-leg", "Ferruginous Rough-legged Hawk", "Chap Hawk", "Gopher Hawk", "Prairie Eagle", "Squirrel Hawk", and "Ferrugy."

ETYMOLOGY

The genus name *Buteo* is Latin for "buzzard", which is an early name for hawks and vultures. It is allied with the Greek "buzo" which means "to hoot". This has little relevance to the calls of any diurnal birds of prey. The specific name *regalis* is Latin for "regal" or "royal", but the name comes from the location in Mexico where this species was first found and described. Real del Monte is the locale, and "Real" is Spanish for "royal." Ferruginous refers to the rusty-red colors and stems from the Latin "ferrugo" or "rust." The word "hawk" has its origins from the Teutonic base "hab", which ultimately led to the Middle English derivative "hauk." Hab meant "to seize or hold."

MYTHOLOGY

None is known for North America.

RANGE

The Ferruginous Hawk breeds from southern British Columbia (very rarely), southeastern Alberta, southern Saskatchewan and extreme southwestern Manitoba south through eastern Washington, eastern Oregon, and Nevada to Arizona and New Mexico. Its breeding range extends eastward to include Utah, Colorado, Wyoming, Idaho, Montana, the Dakotas and small parts of western Nebraska, Oklahoma and Texas. As such, it has the smallest breeding range of any buteo occurring regularly north of Mexico. The wintering range includes the breeding range north only to the latitudes of northern Wyoming, but it expands west in Oregon and includes California, south into Mexico and eastward in South Dakota, Nebraska, Kansas, Oklahoma and Texas. Year-round, the Ferruginous Hawk can be found within the breeding range except for the Canadian provinces, Washington, northern Oregon, Montana, North Dakota and northern South Dakota and northern Wyoming. Stragglers in migration and winter have occurred in Ohio, Tennessee, Virginia, New Jersey, Minnesota, Wisconsin, and Florida.

There are no subspecies and this species occurs nowhere in the world except in North

America.

MIGRATION

Dispersal from the nesting site occurs within about 40 days of fledging and can involve any direction. Southbound migration at the latitudes of the southern Canadian prairies is well-underway by mid to late September and by early October in the northern United States. Birds reach the San Francisco area by September 8, suggesting that southbound migrants are moving by early September in some areas. Band returns indicate that the origin of California birds includes Alberta, North Dakota, Idaho, and Colorado. Movements by southerly nesters are poorly documented and it has been suggested that they may be sedentary. Birds reach northern Mexico at least as early as October 23 and are frequent there until at least March 2.

Substantial movement in Arizona has been noted between March 15 and April 5, with arrivals as far north as South Dakota by late March or early April. In Utah and Colorado, birds return by late February or early March and birds are at Idaho nesting sites by mid March. Movements into southern Canada occur around late March or early April.

Information about migration routes seems limited, but at least some more or less lateral movement occurs during the fall as northern birds disperse into the broadened winter range to the south.

BEHAVIOR

The flight of the Ferruginous Hawk is active, with slow wing beats much like that of a small eagle. Soaring with the wings held in a strong dihedral has been noted, as well as gliding with the wings held flat, or in a modified dihedral. Hovering and low cruising over the ground are also used as hunting techniques. The wing beat has been described as "fluid" by some observers.

Hunting may occur at any time of the day depending upon the activity patterns of the major prey species. A bimodal pattern of early morning and late afternoon hunting may be common. The hunting tactics can be grouped into seven basic strategies:

Perch and Wait

- perching is on any elevated site, natural or man-made

Ground Perching

- the hawk will stand on the ground at a rodent burrow after initially locating it from the air. As the burrowing animal reaches the surface, the hawk rises into the air and pounces upon it even while it is still underneath the loose earth.

Low-level Flight

- birds will course over the landscape within a few yards of the ground and pursue in direct, low level chases, or they will hunt from 40 to 60 feet (12.4 to 18.6 meters) above the ground.

High-level Flight

- birds will hunt while soaring, but the success rate is generally low.

Hovering

- using quickened wing beats, often in times of increased winds, the birds will search the ground and drop on the prey.

Cooperative Hunting

- mates have been known to assist each other.

Piracy

- the Ferruginous Hawk has been observed gathering around a hunter shooting prairie dogs, and to claim shot "dogs" by flying to them and mantling over them.

In the strike, kill, and consumption type of predation, the victims are seized with the feet and a series of blows may be meted out, including driving the rear talon into the body to puncture vital organs. Biting with the beak may also take place. Before bringing prey to the nest, the adults will often eat the head. At the nest, birds are plucked and mammals torn into pieces before being fed to the young. Food caching has been noted, but not generally near the nest.

The Ferruginous Hawk maintains minimum distances from other nesting raptors but will nest closer than necessary, suggesting that the distance is not fixed. The "nearest neighbor" distance has varied from less than 1 mile (1.6 kilometers) to as much as 4 miles (6.4 kilometers) with an average of 2 miles (3.2 kilometers). Nests facing different hunting territories are tolerated much closer than nests facing the same hunting territory. The minimum distance between nests is probably about one half mile on densely-occupied areas. Territorial conflicts have been reported with other species, such as the Great Horned and Short-eared Owl, Northern Harrier, Red-tailed and Swainson's Hawk, Golden Eagle, accipiters, ravens, and magpies. It seems to be quite tolerant of other Ferruginous Hawks from adjacent territories.

Nesting densities in several studies have varied from one pair per four to 2,450 square miles (10.4 to 6,346 square kilometers). In Alberta, on one study site, there was a stable density of one pair per four square miles (10.4 square kilometers), on average with little deviation from this mean. In Idaho, the average home range for four pairs of Ferruginous Hawks in the Snake River area was slightly over two square miles (5.2 square kilometers).

Courtship flights seem to be limited in the accepted sense. Both sexes engage in high, circling flight but literature details are sketchy. Soaring activities may primarily be variations on territorial defense flights as opposed to courtship per se. The "flutter - glide" flight consists of a series of shallow, rapid wing beats interspersed with brief glides and may serve to advertise the territory. The "sky-dance" is stimulated by an intruder and consists of slow flight with deep, labored wing beats with irregular yawing and pitching that may terminate in steep dives. In the "follow-soar" maneuver, the male Ferruginous Hawk will fly below an intruder and escort it out of the territory. High perching occurs from prominent places around the nest, particularly early in the breeding cycle. Aggressive actions such as attacking, talon-grasping, and pursuit have been noted by some observers. Copulation begins before construction of the new nest, and increases in frequency until the start of egg laying. The passing of food may occur before the activity. The duration of copulation is from four to 18 seconds.

Birds have been known to live for 20 years in the wild, but most birds probably die within the first five years. The oldest banded birds were recovered at age 20. First year mortality has been estimated at 66 percent and the adult mortality at 25 percent. The reasons for mortality include illegal shooting, loss of a satisfactory food supply, harassment, predation, and starvation of nestlings during times of low food supply. Ground nests are susceptible to predation by coyotes, and nestlings may be preyed upon by Great Horned Owls and Golden Eagles.

ADAPTATIONS

The Ferruginous Hawk is one of the most adaptable nesters of all of the raptors, and will use trees, ledges, rock or dirt outcrops, the ground, haystacks, nest platforms, power poles, and other man-made structures. Pairs have a high reproductive potential, thus allowing a rapid recovery of populations in response to upswings in the prey base.

HABITAT

The preferred habitat for Ferruginous Hawks are the arid, semiarid and grassland regions of North America. The countryside is open, level, or rolling prairies; foothills or middle elevation plateaus largely devoid of trees saved for copses; and cultivated shelterbelts or riparian corridors. Rock outcrops, shallow canyons, and gullies may characterize some habitats. These hawks avoid high elevations, forest interiors, narrow canyons, and cliff areas.

During the breeding season, the preference is for grasslands, sage, and other arid shrub country. Nesting occurs in the open areas or in trees including cottonwoods, willows, and swamp oaks along watercourses. Cultivated fields and modified grasslands (greater than 50 percent changed) are avoided during the breeding period. The density of Ferruginous Hawks in grasslands declines in a direct, inverse relationship to the degree of cultivation of the grasslands. However, high densities have been reported in areas where nearly 80% of the grassland was under cultivation.

The winter habitat is similar to that used during the summer in that open, arid grass or shrub terrain is preferred. However, cultivated areas are not necessarily avoided, particularly when the crops are not ploughed under after harvest. The standing stubble provides habitat for the small mammal prey base needed by Ferruginous and other hawks.

Some key attributes of the habitat include the availability of perches such as poles, lone trees, knolls, rocky outcrops or large boulders. Nesting will occur in trees if they are available, including riparian strips but the presence of water does not appear to be critical to Ferruginous Hawks.

VOICE

The voice is not well-described in literature. Alarm calls consist of "kree - a" or "ke - ah" and harsh "kaah, kaah" calls. The latter resembling some vocalizations of the Herring Gull. One description referred to the "wavering" alarm call and "breathy" notes while other authors describe screams similar to those of the Red-tailed Hawk

FOOD

The Ferruginous Hawk primarily hunts small to medium-sized mammals but will also take birds, reptiles, and some insects. Mammals generally comprise 80 to 90 percent of the prey items or biomass in the diet with birds being the next most common component. The diet varies somewhat geographically, depending upon the distribution of certain prey species, but where the range of the Ferruginous Hawk overlaps, the black-tailed jackrabbit is a major food species along with ground squirrels and pocket gophers. Depending upon the relative abundance of jackrabbits and ground squirrels, the latter could become the major food source. The particular species is dependent upon its occurrence within the range of the hawk.

In the following list, some generic references to mammals such as jackrabbits and ground squirrels are used, but include a number of species within those groups. The particular species taken by Ferruginous Hawks depends upon range overlap and subsequent availability. Common prey items are jackrabbits (black-tailed, white-tailed), cottontails, ground squirrels (Richardson's, 13-lined, antelope), prairie dog, kangaroo rats (Ord's), northern pocket gopher, voles (various species), mice (white-footed and others), long-tailed

weasel, snowshoe hare, muskrat, pocket mice, Horned Lark, Western Meadowlark, Sharp-tailed Grouse, Ring-necked Pheasant, Gray Partridge, Chukar, ducks, Northern Harrier, Short-eared Owl, Burrowing Owl, Long-billed Curlew, Black-billed Magpie, bull snake, yellow-bellied racer, garter snake, grasshoppers, crickets, carabid beetles, and a few other larger insects.

NESTING

The Ferruginous Hawk is the most adaptable of all the buteos in selecting nest sites. The sites vary from trees, flat ground, rock/dirt outcrops, cliffs, utility poles, transmission towers, buildings, artificial nest platforms, and haystacks. Within some broad categories such as cliffs, the variety includes clay, dirt and rock substrates. Tree nests are typically in isolated trees or isolated clumps of trees in exposed locations. Authors differ as to whether ground nests are more successful than tree nests, but they are more susceptible to mammalian predation. Nest locations are reused frequently, but several nests may be built in an area. Typically, one or two alternate nests may exist but up to eight have been found on some territories.

The nests are made of ground debris such as sticks, branches, cattails and earlier, of old bison bones, usually in combination. Old nests will be refurbished, or nests of other species may be taken over and refurbished with sticks being added on top of the old nests. Odd items such as paper, rubbish, barbed wire, cornstalks, plastic and steel cable have been incorporated into nests. Bark from trees and shrubs will be used for lining along with grasses and cow dung. Bits and pieces of greenery are often added to the nest.

Clutch size varies from one to eight and is likely linked to food supply. The average clutch is three to four eggs, each 2.5 inches (6.35 centimeters) long and 2 inches (5.08 centimeters) wide. They are smooth, non-glossy and whitish in color, irregularly spotted or speckled and blotched with reddish - brown markings. There may be a concentration of darker pigments at the small end of the egg. Occasionally, the eggs are almost unmarked or have faint scribblings on them.

Both sexes are involved with building the nests and bringing materials, but the male seems to be more involved in retrieving materials while the female arranges them in the structure. Copulation occurs during and after nest building. The egg-laying period varies with latitude, weather, and possibly food supply. In the Canadian parts of the range, laying occurs during the latter part of April through late June, whereas farther south laying starts from about March 20 through mid May. The earliest recorded clutch was in January in Utah and laying could occur as late as July 3 in Canada. Egg- laying occurs at two-day intervals with incubation starting when the first egg is laid. Incubation is shared by both sexes with each taking approximately the same number of shifts during the 32 day average incubation period. Replacement clutches following failure appears to be rare.

The nestling period varies from 38 to 50 days with brooding primarily by the female. Males fledge at 38 to 40 days and the females as late as 50 days after hatching, or 10 days later than their male siblings as they take longer to develop. Nestlings lie or sit for the first two weeks, stand at about three weeks and walk soon after. By 16 or 18 days, they are able to feed on their own. Wing flapping starts about day 23 and by day 33 the young are capable of vigorous flapping and "flap jumps." The nestlings are sensitive to high temperatures and seek shade however possible in the nest. Initial movement out of the nest is felt to be a response to heat stress as the young quickly move towards shade. The initial flight for the males is taken at 38 to 40 days while the slower-developing females fly about 10 days later. Post-fledging dependency upon the parents may last for several weeks. During the first four weeks after fledging, the young patrol increasingly large areas around the nest as they learn to hunt. Young hawks have killed prey as early as four days after fledging.

The Ferruginous Hawk is single-brooded and like so many raptors, the number of young reared is tied closely to food supply. In areas where jackrabbit populations are the principal food source, the initial clutch sizes and the number of reared young vary closely with variations in the number of jackrabbits. Fifty percent loss of young has been reported in low jackrabbit years and production of young to flight age has been 15 times as high as in years when prey was scarce. Fledging rates of 2.7 to 3.6 young per nest have been reported during years of abundant food supply. The high potential clutch size allows for a quick response to increases in the prey base.

CONSERVATION

The Ferruginous Hawk was on the National Audubon Society's "Blue List" of species felt to be declining. From 1971 to 1981 it retained its "blue" status, and from 1982 to 1986 it was listed as a species of "Special Concern." The United States Fish and Wildlife Service placed it in a category of "undetermined" in 1973, and various states have placed it in categories of "Threatened" or "Endangered." In Canada, the Committee on the Status of Endangered Wildlife in Canada considered this species "Threatened" in 1980.

Across the Canadian prairies, the range was diminishing up until 1980, and at that time, birds were felt to be occupying 48 percent of its original range. Numbers were generally felt to be diminishing and a total Canadian population was estimated at 500 to 1000 pairs. By 1987, population increases were being noted, and the Alberta population alone was estimated at 1,800 pairs. The upswing was likely due to a greater availability of food on the wintering grounds, making the birds more likely to breed when they returned to Canada. In the United States, there has been a history of concern for this species in many states with declines noted, but in 1988, one study suggested that the population in California and locally elsewhere may have increased significantly. The wintering population north of Mexico was estimated at 5,500 birds in 1986. In 1984, the population estimate for North America was between 3,000 and 4,000 pairs, and in 1987, it was 14,000 individuals.

Threats to the overall population include:

- cultivation of native prairie grassland and subsequent habitat loss
- tree invasion of northern grassland habitats
- reductions in food supply due to agricultural pest management programs
- shooting and human interference

Toxic chemicals have not been suggested as a significant threat to the Ferruginous Hawk.

Management strategies must include the retention or reclamation of native grasslands for breeding as well as on the wintering grounds. Maintenance of high populations of prey species in wintering areas seems critical to the hawks' abilities to move onto the summer range in breeding condition. The integration of agricultural practices and policies into the management strategies is a crucial component of any overall scheme for conservation. The provision of nesting platforms has had positive effects and should be a part of local strategies. Public education and the elimination of persecution and human disturbance must be an important part of the overall conservation program.

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Ferruginous Hawk - light

Buteo regalis

GENERAL DESCRIPTION

The Ferruginous Hawk is a large, long-winged buteo of the open, arid grasslands and shrub steppe country of the interior parts of North America. It occurs in a light and dark color phase with the latter being much less common in general. Its hunting and flight behavior is suggestive of a Golden Eagle and it survives primarily on small to medium-sized mammals and less so on birds. Although flexible in choosing a nest site and exhibiting a high reproductive potential, this bird's restriction to natural grasslands on the breeding grounds and specialized predation on mammals persecuted on rangelands may make conservation a continuous concern. It is migratory in the northern parts of its range but can be found year round in the mid and southwest United States. At times it has been considered threatened, endangered, or of concern on various threatened species lists but recent population increases in local areas, coupled with conservation initiatives, have created some optimism about the bird's future.

SIZE

This is the largest of the buteos and is often mistaken for an eagle due to its size, proportions and behavior. References are inconsistent in reporting the dimensions of this hawk, but all agree that the sexes overlap and the females average larger than the males. Reported length measurements range from 20 to 26 inches (51 to 66 centimeters) with an average of 23 inches (58 centimeters); wingspans from 48 to 60 inches (122 to 152 centimeters) with an average of 56 inches (142 centimeters); and weights from 2.2 to 4.5 pounds (998 to 2,041 grams). The average weight for females from some references was 2.8 pounds (1,270 grams), and for males it was 2.3 pounds (1,043 grams). References do not distinguish genders for some measurements.

MORPHS AND MOLTS

There are two basic color morphs recognized. The adult light-morph is light-headed with rich reddish-browns and blacks on the upper body surface, and a white underbody with reddish flanks and reddish markings on the underwing surface. The adult dark morph is dark-headed with dark upperparts and an all dark belly and underparts. The underparts of the wing are two-toned, with the dark axillars and coverts contrasting with the silvery white primaries and secondaries. There is some variability within the morphs and individuals will interbreed freely. Some populations may have more dark morphs than others. Overall, it appears that dark morphs range from three to 30 percent of a population. The average for North America has been suggested at 10 percent or less of the population being comprised of dark-morph birds.

The juvenile plumage is retained throughout the first winter and into the following spring / summer. By the second fall, the bird molts directly into full adult plumage. By the second spring, most birds should have full adult plumage. Subsequent molts of the adults occur between spring and fall and their appearance remains consistent.

SPECIFIC DESCRIPTION

Adult Light-morph - Perched

Note that the male and female are essentially identical except for size.

HEAD

- variable, but often appearing pale with brown to cinnamon longitudinal streaking which may be more extensive in some birds
- top of head dark brown with rufous to creamy streaks
- the nape or back region of the head is lightish
- the side of the head is white with no dark malar stripe, but a dark streak extends behind the eye
- the side of the face can have varying amounts of reddish to brown streaking
- the throat is white
- the beak is very dark bluish
- the cere is yellow to orange yellow; a large yellow gape is evident
- the eye is light yellow

BODY

- the breast is whitish, grading into pale reddish brown on the lower sides and belly
- the abdomen, sides and flanks have wavy, rusty cross barring
- the undertail coverts are white
- the thighs and tarsal feathering are deep rufous/rusty with black cross barring
- the upperparts are dark brown with rufous markings that extend over the wing coverts so as to give an overall "ferruginous" appearance

WINGS

- the coverts are bright orange-cinnamon/rufous with dark centers
- the secondaries and inner primaries are deep gray while the outer primaries are white on the inner webs and deep gray on the outer webs
- the wing tips almost reach the tip of the tail on perched birds

TAIL

- the upper coverts are bright orange-cinnamon to rusty
- the tail feathers vary from whitish to neutral gray, washed and/or flecked with rust and gray
- the amount of gray and rufous wash varies between individuals
- the tail is unbanded

LEGS

- legs are feathered to the toes
- legs and feet are yellow and the talons are black

Immature Light-morph - Perched

HEAD

- can appear quite light, especially in the forehead area which is white with very dark streaks
- otherwise similar patterns to adults with dark streak behind the eye
- the beak is black, grading to olive-gray near the base and with a yellow gape
- the cere is yellow
- the eye is brownish-yellow

BODY

- the underparts are essentially clean white with a rufous wash extending from the throat onto the breast
- this rufous "bloom" disappears by the first fall of life
- occasional grayish-brown spotting occurs on the sides and flanks, belly often like Red-tailed Hawk

- the thigh and tarsal feathering is white and not rufous as in adults, and may be spotted with dark feathers
- the upperparts and back are dark brown with less cinnamon than in adults

WINGS

- generally the upper wing coverts are dark brown

TAIL

- medium grayish with about four transverse, darker bands and a white tip, but degree of barring may be variable
- white base to tail, inner one-third to one-quarter of tail is white
- the rufous coloring is lacking

LEGS

- legs feathered to the toes; tarsus feathering heavily spotted to dusky
- the legs and feet are dull yellow with dark talons

Adult Light-morph - Flight

- outer primaries small and black and look as if they have been "dipped in ink"
- a large buteo with a reddish upper back and inner wing coverts or "shoulders"
- it appears very long-winged, often holding them up in a dihedral
- the primaries are dark gray with conspicuous light "windows" or "panels" in the innerprimaries
- the upper surface of the tail appears whitish towards the base and rump with varying degrees of rufous coloration towards the tip, and it appears unbanded
- three prominent light areas on the upper surface stand out as two "windows" on the outer wings and a rufous rump mark
- the underwings are whitish overall with rufous markings, particularly in the patagial area, perhaps giving a smudgy appearance but less dark than Red-tailed Hawk
- dark "comma" shaped markings are prominent at the wrists
- the general underparts appear starkly white with the rufous thigh feathering forming a dark "v" mark against the light undersides

Immature Light-morph - Flight

- general upperparts are similar to the adults
- outer primaries small with gray tips
- dark area on flanks
- large legs push spotted flank feathers together and form a conspicuous dark mark
- upper tail lacks the rufous wash and the white upper tail coverts has dark spotting along the lower perimeter
- the underwings are cleanly white with few markings, but the black wrist comma is evident; the white "leggings" do not contrast with the underbelly as in adults
- the tail below is whitish with a dusky band near the tip
- upper tail is white at basal one-quarter to one-third
- has whitish panels, or "windows", on upper primary surfaces like an adult

SIMILAR SPECIES

In size and behavior, the Ferruginous Hawk is the buteo which most closely resembles the Golden Eagle, but it is smaller and differs quite dramatically in plumage in both color phases. Depending upon viewing conditions and lighting, it could be mistaken for a number of other buteos if the observer was only looking at gross patterns and ignoring size or other combinations of features. Some features of the Ferruginous Hawk similar to the same

features in other species are as follows:

dihedral wing posture,

- Swainson's Hawk, Rough-legged Hawk, and Turkey Vulture

dark body, dark underwing,

- all dark buteos

long, broad wings,

- Golden Eagle

hovering behavior,

- Osprey and Rough-legged Hawk

Some races of Red-tailed Hawk have similarities that could cause confusion. Differences occur in wing and tail patterns.

OTHER NAMES

The Ferruginous Hawk is also known as the "Ferruginous Rough-leg", "Ferruginous Rough-legged Hawk", "Chap Hawk", "Gopher Hawk", "Prairie Eagle", "Squirrel Hawk", and "Ferrugy."

ETYMOLOGY

The genus name *Buteo* is Latin for "buzzard", which is an early name for hawks and vultures. It is allied with the Greek "buzo" which means "to hoot". This has little relevance to the calls of any diurnal birds of prey. The specific name *regalis* is Latin for "regal" or "royal", but the name comes from the location in Mexico where this species was first found and described. Real del Monte is the locale, and "Real" is Spanish for "royal." Ferruginous refers to the rusty-red colors and stems from the Latin "ferrugo" or "rust." The word "hawk" has its origins from the Teutonic base "hab", which ultimately led to the Middle English derivative "hauk." Hab meant "to seize or hold."

MYTHOLOGY

None is known for North America.

RANGE

The Ferruginous Hawk breeds from southern British Columbia (very rarely), southeastern Alberta, southern Saskatchewan and extreme southwestern Manitoba south through eastern Washington, eastern Oregon, and Nevada to Arizona and New Mexico. Its breeding range extends eastward to include Utah, Colorado, Wyoming, Idaho, Montana, the Dakotas and small parts of western Nebraska, Oklahoma and Texas. As such, it has the smallest breeding range of any buteo occurring regularly north of Mexico. The wintering range includes the breeding range north only to the latitudes of northern Wyoming, but it expands west in Oregon and includes California, south into Mexico and eastward in South Dakota, Nebraska, Kansas, Oklahoma and Texas. Year-round, the Ferruginous Hawk can be found within the breeding range except for the Canadian provinces, Washington, northern Oregon, Montana, North Dakota and northern South Dakota and northern Wyoming. Stragglers in migration and winter have occurred in Ohio, Tennessee, Virginia, New Jersey, Minnesota, Wisconsin, and Florida.

There are no subspecies and this species occurs nowhere in the world except in North

America.

MIGRATION

Dispersal from the nesting site occurs within about 40 days of fledging and can involve any direction. Southbound migration at the latitudes of the southern Canadian prairies is well-underway by mid to late September and by early October in the northern United States. Birds reach the San Francisco area by September 8, suggesting that southbound migrants are moving by early September in some areas. Band returns indicate that the origin of California birds includes Alberta, North Dakota, Idaho, and Colorado. Movements by southerly nesters are poorly documented and it has been suggested that they may be sedentary. Birds reach northern Mexico at least as early as October 23 and are frequent there until at least March 2.

Substantial movement in Arizona has been noted between March 15 and April 5, with arrivals as far north as South Dakota by late March or early April. In Utah and Colorado, birds return by late February or early March and birds are at Idaho nesting sites by mid March. Movements into southern Canada occur around late March or early April.

Information about migration routes seems limited, but at least some more or less lateral movement occurs during the fall as northern birds disperse into the broadened winter range to the south.

BEHAVIOR

The flight of the Ferruginous Hawk is active, with slow wing beats much like that of a small eagle. Soaring with the wings held in a strong dihedral has been noted, as well as gliding with the wings held flat, or in a modified dihedral. Hovering and low cruising over the ground are also used as hunting techniques. The wing beat has been described as "fluid" by some observers.

Hunting may occur at any time of the day depending upon the activity patterns of the major prey species. A bimodal pattern of early morning and late afternoon hunting may be common. The hunting tactics can be grouped into seven basic strategies:

Perch and Wait

- perching is on any elevated site, natural or man-made

Ground Perching

- the hawk will stand on the ground at a rodent burrow after initially locating it from the air. As the burrowing animal reaches the surface, the hawk rises into the air and pounces upon it even while it is still underneath the loose earth.

Low-level Flight

- birds will course over the landscape within a few yards of the ground and pursue in direct, low level chases, or they will hunt from 40 to 60 feet (12.4 to 18.6 meters) above the ground.

High-level Flight

- birds will hunt while soaring, but the success rate is generally low.

Hovering

- using quickened wing beats, often in times of increased winds, the birds will search the ground and drop on the prey.

Cooperative Hunting

- mates have been known to assist each other.

Piracy

- the Ferruginous Hawk has been observed gathering around a hunter shooting prairie dogs, and to claim shot "dogs" by flying to them and mantling over them.

In the strike, kill, and consumption type of predation, the victims are seized with the feet and a series of blows may be meted out, including driving the rear talon into the body to puncture vital organs. Biting with the beak may also take place. Before bringing prey to the nest, the adults will often eat the head. At the nest, birds are plucked and mammals torn into pieces before being fed to the young. Food caching has been noted, but not generally near the nest.

The Ferruginous Hawk maintains minimum distances from other nesting raptors but will nest closer than necessary, suggesting that the distance is not fixed. The "nearest neighbor" distance has varied from less than 1 mile (1.6 kilometers) to as much as 4 miles (6.4 kilometers) with an average of 2 miles (3.2 kilometers). Nests facing different hunting territories are tolerated much closer than nests facing the same hunting territory. The minimum distance between nests is probably about one half mile on densely-occupied areas. Territorial conflicts have been reported with other species, such as the Great Horned and Short-eared Owl, Northern Harrier, Red-tailed and Swainson's Hawk, Golden Eagle, accipiters, ravens, and magpies. It seems to be quite tolerant of other Ferruginous Hawks from adjacent territories.

Nesting densities in several studies have varied from one pair per four to 2,450 square miles (10.4 to 6,346 square kilometers). In Alberta, on one study site, there was a stable density of one pair per four square miles (10.4 square kilometers), on average with little deviation from this mean. In Idaho, the average home range for four pairs of Ferruginous Hawks in the Snake River area was slightly over two square miles (5.2 square kilometers).

Courtship flights seem to be limited in the accepted sense. Both sexes engage in high, circling flight but literature details are sketchy. Soaring activities may primarily be variations on territorial defense flights as opposed to courtship per se. The "flutter - glide" flight consists of a series of shallow, rapid wing beats interspersed with brief glides and may serve to advertise the territory. The "sky-dance" is stimulated by an intruder and consists of slow flight with deep, labored wing beats with irregular yawing and pitching that may terminate in steep dives. In the "follow-soar" maneuver, the male Ferruginous Hawk will fly below an intruder and escort it out of the territory. High perching occurs from prominent places around the nest, particularly early in the breeding cycle. Aggressive actions such as attacking, talon-grasping, and pursuit have been noted by some observers. Copulation begins before construction of the new nest, and increases in frequency until the start of egg laying. The passing of food may occur before the activity. The duration of copulation is from four to 18 seconds.

Birds have been known to live for 20 years in the wild, but most birds probably die within the first five years. The oldest banded birds were recovered at age 20. First year mortality has been estimated at 66 percent and the adult mortality at 25 percent. The reasons for mortality include illegal shooting, loss of a satisfactory food supply, harassment, predation, and starvation of nestlings during times of low food supply. Ground nests are susceptible to predation by coyotes, and nestlings may be preyed upon by Great Horned Owls and Golden Eagles.

ADAPTATIONS

The Ferruginous Hawk is one of the most adaptable nesters of all of the raptors, and will use trees, ledges, rock or dirt outcrops, the ground, haystacks, nest platforms, power poles, and other man-made structures. Pairs have a high reproductive potential, thus allowing a rapid recovery of populations in response to upswings in the prey base.

HABITAT

The preferred habitat for Ferruginous Hawks are the arid, semiarid and grassland regions of North America. The countryside is open, level, or rolling prairies; foothills or middle elevation plateaus largely devoid of trees saved for copses; and cultivated shelterbelts or riparian corridors. Rock outcrops, shallow canyons, and gullies may characterize some habitats. These hawks avoid high elevations, forest interiors, narrow canyons, and cliff areas.

During the breeding season, the preference is for grasslands, sage, and other arid shrub country. Nesting occurs in the open areas or in trees including cottonwoods, willows, and swamp oaks along watercourses. Cultivated fields and modified grasslands (greater than 50 percent changed) are avoided during the breeding period. The density of Ferruginous Hawks in grasslands declines in a direct, inverse relationship to the degree of cultivation of the grasslands. However, high densities have been reported in areas where nearly 80% of the grassland was under cultivation.

The winter habitat is similar to that used during the summer in that open, arid grass or shrub terrain is preferred. However, cultivated areas are not necessarily avoided, particularly when the crops are not ploughed under after harvest. The standing stubble provides habitat for the small mammal prey base needed by Ferruginous and other hawks.

Some key attributes of the habitat include the availability of perches such as poles, lone trees, knolls, rocky outcrops or large boulders. Nesting will occur in trees if they are available, including riparian strips but the presence of water does not appear to be critical to Ferruginous Hawks.

VOICE

The voice is not well-described in literature. Alarm calls consist of "kree - a" or "ke - ah" and harsh "kaah, kaah" calls. The latter resembling some vocalizations of the Herring Gull. One description referred to the "wavering" alarm call and "breathy" notes while other authors describe screams similar to those of the Red-tailed Hawk

FOOD

The Ferruginous Hawk primarily hunts small to medium-sized mammals but will also take birds, reptiles, and some insects. Mammals generally comprise 80 to 90 percent of the prey items or biomass in the diet with birds being the next most common component. The diet varies somewhat geographically, depending upon the distribution of certain prey species, but where the range of the Ferruginous Hawk overlaps, the black-tailed jackrabbit is a major food species along with ground squirrels and pocket gophers. Depending upon the relative abundance of jackrabbits and ground squirrels, the latter could become the major food source. The particular species is dependent upon its occurrence within the range of the hawk.

In the following list, some generic references to mammals such as jackrabbits and ground squirrels are used, but include a number of species within those groups. The particular species taken by Ferruginous Hawks depends upon range overlap and subsequent availability. Common prey items are jackrabbits (black-tailed, white-tailed), cottontails, ground squirrels (Richardson's, 13-lined, antelope), prairie dog, kangaroo rats (Ord's), northern pocket gopher, voles (various species), mice (white-footed and others), long-tailed

weasel, snowshoe hare, muskrat, pocket mice, Horned Lark, Western Meadowlark, Sharp-tailed Grouse, Ring-necked Pheasant, Gray Partridge, Chukar, ducks, Northern Harrier, Short-eared Owl, Burrowing Owl, Long-billed Curlew, Black-billed Magpie, bull snake, yellow-bellied racer, garter snake, grasshoppers, crickets, carabid beetles, and a few other larger insects.

NESTING

The Ferruginous Hawk is the most adaptable of all the buteos in selecting nest sites. The sites vary from trees, flat ground, rock/dirt outcrops, cliffs, utility poles, transmission towers, buildings, artificial nest platforms, and haystacks. Within some broad categories such as cliffs, the variety includes clay, dirt and rock substrates. Tree nests are typically in isolated trees or isolated clumps of trees in exposed locations. Authors differ as to whether ground nests are more successful than tree nests, but they are more susceptible to mammalian predation. Nest locations are reused frequently, but several nests may be built in an area. Typically, one or two alternate nests may exist but up to eight have been found on some territories.

The nests are made of ground debris such as sticks, branches, cattails and earlier, of old bison bones, usually in combination. Old nests will be refurbished, or nests of other species may be taken over and refurbished with sticks being added on top of the old nests. Odd items such as paper, rubbish, barbed wire, cornstalks, plastic and steel cable have been incorporated into nests. Bark from trees and shrubs will be used for lining along with grasses and cow dung. Bits and pieces of greenery are often added to the nest.

Clutch size varies from one to eight and is likely linked to food supply. The average clutch is three to four eggs, each 2.5 inches (6.35 centimeters) long and 2 inches (5.08 centimeters) wide. They are smooth, non-glossy and whitish in color, irregularly spotted or speckled and blotched with reddish - brown markings. There may be a concentration of darker pigments at the small end of the egg. Occasionally, the eggs are almost unmarked or have faint scribblings on them.

Both sexes are involved with building the nests and bringing materials, but the male seems to be more involved in retrieving materials while the female arranges them in the structure. Copulation occurs during and after nest building. The egg-laying period varies with latitude, weather, and possibly food supply. In the Canadian parts of the range, laying occurs during the latter part of April through late June, whereas farther south laying starts from about March 20 through mid May. The earliest recorded clutch was in January in Utah and laying could occur as late as July 3 in Canada. Egg- laying occurs at two-day intervals with incubation starting when the first egg is laid. Incubation is shared by both sexes with each taking approximately the same number of shifts during the 32 day average incubation period. Replacement clutches following failure appears to be rare.

The nestling period varies from 38 to 50 days with brooding primarily by the female. Males fledge at 38 to 40 days and the females as late as 50 days after hatching, or 10 days later than their male siblings as they take longer to develop. Nestlings lie or sit for the first two weeks, stand at about three weeks and walk soon after. By 16 or 18 days, they are able to feed on their own. Wing flapping starts about day 23 and by day 33 the young are capable of vigorous flapping and "flap jumps." The nestlings are sensitive to high temperatures and seek shade however possible in the nest. Initial movement out of the nest is felt to be a response to heat stress as the young quickly move towards shade. The initial flight for the males is taken at 38 to 40 days while the slower-developing females fly about 10 days later. Post-fledging dependency upon the parents may last for several weeks. During the first four weeks after fledging, the young patrol increasingly large areas around the nest as they learn to hunt. Young hawks have killed prey as early as four days after fledging.

The Ferruginous Hawk is single-brooded and like so many raptors, the number of young reared is tied closely to food supply. In areas where jackrabbit populations are the principal food source, the initial clutch sizes and the number of reared young vary closely with variations in the number of jackrabbits. Fifty percent loss of young has been reported in low jackrabbit years and production of young to flight age has been 15 times as high as in years when prey was scarce. Fledging rates of 2.7 to 3.6 young per nest have been reported during years of abundant food supply. The high potential clutch size allows for a quick response to increases in the prey base.

CONSERVATION

The Ferruginous Hawk was on the National Audubon Society's "Blue List" of species felt to be declining. From 1971 to 1981 it retained its "blue" status, and from 1982 to 1986 it was listed as a species of "Special Concern." The United States Fish and Wildlife Service placed it in a category of "undetermined" in 1973, and various states have placed it in categories of "Threatened" or "Endangered." In Canada, the Committee on the Status of Endangered Wildlife in Canada considered this species "Threatened" in 1980.

Across the Canadian prairies, the range was diminishing up until 1980, and at that time, birds were felt to be occupying 48 percent of its original range. Numbers were generally felt to be diminishing and a total Canadian population was estimated at 500 to 1000 pairs. By 1987, population increases were being noted, and the Alberta population alone was estimated at 1,800 pairs. The upswing was likely due to a greater availability of food on the wintering grounds, making the birds more likely to breed when they returned to Canada. In the United States, there has been a history of concern for this species in many states with declines noted, but in 1988, one study suggested that the population in California and locally elsewhere may have increased significantly. The wintering population north of Mexico was estimated at 5,500 birds in 1986. In 1984, the population estimate for North America was between 3,000 and 4,000 pairs, and in 1987, it was 14,000 individuals.

Threats to the overall population include:

- cultivation of native prairie grassland and subsequent habitat loss
- tree invasion of northern grassland habitats
- reductions in food supply due to agricultural pest management programs
- shooting and human interference

Toxic chemicals have not been suggested as a significant threat to the Ferruginous Hawk.

Management strategies must include the retention or reclamation of native grasslands for breeding as well as on the wintering grounds. Maintenance of high populations of prey species in wintering areas seems critical to the hawks' abilities to move onto the summer range in breeding condition. The integration of agricultural practices and policies into the management strategies is a crucial component of any overall scheme for conservation. The provision of nesting platforms has had positive effects and should be a part of local strategies. Public education and the elimination of persecution and human disturbance must be an important part of the overall conservation program.

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Ferruginous Hawk - dark

Buteo regalis

GENERAL DESCRIPTION

The Ferruginous Hawk is a large, long-winged buteo of the open, arid grasslands and shrub steppe country of the interior parts of North America. It occurs in a light and dark color phase with the latter being much less common in general. Its hunting and flight behavior is suggestive of a Golden Eagle and it survives primarily on small to medium-sized mammals and less so on birds. Although flexible in choosing a nest site and exhibiting a high reproductive potential, this bird's restriction to natural grasslands on the breeding grounds and specialized predation on mammals persecuted on rangelands may make conservation a continuous concern. It is migratory in the northern parts of its range but can be found year round in the mid and southwest United States. At times it has been considered threatened, endangered, or of concern on various threatened species lists but recent population increases in local areas, coupled with conservation initiatives, have created some optimism about the bird's future.

SIZE

This is the largest of the buteos and is often mistaken for an eagle due to its size, proportions and behavior. References are inconsistent in reporting the dimensions of this hawk, but all agree that the sexes overlap and the females average larger than the males. Reported length measurements range from 20 to 26 inches (51 to 66 centimeters) with an average of 23 inches (58 centimeters); wingspans from 48 to 60 inches (122 to 152 centimeters) with an average of 56 inches (142 centimeters); and weights from 2.2 to 4.5 pounds (998 to 2,041 grams). The average weight for females from some references was 2.8 pounds (1,270 grams), and for males it was 2.3 pounds (1,043 grams). References do not distinguish genders for some measurements.

MORPHS AND MOLTS

There are two basic color morphs recognized. The adult light-morph is light-headed with rich reddish-browns and blacks on the upper body surface, and a white underbody with reddish flanks and reddish markings on the underwing surface. The adult dark morph is dark-headed with dark upperparts and an all dark belly and underparts. The underparts of the wing are two-toned, with the dark axillars and coverts contrasting with the silvery white primaries and secondaries. There is some variability within the morphs and individuals will interbreed freely. Some populations may have more dark morphs than others. Overall, it appears that dark morphs range from three to 30 percent of a population. The average for North America has been suggested at 10 percent or less of the population being comprised of dark-morph birds.

The juvenile plumage is retained throughout the first winter and into the following spring / summer. By the second fall, the bird molts directly into full adult plumage. By the second spring, most birds should have full adult plumage. Subsequent molts of the adults occur between spring and fall and their appearance remains consistent.

SPECIFIC DESCRIPTION

Adult Dark-morph - Perched

HEAD

- entire head dark brown with some rufous edgings to throat feathers
- beak dark bluish
- the cere is yellow
- the eye is light to medium brown
- large yellow gape is evident

BODY

- rufous on belly, legs, and undertail coverts contrasting with darker head
- upper tail coverts almost always rufous
- some whitish or tawny mottling may occur on the breast
- the back is similarly dark brown

WINGS

- the upper wing surface is dark as on the body with some degree of rufous
- the primaries are dark gray with white on the inner webs

TAIL

- the upper surface is grayish with some deep brown in the webbing
- the under surface is silvery-white

LEGS

- legs dark and feathered to the toes
- legs and feet are yellow with dark talons

Immature Dark-morph - Perched

HEAD

- no white on forehead giving an all dark brown look to the head
- beak generally dark becoming olive-gray at the base
- the gape and corner of the mouth is yellow
- the cere is yellow
- the iris is brownish-yellow
- large yellow gape is prominent

BODY

- tawny rufous head and breast contrasting abruptly to dark brown back and belly; belly abruptly darker at junction of breast
- the upperparts are similarly dark brown on the back and upper wings
- upper tail coverts are dark brown

WINGS

- the wing coverts are dark brown but otherwise dark gray/brown

TAIL

- the tail is dark brown/gray above with faint darker bands
- the undertail is grayish with darker subterminal band

LEGS

- legs are dark and feathered to the toes
- legs and feet are dull yellow with black talons

Adult Dark-morph - Flight

- small black wing tips look like they have been "dipped in ink"
- a large buteo with a dark upper back and reddish inner wing coverts or "shoulders"

- it appears very long-winged, holding them up in a dihedral
- the head is all dark and the upper surface of the tail is mostly grayish
- underneath, belly almost always rufous with a white tail, but the dark leggings do not contrast with the body as in the light-phase birds
- the underwing is distinctly bicolored with dark coverts and whitish flight feathers
- there are white wrist "commas" on the underwing where the dark coverts join the base of the primary flight feathers
- pale panels, or "windows", are visible from below with a painted shadow on primaries

Immature Dark-morph - Flight

- lacks rufous upper tail coverts of most adults
- appears similar to adults except dark brown parts lack rufous tinges
- the upper tail surface may appear solid dark above or banded gray in good light
- the undertail is silvery white, but unlike the adults, it has a wide dusky band across the trailing edge
- head and breast tawny rufous, sharp contrast to dark belly
- pale panels, or "windows", seen from below on primaries

SIMILAR SPECIES

In size and behavior, the Ferruginous Hawk is the buteo which most closely resembles the Golden Eagle, but it is smaller and differs quite dramatically in plumage in both color phases. Depending upon viewing conditions and lighting, it could be mistaken for a number of other buteos if the observer was only looking at gross patterns and ignoring size or other combinations of features. Some features of the Ferruginous Hawk similar to the same features in other species are as follows:

dihedral wing posture,

- Swainson's Hawk, Rough-legged Hawk, and Turkey Vulture

dark body, dark underwing,

- all dark buteos

long, broad wings,

- Golden Eagle

hovering behavior,

- Osprey and Rough-legged Hawk

Some races of Red-tailed Hawk have similarities that could cause confusion. Differences occur in wing and tail patterns.

OTHER NAMES

The Ferruginous Hawk is also known as the "Ferruginous Rough-leg", "Ferruginous Rough-legged Hawk", "Chap Hawk", "Gopher Hawk", "Prairie Eagle", "Squirrel Hawk", and "Ferrugy."

ETYMOLOGY

The genus name Buteo is Latin for "buzzard", which is an early name for hawks and vultures. It is allied with the Greek "buzo" which means "to hoot". This has little relevance to the calls of any diurnal birds of prey. The specific name regalis is Latin for "regal" or "royal", but the name comes from the location in Mexico where this species was first found and described. Real del Monte is the locale, and "Real" is Spanish for "royal." Ferruginous refers

to the rusty-red colors and stems from the Latin "ferrugo" or "rust." The word "hawk" has its origins from the Teutonic base "hab", which ultimately led to the Middle English derivative "hauk." Hab meant "to seize or hold."

MYTHOLOGY

None is known for North America.

RANGE

The Ferruginous Hawk breeds from southern British Columbia (very rarely), southeastern Alberta, southern Saskatchewan and extreme southwestern Manitoba south through eastern Washington, eastern Oregon, and Nevada to Arizona and New Mexico. Its breeding range extends eastward to include Utah, Colorado, Wyoming, Idaho, Montana, the Dakotas and small parts of western Nebraska, Oklahoma and Texas. As such, it has the smallest breeding range of any *buteo* occurring regularly north of Mexico. The wintering range includes the breeding range north only to the latitudes of northern Wyoming, but it expands west in Oregon and includes California, south into Mexico and eastward in South Dakota, Nebraska, Kansas, Oklahoma and Texas. Year-round, the Ferruginous Hawk can be found within the breeding range except for the Canadian provinces, Washington, northern Oregon, Montana, North Dakota and northern South Dakota and northern Wyoming. Stragglers in migration and winter have occurred in Ohio, Tennessee, Virginia, New Jersey, Minnesota, Wisconsin, and Florida.

There are no subspecies and this species occurs nowhere in the world except in North America.

MIGRATION

Dispersal from the nesting site occurs within about 40 days of fledging and can involve any direction. Southbound migration at the latitudes of the southern Canadian prairies is well-underway by mid to late September and by early October in the northern United States. Birds reach the San Francisco area by September 8, suggesting that southbound migrants are moving by early September in some areas. Band returns indicate that the origin of California birds includes Alberta, North Dakota, Idaho, and Colorado. Movements by southerly nesters are poorly documented and it has been suggested that they may be sedentary. Birds reach northern Mexico at least as early as October 23 and are frequent there until at least March 2.

Substantial movement in Arizona has been noted between March 15 and April 5, with arrivals as far north as South Dakota by late March or early April. In Utah and Colorado, birds return by late February or early March and birds are at Idaho nesting sites by mid March. Movements into southern Canada occur around late March or early April.

Information about migration routes seems limited, but at least some more or less lateral movement occurs during the fall as northern birds disperse into the broadened winter range to the south.

BEHAVIOR

The flight of the Ferruginous Hawk is active, with slow wing beats much like that of a small eagle. Soaring with the wings held in a strong dihedral has been noted, as well as gliding with the wings held flat, or in a modified dihedral. Hovering and low cruising over the ground are also used as hunting techniques. The wing beat has been described as "fluid" by some observers.

Hunting may occur at any time of the day depending upon the activity patterns of the major prey species. A bimodal pattern of early morning and late afternoon hunting may be common. The hunting tactics can be grouped into seven basic strategies:

Perch and Wait

- perching is on any elevated site, natural or man-made

Ground Perching

- the hawk will stand on the ground at a rodent burrow after initially locating it from the air. As the burrowing animal reaches the surface, the hawk rises into the air and pounces upon it even while it is still underneath the loose earth.

Low-level Flight

- birds will course over the landscape within a few yards of the ground and pursue in direct, low level chases, or they will hunt from 40 to 60 feet (12.4 to 18.6 meters) above the ground.

High-level Flight

- birds will hunt while soaring, but the success rate is generally low.

Hovering

- using quickened wing beats, often in times of increased winds, the birds will search the ground and drop on the prey.

Cooperative Hunting

- mates have been known to assist each other.

Piracy

- the Ferruginous Hawk has been observed gathering around a hunter shooting prairie dogs, and to claim shot "dogs" by flying to them and mantling over them.

In the strike, kill, and consumption type of predation, the victims are seized with the feet and a series of blows may be meted out, including driving the rear talon into the body to puncture vital organs. Biting with the beak may also take place. Before bringing prey to the nest, the adults will often eat the head. At the nest, birds are plucked and mammals torn into pieces before being fed to the young. Food caching has been noted, but not generally near the nest.

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Birds have been known to live for 20 years in the wild, but most birds probably die within the first five years. The oldest banded birds were recovered at age 20. First year mortality has been estimated at 66 percent and the adult mortality at 25 percent. The reasons for mortality include illegal shooting, loss of a satisfactory food supply, harassment, predation, and starvation of nestlings during times of low food supply. Ground nests are susceptible to predation by coyotes, and nestlings may be preyed upon by Great Horned Owls and Golden Eagles.

ADAPTATIONS

The Ferruginous Hawk is one of the most adaptable nesters of all of the raptors, and will use trees, ledges, rock or dirt outcrops, the ground, haystacks, nest platforms, power poles, and other man-made structures. Pairs have a high reproductive potential, thus allowing a rapid recovery of populations in response to upswings in the prey base.

HABITAT

The preferred habitat for Ferruginous Hawks are the arid, semiarid and grassland regions of North America. The countryside is open, level, or rolling prairies; foothills or middle elevation plateaus largely devoid of trees saved for copses; and cultivated shelterbelts or riparian corridors. Rock outcrops, shallow canyons, and gullies may characterize some habitats. These hawks avoid high elevations, forest interiors, narrow canyons, and cliff areas.

During the breeding season, the preference is for grasslands, sage, and other arid shrub country. Nesting occurs in the open areas or in trees including cottonwoods, willows, and swamp oaks along watercourses. Cultivated fields and modified grasslands (greater than 50 percent changed) are avoided during the breeding period. The density of Ferruginous Hawks in grasslands declines in a direct, inverse relationship to the degree of cultivation of the grasslands. However, high densities have been reported in areas where nearly 80% of the grassland was under cultivation.

The winter habitat is similar to that used during the summer in that open, arid grass or shrub terrain is preferred. However, cultivated areas are not necessarily avoided, particularly when the crops are not ploughed under after harvest. The standing stubble provides habitat for the small mammal prey base needed by Ferruginous and other hawks.

Some key attributes of the habitat include the availability of perches such as poles, lone trees, knolls, rocky outcrops or large boulders. Nesting will occur in trees if they are available, including riparian strips but the presence of water does not appear to be critical to Ferruginous Hawks.

VOICE

The voice is not well-described in literature. Alarm calls consist of "kree - a" or "ke - ah" and harsh "kaah, kaah" calls. The latter resembling some vocalizations of the Herring Gull. One description referred to the "wavering" alarm call and "breathy" notes while other authors describe screams similar to those of the Red-tailed Hawk

FOOD

The Ferruginous Hawk primarily hunts small to medium-sized mammals but will also take birds, reptiles, and some insects. Mammals generally comprise 80 to 90 percent of the prey items or biomass in the diet with birds being the next most common component. The diet varies somewhat geographically, depending upon the distribution of certain prey species, but where the range of the Ferruginous Hawk overlaps, the black-tailed jackrabbit is a major food species along with ground squirrels and pocket gophers. Depending upon the relative abundance of jackrabbits and ground squirrels, the latter could become the major food source. The particular species is dependent upon its occurrence within the range of the hawk.

In the following list, some generic references to mammals such as jackrabbits and ground squirrels are used, but include a number of species within those groups. The particular species taken by Ferruginous Hawks depends upon range overlap and subsequent availability. Common prey items are jackrabbits (black-tailed, white-tailed), cottontails, ground squirrels (Richardson's, 13-lined, antelope), prairie dog, kangaroo rats (Ord's), northern pocket gopher, voles (various species), mice (white-footed and others), long-tailed weasel, snowshoe hare, muskrat, pocket mice, Horned Lark, Western Meadowlark, Sharp-tailed Grouse, Ring-necked Pheasant, Gray Partridge, Chukar, ducks, Northern Harrier, Short-eared Owl, Burrowing Owl, Long-billed Curlew, Black-billed Magpie, bull snake, yellow-bellied racer, garter snake, grasshoppers, crickets, carabid beetles, and a few other larger insects.

NESTING

The Ferruginous Hawk is the most adaptable of all the buteos in selecting nest sites. The sites vary from trees, flat ground, rock/dirt outcrops, cliffs, utility poles, transmission towers, buildings, artificial nest platforms, and haystacks. Within some broad categories such as cliffs, the variety includes clay, dirt and rock substrates. Tree nests are typically in isolated trees or isolated clumps of trees in exposed locations. Authors differ as to whether ground nests are more successful than tree nests, but they are more susceptible to mammalian predation. Nest locations are reused frequently, but several nests may be built in an area. Typically, one or two alternate nests may exist but up to eight have been found on some territories.

The nests are made of ground debris such as sticks, branches, cattails and earlier, of old bison bones, usually in combination. Old nests will be refurbished, or nests of other species may be taken over and refurbished with sticks being added on top of the old nests. Odd items such as paper, rubbish, barbed wire, cornstalks, plastic and steel cable have been incorporated into nests. Bark from trees and shrubs will be used for lining along with grasses and cow dung. Bits and pieces of greenery are often added to the nest.

Clutch size varies from one to eight and is likely linked to food supply. The average clutch is three to four eggs, each 2.5 inches (6.35 centimeters) long and 2 inches (5.08 centimeters) wide. They are smooth, non-glossy and whitish in color, irregularly spotted or speckled and blotched with reddish - brown markings. There may be a concentration of darker pigments at the small end of the egg. Occasionally, the eggs are almost unmarked or have faint scribbles on them.

Both sexes are involved with building the nests and bringing materials, but the male seems to be more involved in retrieving materials while the female arranges them in the structure. Copulation occurs during and after nest building. The egg-laying period varies with latitude, weather, and possibly food supply. In the Canadian parts of the range, laying occurs during the latter part of April through late June, whereas farther south laying starts from about March 20 through mid May. The earliest recorded clutch was in January in Utah and laying could occur as late as July 3 in Canada. Egg-laying occurs at two-day intervals with incubation starting when the first egg is laid. Incubation is shared by both sexes with each taking approximately the same number of shifts during the 32 day average incubation period. Replacement clutches following failure appears to be rare.

The nestling period varies from 38 to 50 days with brooding primarily by the female. Males fledge at 38 to 40 days and the females as late as 50 days after hatching, or 10 days later than their male siblings as they take longer to develop. Nestlings lie or sit for the first two weeks, stand at about three weeks and walk soon after. By 16 or 18 days, they are able to feed on their own. Wing flapping starts about day 23 and by day 33 the young are capable of vigorous flapping and "flap jumps." The nestlings are sensitive to high temperatures and seek shade however possible in the nest. Initial movement out of the nest is felt to be a response to heat stress as the young quickly move towards shade. The initial flight for the males is taken at 38 to 40 days while the slower-developing females fly about 10 days later. Post-fledging dependency upon the parents may last for several weeks. During the first four weeks after fledging, the young patrol increasingly large areas around the nest as they learn to hunt. Young hawks have killed prey as early as four days after fledging.

The Ferruginous Hawk is single-brooded and like so many raptors, the number of young reared is tied closely to food supply. In areas where jackrabbit populations are the principal food source, the initial clutch sizes and the number of reared young vary closely with variations in the number of jackrabbits. Fifty percent loss of young has been reported in low jackrabbit years and production of young to flight age has been 15 times as high as in years when prey was scarce. Fledging rates of 2.7 to 3.6 young per nest have been reported during years of abundant food supply. The high potential clutch size allows for a quick response to increases in the prey base.

CONSERVATION

The Ferruginous Hawk was on the National Audubon Society's "Blue List" of species felt to be declining. From 1971 to 1981 it retained its "blue" status, and from 1982 to 1986 it was listed as a species of "Special Concern." The United States Fish and Wildlife Service placed it in a category of "undetermined" in 1973, and various states have placed it in categories of "Threatened" or "Endangered." In Canada, the Committee on the Status of Endangered Wildlife in Canada considered this species "Threatened" in 1980.

Across the Canadian prairies, the range was diminishing up until 1980, and at that time, birds were felt to be occupying 48 percent of its original range. Numbers were generally felt to be diminishing and a total Canadian population was estimated at 500 to 1000 pairs. By 1987, population increases were being noted, and the Alberta population alone was estimated at 1,800 pairs. The upswing was likely due to a greater availability of food on the wintering grounds, making the birds more likely to breed when they returned to Canada. In the United States, there has been a history of concern for this species in many states with declines noted, but in 1988, one study suggested that the population in California and locally elsewhere may have increased significantly. The wintering population north of Mexico was estimated at 5,500 birds in 1986. In 1984, the population estimate for North America was between 3,000 and 4,000 pairs, and in 1987, it was 14,000 individuals.

Threats to the overall population include:

- cultivation of native prairie grassland and subsequent habitat loss
- tree invasion of northern grassland habitats
- reductions in food supply due to agricultural pest management programs
- shooting and human interference

Toxic chemicals have not been suggested as a significant threat to the Ferruginous Hawk.

Management strategies must include the retention or reclamation of native grasslands for breeding as well as on the wintering grounds. Maintenance of high populations of prey species in wintering areas seems critical to the hawks' abilities to move onto the summer range in breeding condition. The integration of agricultural practices and policies into the management strategies is a crucial component of any overall scheme for conservation. The provision of nesting platforms has had positive effects and should be a part of local strategies. Public education and the elimination of persecution and human disturbance must be an important part of the overall conservation program.

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Rough-legged Hawk

Buteo lagopus

GENERAL DESCRIPTION

The Rough-legged Hawk is a large buteo and has been called lanky and angular. It is boldly-patterned and shows great variation from whitish light-morph birds with extensive brown and/or black patterning and increasingly dark-morph birds that ultimately are entirely black with limited but distinctive whitish areas. At the light end of the spectrum, adults viewed from below are essentially whitish with heavy dark streaking showing distinctive dark patches in the carpal areas of the wing, across the belly and across the terminal portion of the tail. Immatures show gray tail bands. The dark band on the tail along with a white area at the base is visible from below and on the dorsal surface of flying birds. The wing tips are also dark. The darkest birds on the other hand, look completely black over the head and entire body. The wings are whitish underneath except for the black coverts and primary feather tips. The banded white and dark tail of adults shows prominently from beneath as in lighter birds. Flight patterns are distinctive and include hovering as a frequently-used hunting tactic. Few buteos within the wintering range of this hawk hover as much as the Rough-legged Hawk. The wings are often held in a pronounced dihedral.

This is a bird of the open tundra when breeding and open country when wintering. It is highly migratory and moves from its arctic summer quarters to southern Canada and the northern and central United States for the winter.

SIZE

The Rough-legged Hawk is a fairly large buteo with females averaging larger than males. The overall length range, including both sexes, is from 18.5 to 20.5 inches (47.0 to 52.1 centimeters). The wingspan varies from 47 to 52 inches (119.4 to 132.1 centimeters). Some average measurements for females are: wing chord - 16.4 inches (41.7 centimeters) and tail - 8.8 inches (22.4 centimeters). The same average measurements for males are: wing chord - 16.3 inches (41.4 centimeters) and tail - 8.8 inches (22.3 centimeters). The averages mask the fact that females tend to be the individuals showing the longest measurements in the range for each of the preceding body parts. The weight range is from 1.7 to 3.1 pounds (771 to 1,406 grams) but on average, males weigh about 1.8 pounds (816 grams) and females 2.2 pounds (998 grams).

MORPHS AND MOLT

There are three subspecies recognized in the world but effectively only one in North America. There are no true color morphs. Light and dark birds interbreed. The sexes differ in pattern in the adult (basic) plumage but not in the juvenile stage. The basic differences in color patterns are due mainly to the deposition of the dark pigment melanin. The variation is so great that each individual bird has its own unique pattern, but certain common patterns are evident. Melanism is relatively uncommon in the West (10%) and more common in the East (25%) but can occur and add confusion to an already variable species. There is no post-juvenal molt. Birds of the year retain the feathers they acquire in the nest until the following spring when they begin to molt into the adult type plumage. Following that, birds undergo a single annual molt that takes place during the breeding season mainly from June through September although molting birds have been seen in November on their wintering grounds. The primaries molt from the 4th outward and the innermost 3 molt in sequence with the secondaries. The tail feathers molt from the central pair outwards. Females tend to molt earlier than the males.

SPECIFIC DESCRIPTION

The following description applies to *Buteo lagopus sancti-johannis*, the subspecies common to all of North America except Alaska where a zone of hybridization occurs. It should be noted that the range of variation between light and dark phases is great and attempting to describe a typical extreme for each is difficult. There are sexual differences in the tail pattern, belly pattern, marginal coverts, relative lightness of head to back, and the pattern of the dorsal feathers. These differences are most noticeable in the tail and belly patterns.

Adult Male Light-morph - Perched

Type A

- a lighter head with varying but narrow, dark shaft streaking. These types are only found in about 15 percent of western birds and none are found in eastern birds. Males therefore tend to exhibit less contrast between the head and back whereas females exhibit more tendency for contrast, particularly in the east. Belly markings are important.

Type B

- head not lighter than upper body colors with wide, dark shaft streaking. Belly markings are important.

HEAD

- varies from nearly unmarked white through a gradient of increasing amounts of dark along the feather shafts
- a dark eye line is evident
- the throat also shows an increasing amount of dark streaking
- the beak is black and the cere orange-yellow to orange
- the eye is dark brown
- two broad head patterns have been recognized:

BODY

- the breast is white with streaking of variable width and ranging from light brown through dark brown. The breast often appears as a dark bib at some distance.
- the belly may be clear white or with varying degrees of dark barring or blotchiness
- the lower abdomen, sides and undertail coverts are white through increasing degrees of dark barring or streaking
- the back varies from gray-brown with white or tawny mottling

WINGS

- the coverts are dark overall and tend to have wedge-shaped terminal marks
- the secondaries have a gray-brown with some white tip markings
- the primaries are dark fuscous-black and the wing tips reach the tail tip or beyond

TAIL

- the general underside pattern ranges from white for the basal one half or two-thirds with a dark terminal area
- a series of blackish bands cross the underside, progressing from a wider one near the tip through narrower ones towards the base
- a narrow area at the very tip of the tail is white
- some variations show a dark, diffuse band near the tip and no other banding or at least partial banding along the outer tail feathers
- on the upper surface, the tail is distinctly patterned in the lighter birds with a whitish basal area and a broad dark terminal band that has brown or cinnamon zones within it.

LEGS

- the flanks and thighs range from whitish, heavily barred with dark brown
- the legs are feathered completely to the feet
- the feet are yellow and the talons are black

Adult Female Light-morph - Perched

Type A

- a lighter head with varying but narrow, dark shaft streaking. About 60 percent of eastern females and 27 percent of western females have this type of head that is generally lighter than the back. Color and intensity of belly band is important.

Type B

- head not lighter than upper body colors with wide, dark shaft streaking. Color and intensity of belly band is important.

HEAD

- varies from nearly unmarked white through a gradient of increasing amounts of dark along the feather shafts
- a dark eye line is evident in lighter birds
- the throat shows dark streaking
- the beak is black and the cere orange-yellow to orange
- the iris is dark brown
- two broad head patterns have been recognized

BODY

- the breast is creamy white with streaking of variable width and ranging from light brown through dark brown. The breast often appears as a dark bib at some distance
- the belly is seldom, if ever, clear white and always with varying degrees of dark blotchiness
- the lower abdomen, sides and undertail coverts are white through increasing degrees of dark barring
- the belly usually appears to have a band that is darker than the rest of the underparts and this tendency towards darker bellies is greater in females; it may be a solid or split band. There is often a creamy, "u-shaped" area between the breast and the belly.
- the back varies from gray-brown with white or tawny mottling. Females tend to be more brown than the gray-brown males

WINGS

- the coverts are dark overall and tend to have longitudinal shaft marks
- the secondaries have gray-brown with some white tip markings
- the primaries are dark fuscous-black and the wing tips reach the tail tip

TAIL

- the general underside pattern ranges from white for the basal one half or two-thirds with a dark terminal area
- the series of blackish bands cross the underside found in males are absent such that the dark terminal band is more of a brownish gradient from the light area into the dark
- this "field" of brown may or may not have a darker brown band within it; up to three dark bands found in adult females.
- a narrow area at the very tip of the tail is white
- on the upper surface, the tail is distinctly patterned with a whitish basal area and a broad dark terminal band that has brown or cinnamon zones within it.

LEGS

- the flanks and thighs range from whitish, heavily barred with dark brown
- the legs are feathered completely to the feet
- the feet are yellow and the talons are black

Immature Light-morph - Perched

Note that males and females look the same in the first-year plumage.

HEAD

- light, creamy base with variable brown streaking
- dark line behind the eye
- the head is more frequently lighter than the back than it is the same color. Type A heads are more common.
- the beak is black and the cere is greenish to greenish yellow
- the eye is light gray to light brownish gray; appears pale

BODY

- the breast is creamy with variable mounts of dark streaking
- the dark breast streaking is usually wide as opposed to narrow along the feather shafts and the feather margins are reddish brown
- the belly has a continuous, solid dark band which appears as a paler brown than in most adult females.
- the back is brown with colors more blended than in adults so that the mottling is less distinct

WINGS

- the coverts are dark overall
- the secondaries are gray-brown with some white tip markings
- the primaries are dark fuscous-black and the wing tips reach the tail tip

TAIL

- the underparts are white near the base with a dark brown to dusky band toward the tip, more like female tails
- the upper tail varies from being white near the base with a wide, dark terminal area

LEGS

- the leg feathers are clear, creamy and lightly to not spotted or barred
- the feet are greenish yellow to yellow and the talons are black

Adult Male Light-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- the head may but tends not to contrast markedly from the back colors except for a small percentage of western birds
- the underwings are always two-toned with the coverts varying from moderately to heavily- streaked with dark markings
- the primaries are contrastingly lighter with dark tips
- dark carpal patches are usually prominent features; many males have very mottled carpal patches that do not contrast.
- tail with one or more dark bands
- dark edge trailing wings
- belly, flanks, and legs with spots or bars; sometimes belly is all-white to almost all-white on some birds

- the back is variably mottled dark or blackish with a contrasting white base to the tail or a dark tail with narrow white bands

Adult Female Light-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- the head may contrast markedly from the back colors more so in eastern than western birds
- the underwings are always two-toned with the coverts varying from moderately to heavily- streaked with dark markings
- the primaries are contrastingly lighter with dark tips
- dark edge to hind (trailing) part of wings
- all-dark carpal patches are prominent features; not mottled as in many males.
- there are four prominent dark areas on the underside set against a lighter background. These are the two carpal patches, a darker belly band (solid or split), and the dark terminal area of the tail. The terminal area usually lacks the multiple bands of the male and is more of a diffuse brown area that may have a darker band within it.
- the back is variably mottled gray-brown with a contrasting white base to the tail

Immature Light-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- the head more frequently contrasts markedly from the back colors
- the underwings are less obviously two-toned in lighter birds as the coverts may be unmarked. The tips of the flight feathers are dark and the solid dark carpal patches are obvious.
- gray edge to hind (trailing) part of wings
- individuals may tend to look more white on the underside with a solid dark belly band - the uppertail is more cleanly white at the base contrasting with the gray terminal band, much as black band on adults
- the upper side is variably dark but the primaries always show whitish areas (panels) on the top side. They are absent in adults.
- the under tail surface has a large white area at the base and a dusky terminal band

SIMILAR SPECIES

Lighter colored birds could be mistaken for the light phase Red-tailed Hawk but the latter does not have large dark carpal marks and lacks the white tail base contrasting with a dark terminal band. This latter tail feature could lead to confusion with the Northern Harrier but it is a slimmer looking bird with a longer tail and lacks the other obvious field marks such as carpal patches, dark belly banding and flight styles. Frequently, inexperienced observers mistake the Rough-legged Hawk for an Osprey, particularly due to the hovering flight pattern and the contrasting black and white patterning and wrist markings of lighter birds. Immature dark morph Ferruginous Hawks resemble immature, dark Rough-legged Hawks but the Ferruginous Hawk is larger and has white patches in the carpal area that are lacking in the Rough-legged Hawk. Similarly, a dark immature Red-tailed Hawk may appear similar to some observers but these birds have numerous narrow dark tail bands and pale upper primary coverts. Darker Rough-legged Hawks may also be confused with the Zone-tailed Hawk based on broad plumage traits and the dihedral wing posture in both.

OTHER NAMES

The Rough-legged Hawk is also known as the "Roughie", "Rough-leg", "Black Hawk" (dark

phase), "Chap Hawk", "Chicken Hawk", "Mouse Hawk", "Screech Hawk", "Squalling Hawk", and "Squealing Hawk."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard", which is an early name for hawks and vultures. It is allied with the Greek "buzo" which means "to hoot" which has little relevance to the calls of any diurnal birds of prey. The species name *Lagopus* is Greek for "hare-footed" with reference to the leg feathering extending down to the foot. Rough-legged is also a reference to the leg feathering and "hawk" has its origins from the Teutonic base "hab" which ultimately led to the Middle English derivative "hawk." Hab meant "to seize or hold."

MYTHOLOGY

None is known for North America.

RANGE

The Rough-legged Hawk is a circumboreal species that in North America, breeds north of timberline in Canada and Alaska including most of Newfoundland, the islands of the Canadian Arctic, as well as the Aleutians Islands. In western Canada, breeding has not been proven south of 60 degrees of latitude except at Churchill, Manitoba. The most southerly breeding takes place in central Newfoundland. The altitudinal limits on the breeding grounds appear to be about 3,000 feet (930 meters).

The winter range is well south of the breeding range and the coniferous forest belt that stretches across Canada. Most wintering takes place between southern Canada and the first two tiers of states south of the 49th parallel, but birds have been recorded as far south as New Mexico and Texas, especially during incursion years. The southeastern United States and southern Texas are devoid of winter birds. The northern limit of the breeding range occasionally extends up the west coast to Alaska and includes every Canadian province. The greatest number of birds wintering in the United States occur west of the Mississippi River. There are probably at least a few sight records for every state in the counterminous United States with wanderers to Bermuda and Mexico on occasion.

There are few places that could logically harbor Rough-legged Hawks on a year-round basis due to the wide separation between the summer and winter ranges. Zones of overlap are not known but there are older references to year-round occurrence on Southampton Island, north of Hudson Bay. Alaska is the only state that might claim continuous year-round presence of this species but the summer and winter ranges there do not overlap. This is also the case for Manitoba, Ontario, Quebec, and Newfoundland that have both summering and wintering birds within their geographical boundaries.

Three subspecies are recognized in the world but only one occurs in North America, namely *Buteo lagopus sancti-johannis*. This is the breeding race for all of Canada. Its range includes the Yukon and Northwest Territories including Prince Patrick, Melville, Bathurst, Banks, Baffin, and Somerset and Ellesmere islands, although breeding has not been proven at this latter location. Breeding also occurs around the perimeter of Hudson Bay and across Northern Quebec to central Newfoundland. It apparently does not occur in Alaska which is considered a zone of hybridization between North American and Eurasian type birds. Wintering occurs within North America.

MIGRATION

Movements south to the wintering range can occur early in years of low food supply.

Some birds have been seen on the wintering range as early as August but departure from the breeding range is commonly during September and stragglers may still be there during October. Abundant food supplies will detain birds longer at northern latitudes. Arrival in southern British Columbia, at 50 degrees latitude, can be as early as late September with most of the movement during the latter part of October. The same appears to be true for the Great Lakes region as well. Some eastern hawk observers report southbound movements still occurring ahead of cold fronts in January, indicating that movement around the wintering range may occur as birds adjust to changing conditions.

Spring migration movements at the southern limits of the wintering range can begin in February. March and April are months of increasing movement with most birds passing the western Canada-United States border during April with late birds still moving until about the third week of May. Movements in the Great Lakes area can be quite strong from early March and continue well into May. Migration across the northern boreal forest belt and around Hudson Bay, can still be underway during June when some local birds are already sitting on eggs.

Birds cross the boreal forest zone in their quest to find suitable wintering habitat and again upon their return to the breeding grounds. Corridors are not well known, but concentrations have been noted at some hawk lookouts such as 1,000 on October 18, 1959 at Marathon, Ontario near the north shore of Lake Erie. Perhaps the proximity of a large water body served to concentrate the birds. Birds of southern Baffin Island and northern Quebec probably travel down the east side of Hudson Bay and thence southwesterly towards Lake Superior. Following a more southerly route across the lake brings the birds in a positive direction towards the areas of greater winter concentration on the Great Plains. Other movements out of the central Arctic probably take place in a more direct north-south fashion as birds move into the mid-west prairies. Birds banded in Alaska have been recovered in Colorado indicating that at least some travel in southeasterly direction to reach the mid-west. Interior migration through British Columbia in the fall is not heavy, suggesting that most Alaskan birds bound for United States wintering grounds pass east of the cordilleran ranges.

Spring movements are strong in the Great Lakes area but they are not all directed in a northeasterly line. Possibly birds moving up the eastern Great Lakes are bound for different breeding grounds than those moving through the western Great Lakes area. Here, they can display a north or northwesterly trend as they cross Lake Superior. Spring counts along the south shore of Lake Ontario produce 400 to 600 birds per season at Derby Hill. Combined totals of up to 2,000 birds from all lookouts have been noted during the spring season as birds move through the Great Lakes region. Western concentrations have not been noted in the same numbers and coverage of the northern central plains in a systematic way by hawk watchers is limited so that comparative numbers are not available.

Historical information and more recent systematic counts at hawk-watching stations show larger number of migrants moving in some years than in other years. Spring migration counts do not always correspond with counts taken the previous fall and "flight" years do not necessarily correspond with southerly invasions of other more northerly species such as Snowy Owls or Goshawks. Correlations with known population fluctuations have not been demonstrated.

BEHAVIOR

In level flight, The Rough-legged Hawk tends to utilize steady wingbeats with less of the "pump and glide" type of flight that other buteos use. The wingbeats have been described as "unhurried and methodical" with the overall flight called "effortless, graceful and purposeful." Soaring flight is used and the wings are held in a pronounced dihedral. The

wings extend up from the body and then flatten out. This species seems less dependent upon the use of thermals than other buteos. Hunting occurs during the day but often until much later than in other buteos and can be grouped into the following tactics.

Perch and Wait

- perching with an erect stance on elevated objects such as lone trees, power poles, and building tops is used as an energy saving method

Quartering Flight

- birds will fly slowly, alternately flapping and sailing to cover ground much like a Northern Harrier

Hovering

- using rapid wing beats, birds will hang motionless in mid-air, searching visually and possibly with its ears for prey. This usually occurs at altitudes of 50 to 100 feet (15.5 to 31 meters) but at times in excess of 200 feet (62 meters).

Fishing

- birds have been seen catching fish with Osprey-like plunges into water. They have also been seen wading in water to catch dying fish.

Piracy

- although often the victim of birds like Common Ravens, the Rough-legged Hawk will attack other raptors and cause them to drop their kill which is then consumed. They will also rob other Rough-legged Hawks

Carrion Eating

- wintering Rough-legged Hawks have fed on dead fish washed ashore in freshwater environments as well as on mammal carcasses

Strike, Kill, and Consumption

- the tarsi may be lowered well prior to pouncing on its prey such as when in hovering flight and prey is spotted. The bird will drop with extended legs and if there is nothing to seize, it will glide a short distance and pull up into a hovering position again. Prey are seized with the talons as in other buteos. Prey are typically beheaded and larger victims are torn apart.

The Rough-legged Hawk is quite trusting and docile around humans, allowing close approach which can put them at some risk. In captivity, at rehabilitation centers, it is usually quite calm and unassertive. Around the nest however, it is a fierce defender, engaging in close swoops and chases in order to drive off intruders. However, it is not as aggressive as raptors like the Peregrine Falcon and may well lose out in skirmishes over the ownership of a potential nest site. Response to human intruders at nests varies from limited to aggressive and body contact is not unknown. Territorial conflicts have been reported with Peregrine Falcons, Gyrfalcons, and Golden Eagles as well as aggressive interactions over prey with other Rough-legged Hawks, Northern Harriers, Red-tailed Hawks, and Common Ravens. Communal roosting at night, on some wintering ranges, has been documented in association with high rodent populations. The Rough-legged Hawk is mostly solitary or perhaps paired in migration but it is common to see several perched within a half mile (0.8 kilometer) of each other and hundreds have passed some key migration points in a day in loosely aggregated flocks.

Nesting density probably varies with the availability of nest sites and food supply and it is quite variable across the species' range. Density estimates for one pair of birds range from

two to 31 square miles (5.2 to 7.8 square kilometers) with a suggested average of one nesting pair for every three to four square miles (7.8 to 10.4 square kilometers). Hunting territories probably range from two to three square miles (5.2 to 7.8 square kilometers) and increase to at least four square miles (10.4 square kilometers) after the young have hatched. Internest distances range from 100 yards (91.4 meters) to 14 miles (22.4 kilometers) with averages closer to two miles (3.2 kilometers) in parts of Alaska. Home ranges on winter territories cover four to six square. miles (10.7 to 15.5 square kilometers).

Some observers believe that pair bonding occurs on the wintering ground or during migration as at least some birds may be mated before arrival at the nest site. "High - circling" has been reported on the wintering grounds and also on the breeding grounds. This consists of paired birds circling with the wings and tail spread and occasionally passing close to each other and uttering a two syllable call. The "sky-dance" pattern typical of buteos consists of the male folding its wings tightly in flight and hurtling towards earth. It checks its descent, climbs steeply, stalls with the body held vertically and then pitches forward into another plunge, repeating the whole sequence several times. This display is used on the nesting territory but for only a short duration after arrival. Nesting material may be offered to the female before copulation which starts at least two weeks before the first egg is laid. Pre-laying copulation frequency averaged once or twice per day in a pair of captive birds. The duration of copulation is 8 to 10 seconds. Territorial defense consists of close swoops and chasing flight with the occasional physical contact.

The average life span of 48 dead birds recovered in one study was about 21 months. The oldest bird was 18 years. Collisions with automobiles on the wintering grounds are common as this species frequently hunts roadways. Shooting has historically been a visible cause of mortality but recent figures are not available. As with all predators, the availability of an adequate food supply is critical and starvation on wintering grounds subject to deeper snows is likely higher than in low or no snow areas. Predation on nestlings has been noted by Golden Eagles but this is likely an unimportant source of mortality. On the wintering grounds, birds have died after consuming rodents that had been eating grain treated with Dieldrin. This is an uncertain source of mortality.

ADAPTATIONS

For a buteo, its ability to feed on carrion or hunt for fish is somewhat novel. It will also hover in lighter winds than heavier buteos.

HABITAT

In general, this is a bird of open country, sparsely treed, and offering great visibility. It avoids the forests except to pass over them during migration. The habitat includes arctic tundra, large river deltas, open fields and pastures, native grasslands, shrub steppe valley sides, marshlands, bogs, dunes and any other essentially treeless areas.

The breeding habitat is arctic tundra at lower elevations. Nesting is on steep cliff faces but hunting is over the open, rolling topography. If nesting occurs in forested fringe areas, hunting is done over the open bogs and clearings. Vegetation is usually low and mostly herbaceous with sparse overall shrub cover.

The wintering habitat is similarly open country of prairie grasslands, sagebrush flats and basins, agricultural lands, marshlands, bogs, dunes, sanitary landfills, open fields, and river deltas. Forested areas are avoided as are high alpine habitats under deep snow.

Some critical habitat components are steep, elevated rock or dirt faces for nesting and elevated perching sites for hunting. Low rocks and shrubs are used in the absence of higher

sites, but power poles, lone buildings or other structures, fences, , lone trees or snags are all used as resting or hunting perches. Nesting occasionally occurs in trees if other sites are not available.

VOICE

A commonly heard alarm call is a descending, cat-like, "kee-eer" scream. It has been likened to the scream of the Red-tailed Hawk. Soft "mews" have been heard in captive birds along with high-pitched whistling notes. Various "cheep" notes are given by the male along with squeals and squawks from the female. Two-syllable clucking notes and downslurred whistling noises are also noted for this species. The female also has a clucklike "nar-nar" call. Descending, slurred whistles are also part of the repertoire.

FOODS

The summer food supply is largely lemmings (as much as 80 percent) but also consists of voles, mice, and shrews of various species. Less commonly, arctic ground squirrels and hares along with various bird species such as ptarmigan, Golden Plover, young Whimbrel, American Tree Sparrow, wagtails, Lapland Longspur, and Snow Bunting. Seal and caribou carrion will be eaten during the summer. While up to 90 percent of the preferred diet is small rodents, birds will replace rodents as a food source in years of low mammal numbers.

During migration, and winter periods, small mammals still comprise the preferred diet but this species shows some adaptability and opportunism. The prey variety increases somewhat to include frogs, deer mice, reptiles, carrion of different species including larger birds, domestic chickens, Gray Partridge, Ring-necked Pheasant (young or carrion), fishes, grasshoppers, and various other insects.

NESTING

The Rough-legged Hawk's nest site is primarily high on a rock or dirt cliff on a ledge or in a recess. Eroded river banks, columnar rocks or mounds of rock or dirt will also be used. Occasionally man-made structures will be used and rarely the ground. Where cliffs are not available trees will be used. Whenever possible, the highest of all potential nest sites will be chosen. Unlike falcons who also use cliff faces, a stick nest is constructed. Twigs, bones or any transportable debris are also used where sticks are at a premium. The nest is lined with grasses, sedges, small twigs, feathers, down and rodent fur. The nest shape may vary depending upon constraints of the site, but will be at least 30 inches (76 centimeters) in diameter and 15 inches (38 centimeters) in height with about a 10 inch (25 centimeters) bowl. Nests are refurbished each year and can become quite large but alternate nests may be built nearby (within 100 yards [91 meters] or up to half a mile away [0.8 kilometers]). Favored sites are likely traditional and used for many years by the same pair unless they are displaced by another raptor. The male brings the sticks and the female builds the nest.

Initial breeding may not occur until age two or three. Clutch sizes vary with food supply but usually two to three and as many as five to seven eggs in a year of abundant rodents. Some areas are consistently three to five eggs and other places four to six eggs with seven being infrequent. The eggs are generally elliptical and average 2.2 inches (56 millimeters) long by 1.8 inches (46 millimeters) wide. The ground color is generally reported as white but it has been described as palish green or blue that bleaches to white. The markings are highly variable blotching and streaking of chestnut, brown or violet and may form somewhat of a ring around the larger end. Not all eggs in the clutch are marked to the same intensity but none are ever plain. The laying interval in the wild is probably 1 day, but in captivity, the interval has been as much as two or three days. Depending upon latitude and general climate, egg laying could start in late April but over most of the range, laying probably peaks

from late May through June. Incubation is primarily by the female but the male may perform brief incubation duties in between his hunting forays. Incubation starts as the first egg is laid and averages 31 days.

The nestling period is about 40 days, but males are often able to fly at 36 days, and females around 40. Nestlings can be fed at about six hours and by 21 days, juvenile feathers appear as the young are able to feed themselves. Standing happens by day 28 and by 35 days, they are able to tear up large prey items. Fledglings will remain dependent upon the parents at least until migration begins but some birds are independent at about 30 days after fledging. Rough-leggeds are single brooded but if eggs are lost early enough in the season, a replacement clutch may be laid.

CONSERVATION

In 1986, it was estimated that nearly 50,000 individuals were wintering in the United States alone. Pesticides do not appear to be as problematic as they have been for other raptors as the Rough-legged Hawk's major food sources are not migratory and accumulate very small amounts of chemicals. It may be the most common raptor breeding in the arctic regions. The populations obviously fluctuate but are not cyclic in nature. To suggest that the populations fluctuate directly with fluctuations in lemming and small mammal populations on the breeding grounds is appealing but is not supported by studies. This *buteo* has the ability to switch to other prey items when mammals are low so this may allow it to survive the periodicity or random fluctuations in mammal populations. Rough-legged Hawk declines may reflect circumstances where all major prey resources are at lowered levels, leaving few options for the birds. Climate has been implicated as a stronger factor influencing populations.

In general, it seems that the Rough-legged Hawk population in North America is under no immediate threat. As with all species, the maintenance of appropriate habitat is critical to long term survival. As arctic petroleum reserves and other resources are developed, habitat pressures can only increase and constant vigil is necessary to ensure that there is no net loss. Wintering habitats are under more severe pressure and again, good land stewardship aimed at maintaining biodiversity must be practiced in order to maintain species like the Rough-legged Hawk.

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Rough-legged Hawk - light

Buteo lagopus

GENERAL DESCRIPTION

The Rough-legged Hawk is a large buteo and has been called lanky and angular. It is boldly-patterned and shows great variation from whitish light-morph birds with extensive brown and/or black patterning and increasingly dark-morph birds that ultimately are entirely black with limited but distinctive whitish areas. At the light end of the spectrum, adults viewed from below are essentially whitish with heavy dark streaking showing distinctive dark patches in the carpal areas of the wing, across the belly and across the terminal portion of the tail. Immatures show gray tail bands. The dark band on the tail along with a white area at the base is visible from below and on the dorsal surface of flying birds. The wing tips are also dark. The darkest birds on the other hand, look completely black over the head and entire body. The wings are whitish underneath except for the black coverts and primary feather tips. The banded white and dark tail of adults shows prominently from beneath as in lighter birds. Flight patterns are distinctive and include hovering as a frequently-used hunting tactic. Few buteos within the wintering range of this hawk hover as much as the Rough-legged Hawk. The wings are often held in a pronounced dihedral.

This is a bird of the open tundra when breeding and open country when wintering. It is highly migratory and moves from its arctic summer quarters to southern Canada and the northern and central United States for the winter.

SIZE

The Rough-legged Hawk is a fairly large buteo with females averaging larger than males. The overall length range, including both sexes, is from 18.5 to 20.5 inches (47.0 to 52.1 centimeters). The wingspan varies from 47 to 52 inches (119.4 to 132.1 centimeters). Some average measurements for females are: wing chord - 16.4 inches (41.7 centimeters) and tail - 8.8 inches (22.4 centimeters). The same average measurements for males are: wing chord - 16.3 inches (41.4 centimeters) and tail - 8.8 inches (22.3 centimeters). The averages mask the fact that females tend to be the individuals showing the longest measurements in the range for each of the preceding body parts. The weight range is from 1.7 to 3.1 pounds (771 to 1,406 grams) but on average, males weigh about 1.8 pounds (816 grams) and females 2.2 pounds (998 grams).

MORPHS AND MOLT

There are three subspecies recognized in the world but effectively only one in North America. There are no true color morphs. Light and dark birds interbreed. The sexes differ in pattern in the adult (basic) plumage but not in the juvenile stage. The basic differences in color patterns are due mainly to the deposition of the dark pigment melanin. The variation is so great that each individual bird has its own unique pattern, but certain common patterns are evident. Melanism is relatively uncommon in the West (10%) and more common in the East (25%) but can occur and add confusion to an already variable species. There is no post-juvenal molt. Birds of the year retain the feathers they acquire in the nest until the following spring when they begin to molt into the adult type plumage. Following that, birds undergo a single annual molt that takes place during the breeding season mainly from June through September although molting birds have been seen in November on their wintering grounds. The primaries molt from the 4th outward and the innermost 3 molt in sequence with the secondaries. The tail feathers molt from the central pair outwards. Females tend to molt earlier than the males.

SPECIFIC DESCRIPTION

The following description applies to *Buteo lagopus sancti-johannis*, the subspecies common to all of North America except Alaska where a zone of hybridization occurs. It should be noted that the range of variation between light and dark phases is great and attempting to describe a typical extreme for each is difficult. There are sexual differences in the tail pattern, belly pattern, marginal coverts, relative lightness of head to back, and the pattern of the dorsal feathers. These differences are most noticeable in the tail and belly patterns.

Adult Male Light-morph - Perched

Type A

- a lighter head with varying but narrow, dark shaft streaking. These types are only found in about 15 percent of western birds and none are found in eastern birds. Males therefore tend to exhibit less contrast between the head and back whereas females exhibit more tendency for contrast, particularly in the east. Belly markings are important.

Type B

- head not lighter than upper body colors with wide, dark shaft streaking. Belly markings are important.

HEAD

- varies from nearly unmarked white through a gradient of increasing amounts of dark along the feather shafts
- a dark eye line is evident
- the throat also shows an increasing amount of dark streaking
- the beak is black and the cere orange-yellow to orange
- the eye is dark brown
- two broad head patterns have been recognized:

BODY

- the breast is white with streaking of variable width and ranging from light brown through dark brown. The breast often appears as a dark bib at some distance.
- the belly may be clear white or with varying degrees of dark barring or blotchiness
- the lower abdomen, sides and undertail coverts are white through increasing degrees of dark barring or streaking
- the back varies from gray-brown with white or tawny mottling

WINGS

- the coverts are dark overall and tend to have wedge-shaped terminal marks
- the secondaries have a gray-brown with some white tip markings
- the primaries are dark fuscous-black and the wing tips reach the tail tip or beyond

TAIL

- the general underside pattern ranges from white for the basal one half or two-thirds with a dark terminal area
- a series of blackish bands cross the underside, progressing from a wider one near the tip through narrower ones towards the base
- a narrow area at the very tip of the tail is white
- some variations show a dark, diffuse band near the tip and no other banding or at least partial banding along the outer tail feathers
- on the upper surface, the tail is distinctly patterned in the lighter birds with a whitish basal area and a broad dark terminal band that has brown or cinnamon zones within it.

LEGS

- the flanks and thighs range from whitish, heavily barred with dark brown
- the legs are feathered completely to the feet
- the feet are yellow and the talons are black

Adult Female Light-morph - Perched

Type A

- a lighter head with varying but narrow, dark shaft streaking. About 60 percent of eastern females and 27 percent of western females have this type of head that is generally lighter than the back. Color and intensity of belly band is important.

Type B

- head not lighter than upper body colors with wide, dark shaft streaking. Color and intensity of belly band is important.

HEAD

- varies from nearly unmarked white through a gradient of increasing amounts of dark along the feather shafts
- a dark eye line is evident in lighter birds
- the throat shows dark streaking
- the beak is black and the cere orange-yellow to orange
- the iris is dark brown
- two broad head patterns have been recognized

BODY

- the breast is creamy white with streaking of variable width and ranging from light brown through dark brown. The breast often appears as a dark bib at some distance
- the belly is seldom, if ever, clear white and always with varying degrees of dark blotchiness
- the lower abdomen, sides and undertail coverts are white through increasing degrees of dark barring
- the belly usually appears to have a band that is darker than the rest of the underparts and this tendency towards darker bellies is greater in females; it may be a solid or split band. There is often a creamy, "u-shaped" area between the breast and the belly.
- the back varies from gray-brown with white or tawny mottling. Females tend to be more brown than the gray-brown males

WINGS

- the coverts are dark overall and tend to have longitudinal shaft marks
- the secondaries have gray-brown with some white tip markings
- the primaries are dark fuscous-black and the wing tips reach the tail tip

TAIL

- the general underside pattern ranges from white for the basal one half or two-thirds with a dark terminal area
- the series of blackish bands cross the underside found in males are absent such that the dark terminal band is more of a brownish gradient from the light area into the dark
- this "field" of brown may or may not have a darker brown band within it; up to three dark bands found in adult females.
- a narrow area at the very tip of the tail is white
- on the upper surface, the tail is distinctly patterned with a whitish basal area and a broad dark terminal band that has brown or cinnamon zones within it.

LEGS

- the flanks and thighs range from whitish, heavily barred with dark brown
- the legs are feathered completely to the feet
- the feet are yellow and the talons are black

Immature Light-morph - Perched

Note that males and females look the same in the first-year plumage.

HEAD

- light, creamy base with variable brown streaking
- dark line behind the eye
- the head is more frequently lighter than the back than it is the same color. Type A heads are more common.
- the beak is black and the cere is greenish to greenish yellow
- the eye is light gray to light brownish gray; appears pale

BODY

- the breast is creamy with variable mounts of dark streaking
- the dark breast streaking is usually wide as opposed to narrow along the feather shafts and the feather margins are reddish brown
- the belly has a continuous, solid dark band which appears as a paler brown than in most adult females.
- the back is brown with colors more blended than in adults so that the mottling is less distinct

WINGS

- the coverts are dark overall
- the secondaries are gray-brown with some white tip markings
- the primaries are dark fuscous-black and the wing tips reach the tail tip

TAIL

- the underparts are white near the base with a dark brown to dusky band toward the tip, more like female tails
- the upper tail varies from being white near the base with a wide, dark terminal area

LEGS

- the leg feathers are clear, creamy and lightly to not spotted or barred
- the feet are greenish yellow to yellow and the talons are black

Adult Male Light-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- the head may but tends not to contrast markedly from the back colors except for a small percentage of western birds
- the underwings are always two-toned with the coverts varying from moderately to heavily- streaked with dark markings
- the primaries are contrastingly lighter with dark tips
- dark carpal patches are usually prominent features; many males have very mottled carpal patches that do not contrast.
- tail with one or more dark bands
- dark edge trailing wings
- belly, flanks, and legs with spots or bars; sometimes belly is all-white to almost all-white on some birds

- the back is variably mottled dark or blackish with a contrasting white base to the tail or a dark tail with narrow white bands

Adult Female Light-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- the head may contrast markedly from the back colors more so in eastern than western birds
- the underwings are always two-toned with the coverts varying from moderately to heavily- streaked with dark markings
- the primaries are contrastingly lighter with dark tips
- dark edge to hind (trailing) part of wings
- all-dark carpal patches are prominent features; not mottled as in many males.
- there are four prominent dark areas on the underside set against a lighter background. These are the two carpal patches, a darker belly band (solid or split), and the dark terminal area of the tail. The terminal area usually lacks the multiple bands of the male and is more of a diffuse brown area that may have a darker band within it.
- the back is variably mottled gray-brown with a contrasting white base to the tail

Immature Light-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- the head more frequently contrasts markedly from the back colors
- the underwings are less obviously two-toned in lighter birds as the coverts may be unmarked. The tips of the flight feathers are dark and the solid dark carpal patches are obvious.
- gray edge to hind (trailing) part of wings
- individuals may tend to look more white on the underside with a solid dark belly band - the uppertail is more cleanly white at the base contrasting with the gray terminal band, much as black band on adults
- the upper side is variably dark but the primaries always show whitish areas (panels) on the top side. They are absent in adults.
- the under tail surface has a large white area at the base and a dusky terminal band

SIMILAR SPECIES

Lighter colored birds could be mistaken for the light phase Red-tailed Hawk but the latter does not have large dark carpal marks and lacks the white tail base contrasting with a dark terminal band. This latter tail feature could lead to confusion with the Northern Harrier but it is a slimmer looking bird with a longer tail and lacks the other obvious field marks such as carpal patches, dark belly banding and flight styles. Frequently, inexperienced observers mistake the Rough-legged Hawk for an Osprey, particularly due to the hovering flight pattern and the contrasting black and white patterning and wrist markings of lighter birds. Immature dark morph Ferruginous Hawks resemble immature, dark Rough-legged Hawks but the Ferruginous Hawk is larger and has white patches in the carpal area that are lacking in the Rough-legged Hawk. Similarly, a dark immature Red-tailed Hawk may appear similar to some observers but these birds have numerous narrow dark tail bands and pale upper primary coverts. Darker Rough-legged Hawks may also be confused with the Zone-tailed Hawk based on broad plumage traits and the dihedral wing posture in both.

OTHER NAMES

The Rough-legged Hawk is also known as the "Roughie", "Rough-leg", "Black Hawk" (dark

phase), "Chap Hawk", "Chicken Hawk", "Mouse Hawk", "Screech Hawk", "Squalling Hawk", and "Squealing Hawk."

ETYMOLOGY

The genus *Buteo* is Latin for "buzzard", which is an early name for hawks and vultures. It is allied with the Greek "buzo" which means "to hoot" which has little relevance to the calls of any diurnal birds of prey. The species name *Lagopus* is Greek for "hare-footed" with reference to the leg feathering extending down to the foot. Rough-legged is also a reference to the leg feathering and "hawk" has its origins from the Teutonic base "hab" which ultimately led to the Middle English derivative "hawk." Hab meant "to seize or hold."

MYTHOLOGY

None is known for North America.

RANGE

The Rough-legged Hawk is a circumboreal species that in North America, breeds north of timberline in Canada and Alaska including most of Newfoundland, the islands of the Canadian Arctic, as well as the Aleutians Islands. In western Canada, breeding has not been proven south of 60 degrees of latitude except at Churchill, Manitoba. The most southerly breeding takes place in central Newfoundland. The altitudinal limits on the breeding grounds appear to be about 3,000 feet (930 meters).

The winter range is well south of the breeding range and the coniferous forest belt that stretches across Canada. Most wintering takes place between southern Canada and the first two tiers of states south of the 49th parallel, but birds have been recorded as far south as New Mexico and Texas, especially during incursion years. The southeastern United States and southern Texas are devoid of winter birds. The northern limit of the breeding range occasionally extends up the west coast to Alaska and includes every Canadian province. The greatest number of birds wintering in the United States occur west of the Mississippi River. There are probably at least a few sight records for every state in the counterminous United States with wanderers to Bermuda and Mexico on occasion.

There are few places that could logically harbor Rough-legged Hawks on a year-round basis due to the wide separation between the summer and winter ranges. Zones of overlap are not known but there are older references to year-round occurrence on Southampton Island, north of Hudson Bay. Alaska is the only state that might claim continuous year-round presence of this species but the summer and winter ranges there do not overlap. This is also the case for Manitoba, Ontario, Quebec, and Newfoundland that have both summering and wintering birds within their geographical boundaries.

Three subspecies are recognized in the world but only one occurs in North America, namely *Buteo lagopus sancti-johannis*. This is the breeding race for all of Canada. Its range includes the Yukon and Northwest Territories including Prince Patrick, Melville, Bathurst, Banks, Baffin, and Somerset and Ellesmere islands, although breeding has not been proven at this latter location. Breeding also occurs around the perimeter of Hudson Bay and across Northern Quebec to central Newfoundland. It apparently does not occur in Alaska which is considered a zone of hybridization between North American and Eurasian type birds. Wintering occurs within North America.

MIGRATION

Movements south to the wintering range can occur early in years of low food supply.

Some birds have been seen on the wintering range as early as August but departure from the breeding range is commonly during September and stragglers may still be there during October. Abundant food supplies will detain birds longer at northern latitudes. Arrival in southern British Columbia, at 50 degrees latitude, can be as early as late September with most of the movement during the latter part of October. The same appears to be true for the Great Lakes region as well. Some eastern hawk observers report southbound movements still occurring ahead of cold fronts in January, indicating that movement around the wintering range may occur as birds adjust to changing conditions.

Spring migration movements at the southern limits of the wintering range can begin in February. March and April are months of increasing movement with most birds passing the western Canada-United States border during April with late birds still moving until about the third week of May. Movements in the Great Lakes area can be quite strong from early March and continue well into May. Migration across the northern boreal forest belt and around Hudson Bay, can still be underway during June when some local birds are already sitting on eggs.

Birds cross the boreal forest zone in their quest to find suitable wintering habitat and again upon their return to the breeding grounds. Corridors are not well known, but concentrations have been noted at some hawk lookouts such as 1,000 on October 18, 1959 at Marathon, Ontario near the north shore of Lake Erie. Perhaps the proximity of a large water body served to concentrate the birds. Birds of southern Baffin Island and northern Quebec probably travel down the east side of Hudson Bay and thence southwesterly towards Lake Superior. Following a more southerly route across the lake brings the birds in a positive direction towards the areas of greater winter concentration on the Great Plains. Other movements out of the central Arctic probably take place in a more direct north-south fashion as birds move into the mid-west prairies. Birds banded in Alaska have been recovered in Colorado indicating that at least some travel in southeasterly direction to reach the mid-west. Interior migration through British Columbia in the fall is not heavy, suggesting that most Alaskan birds bound for United States wintering grounds pass east of the cordilleran ranges.

Spring movements are strong in the Great Lakes area but they are not all directed in a northeasterly line. Possibly birds moving up the eastern Great Lakes are bound for different breeding grounds than those moving through the western Great Lakes area. Here, they can display a north or northwesterly trend as they cross Lake Superior. Spring counts along the south shore of Lake Ontario produce 400 to 600 birds per season at Derby Hill. Combined totals of up to 2,000 birds from all lookouts have been noted during the spring season as birds move through the Great Lakes region. Western concentrations have not been noted in the same numbers and coverage of the northern central plains in a systematic way by hawk watchers is limited so that comparative numbers are not available.

Historical information and more recent systematic counts at hawk-watching stations show larger number of migrants moving in some years than in other years. Spring migration counts do not always correspond with counts taken the previous fall and "flight" years do not necessarily correspond with southerly invasions of other more northerly species such as Snowy Owls or Goshawks. Correlations with known population fluctuations have not been demonstrated.

BEHAVIOR

In level flight, The Rough-legged Hawk tends to utilize steady wingbeats with less of the "pump and glide" type of flight that other buteos use. The wingbeats have been described as "unhurried and methodical" with the overall flight called "effortless, graceful and purposeful." Soaring flight is used and the wings are held in a pronounced dihedral. The

wings extend up from the body and then flatten out. This species seems less dependent upon the use of thermals than other buteos. Hunting occurs during the day but often until much later than in other buteos and can be grouped into the following tactics.

Perch and Wait

- perching with an erect stance on elevated objects such as lone trees, power poles, and building tops is used as an energy saving method

Quartering Flight

- birds will fly slowly, alternately flapping and sailing to cover ground much like a Northern Harrier

Hovering

- using rapid wing beats, birds will hang motionless in mid-air, searching visually and possibly with its ears for prey. This usually occurs at altitudes of 50 to 100 feet (15.5 to 31 meters) but at times in excess of 200 feet (62 meters).

Fishing

- birds have been seen catching fish with Osprey-like plunges into water. They have also been seen wading in water to catch dying fish.

Piracy

- although often the victim of birds like Common Ravens, the Rough-legged Hawk will attack other raptors and cause them to drop their kill which is then consumed. They will also rob other Rough-legged Hawks

Carrion Eating

- wintering Rough-legged Hawks have fed on dead fish washed ashore in freshwater environments as well as on mammal carcasses

Strike, Kill, and Consumption

- the tarsi may be lowered well prior to pouncing on its prey such as when in hovering flight and prey is spotted. The bird will drop with extended legs and if there is nothing to seize, it will glide a short distance and pull up into a hovering position again. Prey are seized with the talons as in other buteos. Prey are typically beheaded and larger victims are torn apart.

The Rough-legged Hawk is quite trusting and docile around humans, allowing close approach which can put them at some risk. In captivity, at rehabilitation centers, it is usually quite calm and unassertive. Around the nest however, it is a fierce defender, engaging in close swoops and chases in order to drive off intruders. However, it is not as aggressive as raptors like the Peregrine Falcon and may well lose out in skirmishes over the ownership of a potential nest site. Response to human intruders at nests varies from limited to aggressive and body contact is not unknown. Territorial conflicts have been reported with Peregrine Falcons, Gyrfalcons, and Golden Eagles as well as aggressive interactions over prey with other Rough-legged Hawks, Northern Harriers, Red-tailed Hawks, and Common Ravens. Communal roosting at night, on some wintering ranges, has been documented in association with high rodent populations. The Rough-legged Hawk is mostly solitary or perhaps paired in migration but it is common to see several perched within a half mile (0.8 kilometer) of each other and hundreds have passed some key migration points in a day in loosely aggregated flocks.

Nesting density probably varies with the availability of nest sites and food supply and it is quite variable across the species' range. Density estimates for one pair of birds range from

two to 31 square miles (5.2 to 7.8 square kilometers) with a suggested average of one nesting pair for every three to four square miles (7.8 to 10.4 square kilometers). Hunting territories probably range from two to three square miles (5.2 to 7.8 square kilometers) and increase to at least four square miles (10.4 square kilometers) after the young have hatched. Internest distances range from 100 yards (91.4 meters) to 14 miles (22.4 kilometers) with averages closer to two miles (3.2 kilometers) in parts of Alaska. Home ranges on winter territories cover four to six square. miles (10.7 to 15.5 square kilometers).

Some observers believe that pair bonding occurs on the wintering ground or during migration as at least some birds may be mated before arrival at the nest site. "High - circling" has been reported on the wintering grounds and also on the breeding grounds. This consists of paired birds circling with the wings and tail spread and occasionally passing close to each other and uttering a two syllable call. The "sky-dance" pattern typical of buteos consists of the male folding its wings tightly in flight and hurtling towards earth. It checks its descent, climbs steeply, stalls with the body held vertically and then pitches forward into another plunge, repeating the whole sequence several times. This display is used on the nesting territory but for only a short duration after arrival. Nesting material may be offered to the female before copulation which starts at least two weeks before the first egg is laid. Pre-laying copulation frequency averaged once or twice per day in a pair of captive birds. The duration of copulation is 8 to 10 seconds. Territorial defense consists of close swoops and chasing flight with the occasional physical contact.

The average life span of 48 dead birds recovered in one study was about 21 months. The oldest bird was 18 years. Collisions with automobiles on the wintering grounds are common as this species frequently hunts roadways. Shooting has historically been a visible cause of mortality but recent figures are not available. As with all predators, the availability of an adequate food supply is critical and starvation on wintering grounds subject to deeper snows is likely higher than in low or no snow areas. Predation on nestlings has been noted by Golden Eagles but this is likely an unimportant source of mortality. On the wintering grounds, birds have died after consuming rodents that had been eating grain treated with Dieldrin. This is an uncertain source of mortality.

ADAPTATIONS

For a buteo, its ability to feed on carrion or hunt for fish is somewhat novel. It will also hover in lighter winds than heavier buteos.

HABITAT

In general, this is a bird of open country, sparsely treed, and offering great visibility. It avoids the forests except to pass over them during migration. The habitat includes arctic tundra, large river deltas, open fields and pastures, native grasslands, shrub steppe valley sides, marshlands, bogs, dunes and any other essentially treeless areas.

The breeding habitat is arctic tundra at lower elevations. Nesting is on steep cliff faces but hunting is over the open, rolling topography. If nesting occurs in forested fringe areas, hunting is done over the open bogs and clearings. Vegetation is usually low and mostly herbaceous with sparse overall shrub cover.

The wintering habitat is similarly open country of prairie grasslands, sagebrush flats and basins, agricultural lands, marshlands, bogs, dunes, sanitary landfills, open fields, and river deltas. Forested areas are avoided as are high alpine habitats under deep snow.

Some critical habitat components are steep, elevated rock or dirt faces for nesting and elevated perching sites for hunting. Low rocks and shrubs are used in the absence of higher

sites, but power poles, lone buildings or other structures, fences, , lone trees or snags are all used as resting or hunting perches. Nesting occasionally occurs in trees if other sites are not available.

VOICE

A commonly heard alarm call is a descending, cat-like, "kee-eer" scream. It has been likened to the scream of the Red-tailed Hawk. Soft "mews" have been heard in captive birds along with high-pitched whistling notes. Various "cheep" notes are given by the male along with squeals and squawks from the female. Two-syllable clucking notes and downslurred whistling noises are also noted for this species. The female also has a clucklike "nar-nar" call. Descending, slurred whistles are also part of the repertoire.

FOODS

The summer food supply is largely lemmings (as much as 80 percent) but also consists of voles, mice, and shrews of various species. Less commonly, arctic ground squirrels and hares along with various bird species such as ptarmigan, Golden Plover, young Whimbrel, American Tree Sparrow, wagtails, Lapland Longspur, and Snow Bunting. Seal and caribou carrion will be eaten during the summer. While up to 90 percent of the preferred diet is small rodents, birds will replace rodents as a food source in years of low mammal numbers.

During migration, and winter periods, small mammals still comprise the preferred diet but this species shows some adaptability and opportunism. The prey variety increases somewhat to include frogs, deer mice, reptiles, carrion of different species including larger birds, domestic chickens, Gray Partridge, Ring-necked Pheasant (young or carrion), fishes, grasshoppers, and various other insects.

NESTING

The Rough-legged Hawk's nest site is primarily high on a rock or dirt cliff on a ledge or in a recess. Eroded river banks, columnar rocks or mounds of rock or dirt will also be used. Occasionally man-made structures will be used and rarely the ground. Where cliffs are not available trees will be used. Whenever possible, the highest of all potential nest sites will be chosen. Unlike falcons who also use cliff faces, a stick nest is constructed. Twigs, bones or any transportable debris are also used where sticks are at a premium. The nest is lined with grasses, sedges, small twigs, feathers, down and rodent fur. The nest shape may vary depending upon constraints of the site, but will be at least 30 inches (76 centimeters) in diameter and 15 inches (38 centimeters) in height with about a 10 inch (25 centimeters) bowl. Nests are refurbished each year and can become quite large but alternate nests may be built nearby (within 100 yards [91 meters] or up to half a mile away [0.8 kilometers]). Favored sites are likely traditional and used for many years by the same pair unless they are displaced by another raptor. The male brings the sticks and the female builds the nest.

Initial breeding may not occur until age two or three. Clutch sizes vary with food supply but usually two to three and as many as five to seven eggs in a year of abundant rodents. Some areas are consistently three to five eggs and other places four to six eggs with seven being infrequent. The eggs are generally elliptical and average 2.2 inches (56 millimeters) long by 1.8 inches (46 millimeters) wide. The ground color is generally reported as white but it has been described as palish green or blue that bleaches to white. The markings are highly variable blotching and streaking of chestnut, brown or violet and may form somewhat of a ring around the larger end. Not all eggs in the clutch are marked to the same intensity but none are ever plain. The laying interval in the wild is probably 1 day, but in captivity, the interval has been as much as two or three days. Depending upon latitude and general climate, egg laying could start in late April but over most of the range, laying probably peaks

from late May through June. Incubation is primarily by the female but the male may perform brief incubation duties in between his hunting forays. Incubation starts as the first egg is laid and averages 31 days.

The nestling period is about 40 days, but males are often able to fly at 36 days, and females around 40. Nestlings can be fed at about six hours and by 21 days, juvenile feathers appear as the young are able to feed themselves. Standing happens by day 28 and by 35 days, they are able to tear up large prey items. Fledglings will remain dependent upon the parents at least until migration begins but some birds are independent at about 30 days after fledging. Rough-leggeds are single brooded but if eggs are lost early enough in the season, a replacement clutch may be laid.

CONSERVATION

In 1986, it was estimated that nearly 50,000 individuals were wintering in the United States alone. Pesticides do not appear to be as problematic as they have been for other raptors as the Rough-legged Hawk's major food sources are not migratory and accumulate very small amounts of chemicals. It may be the most common raptor breeding in the arctic regions. The populations obviously fluctuate but are not cyclic in nature. To suggest that the populations fluctuate directly with fluctuations in lemming and small mammal populations on the breeding grounds is appealing but is not supported by studies. This *buteo* has the ability to switch to other prey items when mammals are low so this may allow it to survive the periodicity or random fluctuations in mammal populations. Rough-legged Hawk declines may reflect circumstances where all major prey resources are at lowered levels, leaving few options for the birds. Climate has been implicated as a stronger factor influencing populations.

In general, it seems that the Rough-legged Hawk population in North America is under no immediate threat. As with all species, the maintenance of appropriate habitat is critical to long term survival. As arctic petroleum reserves and other resources are developed, habitat pressures can only increase and constant vigil is necessary to ensure that there is no net loss. Wintering habitats are under more severe pressure and again, good land stewardship aimed at maintaining biodiversity must be practiced in order to maintain species like the Rough-legged Hawk.

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Rough-legged Hawk - dark

Buteo lagopus

GENERAL DESCRIPTION

The Rough-legged Hawk is a large buteo and has been called lanky and angular. It is boldly-patterned and shows great variation from whitish birds with extensive brown and/or black patterning through increasingly dark birds that ultimately are entirely black with limited but distinctive whitish areas. Birds vary continuously from the light extreme through to the darkest extreme. At the light end of the spectrum, flying birds viewed from below are essentially whitish with heavy dark streaking showing distinctive dark patches in the carpal areas of the wing, across the belly and across the terminal portion of the tail. The dark band on the tail along with a white area at the base is visible from below and on the dorsal surface of flying birds. The wing tips are also dark. The darkest birds on the other hand, look completely black over the head and entire body. The wings are whitish underneath except for the black coverts and primary feather tips. The banded white and dark tail shows prominently from beneath as in lighter birds. Flight patterns are distinctive and include hovering as a frequently-used hunting tactic. Few buteos within the wintering range of this hawk hover as much as the Rough-legged Hawk. The wings are often held in a pronounced dihedral.

This is a bird of the open tundra when breeding and open country when wintering. It is highly migratory and moves from its arctic summer quarters to southern Canada and the United States for the winter.

SIZE

The Rough-legged Hawk is a fairly large buteo with females averaging larger than males. The overall length range, including both sexes, is from 18.5 to 20.5 inches (47.0 to 52.1 centimeters). The wingspan varies from 47 to 52 inches (119.4 to 132.1 centimeters). Some average measurements for females are: wing chord - 16.4 inches (41.7 centimeters) and tail - 8.8 inches (22.4 centimeters). The same average measurements for males are: wing chord - 16.3 inches (41.4 centimeters) and tail - 8.8 inches (22.3 centimeters). The averages mask the fact that females tend to be the individuals showing the longest measurements in the range for each of the preceding body parts. The weight range is from 1.7 to 3.1 pounds (771 to 1,406 grams) but on average, males weigh about 1.8 pounds (816 grams) and females 2.2 pounds (998 grams).

MORPHS AND MOLT

There are three subspecies recognized in the world but effectively only one in North America. There are no true color phases but rather, an unbroken continuum of variation from light to dark birds. Light and dark birds interbreed. The sexes differ in pattern in the adult (basic) plumage but not in the juvenile stage. The basic differences in color patterns are due mainly to the deposition of the dark pigment melanin. The variation is so great that each individual bird has its own unique pattern, but certain common patterns are evident. Melanism is relatively uncommon but can occur and add confusion to an already variable species. There is no post-juvinal molt. Birds of the year retain the feathers they acquire in the nest until the following spring when they begin to molt into the adult type plumage. Following that, birds undergo a single annual molt that takes place during the breeding season from June through September. The primaries molt from the 4th outward and the innermost 3 molt in sequence with the secondaries. The tail feathers molt from the central pair outwards. Females tend to molt earlier than the males.

SPECIFIC DESCRIPTION

The following description applies to *Buteo lagopus sancti-johannis*, the subspecies common to all of North America except Alaska where a zone of hybridization occurs. It should be noted that the range of variation between light and dark phases is great and attempting to describe a typical extreme for each is difficult. There are sexual differences in the tail pattern, belly pattern, marginal coverts, relative lightness of head to back, and the pattern of the dorsal feathers. These differences are most noticeable in the tail and belly patterns.

Adult Male Dark-morph - Perched

- body all-dark-brown to all-black; legs feathered to toes
- white patch with dark center on back of head
- dark eye; white to light forehead and outer lores
- dark brown to black tail with three to four narrow whitish bands of equal size

Adult Female Dark-morph - Perched

- body all-dark-brown; legs feathered to toes
- white patch with dark center on back of head which is often lighter or paler than in the male
- dark eyes; white to light forehead and outer lores
- tail is dusky-brown to dark brown above, whitish to silvery below with wide dark band at tip

Immature Dark-morph - Perched

- body all-medium to dark-brown, sometimes reddish-brown in the darkest birds; legs feathered to toes
- white patch with dark center on back of head
- pale to light brown eye
- tail dark above and silvery-white below with several lighter cross bands that are not white; dusky, not well defined, band near tip of tail

Adult Male Dark-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- all-black body
- two-toned underwings with all-black coverts; primary feathers are contrastingly lighter
- black tail with three to four narrow light to white bands, each about the same size

Adult Female Dark-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- all dark-brown body
- two-toned underwings with reddish-brown coverts; primary feathers are contrastingly lighter
- dark tail above, whitish to silvery below, with wide band near tip
- dark carpal patches may be evident

Immature Dark-morph - Flight

- a large, long-winged, long-tailed buteo that often hovers in flight and holds its wings in a dihedral
- all dark-brown body
- two-toned wing pattern less obvious than in adults
- light to whitish patch (panel) in upper part of primary feathers
- underwing coverts all-dark, or rufous; when reddish-brown the carpal patch may be noticeable
- tail is dark above and whitish to silvery below with wide dusky band near tip

SIMILAR SPECIES

Lighter colored birds could be mistaken for the light phase Red-tailed Hawk but the latter does not have large dark carpal marks and lacks the white tail base contrasting with a dark terminal band. This latter tail feature could lead to confusion with the Northern Harrier but it is a slimmer looking bird with a longer tail and lacks the other obvious field marks such as carpal patches, dark belly banding and flight styles. Frequently, inexperienced observers mistake the Rough-legged Hawk for an Osprey, particularly due to the hovering flight pattern and the contrasting black and white patterning and wrist markings of lighter birds. Immature dark morph Ferruginous Hawks resemble immature, dark Rough-legged Hawks but the Ferruginous Hawk is larger and has white patches in the carpal area that are lacking in the Rough-legged Hawk. Similarly, a dark immature Red-tailed Hawk may appear similar to some observers. Darker Rough-legged Hawks may also be confused with the Zone-tailed Hawk based on broad plumage traits and the dihedral wing posture in both.

OTHER NAMES

The Rough-legged Hawk is also known as the "Roughie", "Rough-leg", "Black Hawk" (dark phase), "Chap Hawk", "Chicken Hawk", "Mouse Hawk", "Screech Hawk", "Squalling Hawk", and "Squealing Hawk."

ETYMOLOGY

The genus Buteo is Latin for "buzzard", which is an early name for hawks and vultures. It is allied with the Greek "buzo" which means "to hoot" which has little relevance to the calls of any diurnal birds of prey. The species name Lagopus is Greek for "hare-footed" with reference to the leg feathering extending down to the foot. Rough-legged is also a reference to the leg feathering and "hawk" has its origins from the Teutonic base "hab" which ultimately led to the Middle English derivative "hawk." Hab meant "to seize or hold."

MYTHOLOGY

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RANGE

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Birds cross the boreal forest zone in their quest to find suitable wintering habitat and again upon their return to the breeding grounds. Corridors are not well known, but concentrations have been noted at some hawk lookouts such as 1,000 on October 18, 1959 at Marathon, Ontario near the north shore of Lake Erie. Perhaps the proximity of a large water body served to concentrate the birds. Birds of southern Baffin Island and northern Quebec probably travel down the east side of Hudson Bay and thence southwesterly towards Lake Superior. Following a more southerly route across the lake brings the birds in a positive direction towards the areas of greater winter concentration on the Great Plains. Other movements out of the central Arctic probably take place in a more direct north-south fashion as birds move into the mid-west prairies. Birds banded in Alaska have been recovered in Colorado indicating that at least some travel in southeasterly direction to reach the mid-

west. Interior migration through British Columbia in the fall is not heavy, suggesting that most Alaskan birds bound for United States wintering grounds pass east of the cordilleran ranges.

Spring movements are strong in the Great Lakes area but they are not all directed in a northeasterly line. Possibly birds moving up the eastern Great Lakes are bound for different breeding grounds than those moving through the western Great Lakes area. Here, they can display a north or northwesterly trend as they cross Lake Superior. Spring counts along the south shore of Lake Ontario produce 400 to 600 birds per season at Derby Hill. Combined totals of up to 2,000 birds from all lookouts have been noted during the spring season as birds move through the Great Lakes region. Western concentrations have not been noted in the same numbers and coverage of the northern central plains in a systematic way by hawk watchers is limited so that comparative numbers are not available.

Historical information and more recent systematic counts at hawk-watching stations show larger number of migrants moving in some years than in other years. Spring migration counts do not always correspond with counts taken the previous fall and "flight" years do not necessarily correspond with southerly invasions of other more northerly species such as Snowy Owls or Goshawks. Correlations with known population fluctuations have not been demonstrated.

BEHAVIOR

In level flight, The Rough-legged Hawk tends to utilize steady wingbeats with less of the "pump and glide" type of flight that other buteos use. The wingbeats have been described as "unhurried and methodical" with the overall flight called "effortless, graceful and purposeful." Soaring flight is used and the wings are held in a pronounced dihedral. The wings extend up from the body and then flatten out. This species seems less dependent upon the use of thermals than other buteos. Hunting occurs during the day but often until much later than in other buteos and can be grouped into the following tactics.

Perch and Wait

- perching with an erect stance on elevated objects such as lone trees, power poles, and building tops is used as an energy saving method

Quartering Flight

- birds will fly slowly, alternately flapping and sailing to cover ground much like a Northern Harrier

Hovering

- using rapid wing beats, birds will hang motionless in mid-air, searching visually and possibly with its ears for prey. This usually occurs at altitudes of 50 to 100 feet (15.5 to 31 meters) but at times in excess of 200 feet (62 meters).

Fishing

- birds have been seen catching fish with Osprey-like plunges into water. They have also been seen wading in water to catch dying fish.

Piracy

- although often the victim of birds like Common Ravens, the Rough-legged Hawk will attack other raptors and cause them to drop their kill which is then consumed. They will also rob other Rough-legged Hawks

Carrion Eating

- wintering Rough-legged Hawks have fed on dead fish washed ashore in freshwater

environments as well as on mammal carcasses

Strike, Kill, and Consumption

- the tarsi may be lowered well prior to pouncing on its prey such as when in hovering flight and prey is spotted. The bird will drop with extended legs and if there is nothing to seize, it will glide a short distance and pull up into a hovering position again. Prey are seized with the talons as in other buteos. Prey are typically beheaded and larger victims are torn apart.

The Rough-legged Hawk is quite trusting and docile around humans, allowing close approach which can put them at some risk. In captivity, at rehabilitation centers, it is usually quite calm and unassertive. Around the nest however, it is a fierce defender, engaging in close swoops and chases in order to drive off intruders. However, it is not as aggressive as raptors like the Peregrine Falcon and may well lose out in skirmishes over the ownership of a potential nest site. Response to human intruders at nests varies from limited to aggressive and body contact is not unknown. Territorial conflicts have been reported with Peregrine Falcons, Gyrfalcons, and Golden Eagles as well as aggressive interactions over prey with other Rough-legged Hawks, Northern Harriers, Red-tailed Hawks, and Common Ravens. Communal roosting at night, on some wintering ranges, has been documented in association with high rodent populations. The Rough-legged Hawk is mostly solitary or perhaps paired in migration but it is common to see several perched within a half mile (0.8 kilometer) of each other and hundreds have passed some key migration points in a day in loosely aggregated flocks.

Nesting density probably varies with the availability of nest sites and food supply and it is quite variable across the species' range. Density estimates for one pair of birds range from two to 31 square miles (5.2 to 7.8 square kilometers) with a suggested average of one nesting pair for every three to four square miles (7.8 to 10.4 square kilometers). Hunting territories probably range from two to three square miles (5.2 to 7.8 square kilometers) and increase to at least four square miles (10.4 square kilometers) after the young have hatched. Internest distances range from 100 yards (91.4 meters) to 14 miles (22.4 kilometers) with averages closer to two miles (3.2 kilometers) in parts of Alaska. Home ranges on winter territories cover four to six square miles (10.7 to 15.5 square kilometers).

Some observers believe that pair bonding occurs on the wintering ground or during migration as at least some birds may be mated before arrival at the nest site. "High - circling" has been reported on the wintering grounds and also on the breeding grounds. This consists of paired birds circling with the wings and tail spread and occasionally passing close to each other and uttering a two syllable call. The "sky-dance" pattern typical of buteos consists of the male folding its wings tightly in flight and hurtling towards earth. It checks its descent, climbs steeply, stalls with the body held vertically and then pitches forward into another plunge, repeating the whole sequence several times. This display is used on the nesting territory but for only a short duration after arrival. Nesting material may be offered to the female before copulation which starts at least two weeks before the first egg is laid. Pre-laying copulation frequency averaged once or twice per day in a pair of captive birds. The duration of copulation is 8 to 10 seconds. Territorial defense consists of close swoops and chasing flight with the occasional physical contact.

The average life span of 48 dead birds recovered in one study was about 21 months. The oldest bird was 18 years. Collisions with automobiles on the wintering grounds are common as this species frequently hunts roadways. Shooting has historically been a visible cause of mortality but recent figures are not available. As with all predators, the availability of an adequate food supply is critical and starvation on wintering grounds subject to deeper snows is likely higher than in low or no snow areas. Predation on nestlings has been noted by

Golden Eagles but this is likely an unimportant source of mortality. On the wintering grounds, birds have died after consuming rodents that had been eating grain treated with Dieldrin. This is an uncertain source of mortality.

ADAPTATIONS

For a buteo, its ability to feed on carrion or hunt for fish is somewhat novel. It will also hover in lighter winds than heavier buteos.

HABITAT

In general, this is a bird of open country, sparsely treed, and offering great visibility. It avoids the forests except to pass over them during migration. The habitat includes arctic tundra, large river deltas, open fields and pastures, native grasslands, shrub steppe valley sides, marshlands, bogs, dunes and any other essentially treeless areas.

The breeding habitat is arctic tundra at lower elevations. Nesting is on steep cliff faces but hunting is over the open, rolling topography. If nesting occurs in forested fringe areas, hunting is done over the open bogs and clearings. Vegetation is usually low and mostly herbaceous with sparse overall shrub cover.

The wintering habitat is similarly open country of prairie grasslands, sagebrush flats and basins, agricultural lands, marshlands, bogs, dunes, sanitary landfills, open fields, and river deltas. Forested areas are avoided as are high alpine habitats under deep snow.

Some critical habitat components are steep, elevated rock or dirt faces for nesting and elevated perching sites for hunting. Low rocks and shrubs are used in the absence of higher sites, but power poles, lone buildings or other structures, fences, , lone trees or snags are all used as resting or hunting perches. Nesting occasionally occurs in trees if other sites are not available.

VOICE

A commonly heard alarm call is a descending, cat-like, "kee-er" scream. It has been likened to the scream of the Red-tailed Hawk. Soft "mews" have been heard in captive birds along with high-pitched whistling notes. Various "cheep" notes are given by the male along with squeals and squawks from the female. Two-syllable clucking notes and downslurred whistling noises are also noted for this species. The female also has a clucklike "nar-nar" call. Descending, slurred whistles are also part of the repertoire.

FOODS

The summer food supply is largely lemmings (as much as 80 percent) but also consists of voles, mice, and shrews of various species. Less commonly, arctic ground squirrels and hares along with various bird species such as ptarmigan, Golden Plover, young Whimbrel, American Tree Sparrow, wagtails, Lapland Longspur, and Snow Bunting. Seal and caribou carrion will be eaten during the summer. While up to 90 percent of the preferred diet is small rodents, birds will replace rodents as a food source in years of low mammal numbers.

During migration, and winter periods, small mammals still comprise the preferred diet but this species shows some adaptability and opportunism. The prey variety increases somewhat to include frogs, deer mice, reptiles, carrion of different species including larger birds, domestic chickens, Gray Partridge, Ring-necked Pheasant (young or carrion), fishes, grasshoppers, and various other insects.

NESTING

The Rough-legged Hawk's nest site is primarily high on a rock or dirt cliff on a ledge or in a recess. Eroded river banks, columnar rocks or mounds of rock or dirt will also be used. Occasionally man-made structures will be used and rarely the ground. Where cliffs are not available trees will be used. Whenever possible, the highest of all potential nest sites will be chosen. Unlike falcons who also use cliff faces, a stick nest is constructed. Twigs, bones or any transportable debris are also used where sticks are at a premium. The nest is lined with grasses, sedges, small twigs, feathers, down and rodent fur. The nest shape may vary depending upon constraints of the site, but will be at least 30 inches (76 centimeters) in diameter and 15 inches (38 centimeters) in height with about a 10 inch (25 centimeters) bowl. Nests are refurbished each year and can become quite large but alternate nests may be built nearby (within 100 yards [91 meters] or up to half a mile away [0.8 kilometers]). Favored sites are likely traditional and used for many years by the same pair unless they are displaced by another raptor. The male brings the sticks and the female builds the nest.

Initial breeding may not occur until age two or three. Clutch sizes vary with food supply but usually two to three and as many as five to seven eggs in a year of abundant rodents. Some areas are consistently three to five eggs and other places four to six eggs with seven being infrequent. The eggs are generally elliptical and average 2.2 inches (56 millimeters) long by 1.8 inches (46 millimeters) wide. The ground color is generally reported as white but it has been described as palish green or blue that bleaches to white. The markings are highly variable blotching and streaking of chestnut, brown or violet and may form somewhat of a ring around the larger end. Not all eggs in the clutch are marked to the same intensity but none are ever plain. The laying interval in the wild is probably 1 day, but in captivity, the interval has been as much as two or three days. Depending upon latitude and general climate, egg laying could start in late April but over most of the range, laying probably peaks from late May through June. Incubation is primarily by the female but the male may perform brief incubation duties in between his hunting forays. Incubation starts as the first egg is laid and averages 31 days.

The nestling period is about 40 days, but males are often able to fly at 36 days, and females around 40. Nestlings can be fed at about six hours and by 21 days, juvenile feathers appear as the young are able to feed themselves. Standing happens by day 28 and by 35 days, they are able to tear up large prey items. Fledglings will remain dependent upon the parents at least until migration begins but some birds are independent at about 30 days after fledging. Rough-leggeds are single brooded but if eggs are lost early enough in the season, a replacement clutch may be laid.

CONSERVATION

In 1986, it was estimated that nearly 50,000 individuals were wintering in the United States alone. Pesticides do not appear to be as problematic as they have been for other raptors as the Rough-legged Hawk's major food sources are not migratory and accumulate very small amounts of chemicals. It may be the most common raptor breeding in the arctic regions. The populations obviously fluctuate but are not cyclic in nature. To suggest that the populations fluctuate directly with fluctuations in lemming and small mammal populations on the breeding grounds is appealing but is not supported by studies. This buteo has the ability to switch to other prey items when mammals are low so this may allow it to survive the periodicity or random fluctuations in mammal populations. Rough-legged Hawk declines may reflect circumstances where all major prey resources are at lowered levels, leaving few options for the birds. Climate has been implicated as a stronger factor influencing populations.

In general, it seems that the Rough-legged Hawk population in North America is under

no immediate threat. As with all species, the maintenance of appropriate habitat is critical to long term survival. As arctic petroleum reserves and other resources are developed, habitat pressures can only increase and constant vigil is necessary to ensure that there is no net loss. Wintering habitats are under more severe pressure and again, good land stewardship aimed at maintaining biodiversity must be practiced in order to maintain species like the Rough-legged Hawk.

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Golden Eagle

Aquila chrysaetos

GENERAL DESCRIPTION

The Golden Eagle is a large, dark, long-winged raptor that soars on flat or slightly up-tilted wings. In all ages except newly fledged juveniles, and especially in adult plumage, the nape feathers create a "golden" hue found in no other species of raptor. The sexes are similar, and in flight, the adults are essentially all dark with no light markings. The juveniles, immatures, and sub-adults resemble the adults in that they are large, dark raptors, but the base of the primaries and the base of the tail are boldly whitish and contrast markedly with the rest of the plumage. It is mainly a bird of the open country that prefers to nest on cliffs or in very large trees. It hunts largely by soaring and feeds on small mammals, birds, and carrion, and has been unjustifiably persecuted for allegedly causing great losses to the livestock industry through predation of young animals. The legs are feathered to the toes.

SIZE

The Golden Eagle is a large raptor exceeded in size in North America only by the California Condor and the Bald, Steller's, and White-tailed eagles. The female averages larger than the male but there is overlap in some measurements. Combined length measurements for males and females range from 30 to 40 inches (76.2 to 101.6 centimeters). The combined wingspread ranges from 60 to 80 inches (152.4 to 203.2 centimeters). Weights for males vary from 6.5 to 9.5 pounds (3.0 to 4.3 kilograms) with an average 8.6 pounds (3.9 kilograms) and females from 8 to 13 pounds (3.6 to 5.9 kilograms) with an average of 10.6 pounds (4.8 kilograms). Birds in their first year of life weigh as much as the adults.

MORPHS AND MOLTS

There are no color-morphs of Golden Eagle. There is however, a juvenile plumage followed by three or four "subadult", or pre-definitive plumages prior to the "adult", or definitive plumage developing. Incomplete molts result in various feathers always present from previous plumage generations such that some birds may never acquire pure, complete definitive feathering. The molt is prolonged and appears confusing, if not chaotic to understand in terms of the sequence of individual feather molt. For example, the primary flight feathers start molting from the innermost outward. After a few feathers are renewed, the molt ceases until the following year, beginning again where it left off, progressing outwards. Simultaneously, the molt can start again with the innermost primaries.

The juvenile plumage is acquired while the young are in the nest. It begins to appear about day 24 and covers the nestling by about day 56. The plumage is fully-grown by about 112 days. This plumage is retained throughout the winter and is then replaced by the first prebasic molt which begins at about month 11 and is prolonged. The first basic (immature) plumage is attained from spring into late summer of the year following hatching and is retained for about one year. The second basic plumage is attained from spring through late summer of the second year after hatching. It too is retained for almost one year. Birds in this plumage essentially look like adults. The third basic plumage is attained from spring through late summer of the third year after hatching and retained for one year. Again, it looks like the adult plumage. The fourth basic plumage is attained from spring through summer of the fourth year after hatching. This is the plumage that is repeated annually thereafter and is considered to be the first true definitive or "adult" plumage by some authors. Depending upon interpretation, the first true adult plumage is therefore not acquired until the fourth or fifth calendar year of life, even though by the third calendar year, birds may well look like

adults in the field. The presence of earlier juvenile type feathers in this third year are difficult to detect under field conditions.

SPECIFIC DESCRIPTION

Apart from size differences, the plumage of the sexes are very similar.

Adult Male - Perched

HEAD

- crown and nape feathers are coppery-reddish fading to straw during the winter forming a "golden" cape
- sides of head and throat are deep brown
- the beak is tri-colored with a dark tip, horn colored base, and yellow cere
- the iris varies from yellowish to reddish brown; usually becomes paler with age

BODY

- body often appears mottled with old faded and new dark feathers
- the breast and abdomen are dark brown
- the undertail coverts are brown and perhaps reddish brown
- the back is brown but may appear somewhat variegated

WINGS

- the scapulars are brown to dark and the coverts more tawny which may give the impression of a lighter bar across the wing
- the primaries are black
- the wing tips do not reach the tip of the tail

TAIL

- the undertail is variable from grayed brown through dark brown and there may be fainter, lighter zig zag bands across the tail
- the upper tail is variable from grayed brown to dark with lighter zig zag bands; males have two to three narrow gray bands while females have two wide gray bands

LEGS

- the legs and tarsi are well feathered to the toes with light brown to white feathers that are distinctly lighter than the remaining underside
- the light brown buff or whitish feathers contrast with the underside of the body
- the feet are various shades of yellow and the talons are black

Adult Female - Perched

The female is essentially the same as the male except for size. There may be minor variations in the tail with the female having wider gray tail bands.

HEAD

- crown and nape feathers are coppery-reddish fading to straw during the winter, forming a "golden" cape
- sides of head and throat are deep brown
- the iris varies from yellowish to reddish brown

BODY

- the breast and abdomen are dark brown and mottled because of continued body molt of old and new feathers

- the undertail coverts are brown and perhaps reddish brown
- the legs and tarsi are well feathered with light brown to white feathers that are distinctly lighter than the remaining underside
- the back is brown but may appear somewhat variegated

WINGS

- the scapulars are brown to dark and the coverts more tawny which may give the impression of a lighter bar across the wing
- the primaries are black
- the wing tips do not reach the tip of the tail

TAIL

- the undertail is variable from grayed brown through dark brown and there may be fainter, lighter zig-zag bands across the tail
- the upper tail is variable from grayed brown to dark with lighter zig zag bands
- the posterior bands may be wider and more distinctive than in the males

LEGS

- the legs are feathered down to the foot and can reach the base of the toes
- the light brown, buff or whitish feathers contrast with the underside of the body
- the feet are yellow (various shades) and the talons are black

Immature (first year) - Perched

HEAD

- the crown is blackish, but the rear of the crown and nape are reddish brown and contrast with the rest of the head and back
- the sides of the head and throat are very dark brown
- the cere is yellow
- the iris varies from brown to hazel and lightens with age

BODY

- body is uniformly dark as no molt is present so all feathers appear uniform in color
- the breast and belly are generally a dark, sooty brown but some feathers may have light tips
- the undertail coverts are lighter and may be pale yellowish brown
- the back is blackish brown or sooty and may develop a purplish sheen, and the upper tail coverts are dark

WINGS

- the coverts are variably brownish and could fade even lighter, but some authors feel that they are dark
- the primaries are blackish and a bit shorter than in other plumages
- the wing tips do not reach the tip of the tail

TAIL

- on average, a little longer than in other plumages
- the feathers are white at the base with a dark terminal band that varies from more or less one half the tail length to as little as one-third of the length

LEGS

- the feathering extends to the toes and is generally quite light
- the feet are whitish according to some authors, and deep yellow according to other authorities

Subadult (second to fourth year) - Perched

The descriptions that follow pertain to the plumage stages between the juvenile and adult plumages. Differences may be subtle on perched birds and slightly easier to distinguish on flying birds because feathers and tail show better in flight.

HEAD

- feathers on rear of crown and nape light to vivid reddish brown and longer than in juvenile
- sides of head and throat dark brown but somewhat lighter than in juvenile

BODY

- generally dark and mottled with faded old feathers
- the undertail coverts are browner, but they still retain light basal areas
- the back is dark brown / black

WINGS

- the coverts are brownish and the primaries are black
- a tawny bar may be evident across the wing coverts

TAIL

- overall, the length is a little shorter than in juvenile plumage and more squarish terminally
- the amount of white basal area gradually reduces over the series of molts in this plumage
- a second narrow, dark band next to the terminal band develops after the juvenile plumage, and two narrow bands may develop as the molts of this plumage progress into more adult-like plumage. Male has two to three bands, female has two bands.

LEGS

- the feet are yellow with black talons

Adult Male - Flight

- adults appear as large, dark birds with wide, long wings
- the underside of the body and wings are not uniform dark brown but appear mottled due to old and new feathers
- the underside of the tail is dark with lighter narrow grayish banding evident in good lighting
- the top of the bird is all dark including the wings
- a tawny band through the coverts may be evident on the upper surface
- rarely, whitish patches or epaulettes may be seen on the shoulder areas of the upper wing
- the nape area stands out as being lighter, golden, or blondish and is distinctive at some distance
- the rear trailing edge of the wing indents where the wings join the body and the secondaries bulge rearward, giving the wing edge more of an "S" shape and the bird more of a narrow waisted look than in the Bald Eagle
- the head looks relatively small, appearing to be about one-third as long as the tail
- trailing edge of wing has wide dark band
- the wings may be held flat or in a strong dihedral when soaring, especially in high winds
- the wing beat is slow but more shallow than that of the Bald Eagle

Adult Female - Flight

- adults appear as large, dark birds with wide, long wings
- most will appear larger than males
- the underside of the body and wings are mottled with dark brown due to old and new feather pattern
- the underside of the tail is dark with lighter grayish banding evident in good lighting
- one narrow and one wide tail band
- the top of the bird is all dark including the wings
- a tawny band through the coverts may be evident on the upper surface
- rarely, whitish patches or epaulettes may be seen on the shoulder areas of the upper wing
- the nape area stands out as being lighter, golden, or blondish and is distinctive at some distance
- the rear trailing edge of the wing indents where the wings join the body and the secondaries bulge rearward, giving the wing edge more of an "S" shape and the bird more of a narrow waisted look than in the Bald Eagle
- the head looks relatively small, appearing to be about one-third as long as the tail
- the wings may be held flat or in a slight dihedral when soaring
- the wing beat is slow but more shallow than that of the Bald Eagle

Immature (first year) - Flight

- appears as a large, dark raptor with contrasting hackles just as adults do
 - the body appears uniformly dark but the base of the tail is white set against a prominent dark terminal band
 - the two-toned tail is visible on both the upper and lower surface
 - the primaries may show large white patches on both the upper and lower surface.
- However, many immatures (first year) have little or no white in the wings.
- the overall impression from below is of a large, dark raptor with three apparent white patches in the outer wings and tail
 - this contrasts with immature Bald Eagles that can show three white areas, but they are in the inner wings and tail area
 - other flight traits are as for adults except that the tawny wing bar on the upper surface may not be present

Subadult (second to fourth year) - Flight

- in general, these birds appear similar to the juveniles
- as they become older and progress through the several molts of this period, the amount of white in the primaries becomes reduced as does the amount of white in the basal area of the tail
- due to individual variation and the potential to be in various stages of the subadult plumages, it is difficult to generalize about the amount of white that could be visible on any particular bird, but in general, any white in the tail or wings is indicative of the bird being four years old or less. Some individuals will retain white markings in the tail throughout their life however.
- the tawny diagonal bar on the upper wing surface is visible
- other flight traits are similar to the adults

SIMILAR SPECIES

In North America, the Golden Eagle might only reasonably be confused with some immature plumages of the Bald Eagle. The first-year Bald Eagle resembles the adult Golden Eagle, but lacks the lighter, "gold" hackles and has a larger, mono-toned dark beak as opposed to a two-toned beak. It also lacks the tawny stripe across the wing. The Bald Eagle

has bare tarsi whereas the Golden Eagle has feathered ones. Other transition plumages of the immature Bald Eagle has some degree of white on the back and belly which is lacking in the Golden Eagle of any age. In flight, the Golden Eagle has dark axillars in all plumages whereas the Bald Eagle has some degree of white axillars during all of the immature plumages. By the time the Bald Eagle axillars become dark, the white head and tail has been acquired. In any plumage, the immature Bald Eagle has distinct white patches only in the first three primaries. Thus, any eagle without a white head with dark axillars or wing linings, is a Golden Eagle. Any eagle with white markings on the wing linings is a Bald Eagle, irrespective of head color.

At some distance, vultures and condors might be mistaken for a Golden Eagle due to their size and overall dark coloration. Their habit of soaring with their wings in a pronounced dihedral and rocking back and forth in flight distinguish them from the Golden Eagle. The latter species does not hold its wings as high and has a steady flight. Perched vultures have reddish heads on adults and gray heads on immatures in contrast with the brown and gold head of the eagle. The Black Vulture has bold white wing patches at the tips of the wings - a trait not shared by any plumage of the Golden Eagle. The Black Vulture holds its wings flat when soaring, but it is a much smaller bird than the Golden Eagle and the wings appear short and wide. The fanned tail is also very short and wide. The California Condor is no longer likely to be seen, but is extremely large and flies in level flight with little flapping. Large triangular white patches in the axillar area distinguish this endangered species from any plumage of the Golden Eagle. The tail of the Golden Eagle is proportionately longer than that of a condor and the eagle is significantly smaller.

OTHER NAMES

The Golden Eagle is also referred to as "Black Eagle", "Brown Eagle", "Dark Eagle", "Calumet Eagle", "Mountain Eagle", "Canadian Eagle", "Royal Eagle", "Ring-tailed Eagle", "War Eagle", and "Black Mexican Eagle."

ETYMOLOGY

The genus name *Aquila* is Latin for "eagle." The species name *chrysaetos* is Greek for "golden eagle" which is obtained from the combination of *khrysos* for "golden" and *aetos* for "eagle." Golden refers to the color of the feathering on the nape. Eagle is a restricted reference to certain large, superficially similar diurnal birds of prey but it does not necessarily imply evolutionary or genetic relationships.

MYTHOLOGY

The Golden Eagle occupies a prominent place in the legends and culture of many peoples. From myths, legends, taboos, rituals, aesthetic appreciation, totems and heraldry, the belief in the sacred values of this bird extends deep into the culture of our native North Americans. Eagle feathers were used in ceremonies and worn by people to ward off evil spirits, or to empower themselves with the strength of the eagle itself. War bonnets were made by some tribes and symbolize the relationship embodied there.

RANGE

The Golden Eagle occurs worldwide across the boreal regions of the globe. In North America, it breeds from Alaska eastward across the Canadian arctic to northern Labrador, but is absent from most of Keewatin and the arctic archipelago. In the west, it occurs south to Baja and northern Mexico, including all of the western states, east to about 103 degrees of longitude. In eastern North America, it breeds sparsely south to northern New York state, but is absent as a breeder in the Canadian maritime provinces and south throughout the

eastern United States.

Withdrawal from the northern breeding areas is common during the winter. Wintering birds can be found primarily from British Columbia and Alberta south throughout the western breeding range. Birds are also found in southern Manitoba, Saskatchewan, Ontario and Quebec, but wintering populations become scarce or irregular east of the 100th meridian and south of Canada.

Year-round, birds can be found in extreme southern Alaska and presumably, these are non-migratory. Birds can be found year-round throughout the breeding range south of about 55 degrees in the western interior and 50 degrees latitude in the east. Numbers increase in the southern areas as the resident birds are joined by migrants from the northern breeding areas of Alaska and the Territories.

Depending upon the authority, from five to eight subspecies exist. Only one occurs in North America, namely *A. c. canadensis*.

MIGRATION

The Arctic, and at least some of the boreal breeding population, is highly migratory, leaving the colder northern regions in the fall. It has been postulated that these migrants "leapfrog" over resident birds at mid-latitudes as they make their way to more southern wintering grounds. Indeed, high elevation migrants moving in large numbers along the western mountain ridges give the impression that they are overflying any lower elevation birds that may be present at the same latitudes at the same time. Banding information from southern nest sites provides evidence that as long as seven years after being banded as nestlings, birds were still within 50 miles (80 kilometers) of the nest site, and quite likely had not engaged in any significant migratory activities in the intervening period. Coastal birds in southern Alaska and the Aleutians are likely resident. South of the birds that migrate some distance, there may be a zone across Canada where birds move smaller distances to adjust to essentially local opportunities, but they are not moving hundreds of miles or more. Birds that breed in the hot, arid southern states, appear to move up into cooler alpine conditions after nesting.

Northern breeders are enroute south out of Alaska and the eastern arctic by early September. Migrants pass the 49th parallel along the ridges of the Rocky Mountains in large numbers between mid September and the end of October. Peak movements through the Great Lakes area are from late October through mid November, but numbers are dramatically less than in the west. Fall seasonal totals for all of the hawk watching sites in the Great Lakes area may be about 300 birds, whereas in southern Alberta, at one site alone, 4,600 Golden Eagles passed during the fall of 1993. At the Bridger Mountains site, some 300 miles southeast along the Rocky Mountain chain in Montana, some 1,700 eagles passed during the same time period. Migration routes along the Appalachian Mountains are quite well known, but again, the numbers are typically 300 to 500 birds per year through the northern Appalachians and less than 100 through the southern Appalachians.

In the mountains of the United States southwest, seasonal fall migration totals are again, dramatically less than counts farther north in the Rocky Mountains, suggesting that large numbers of birds may be dropping off at wintering sites before reaching the southwestern regions. Movements west of the cordillera in California are similarly light. Thus, the eastern side of the Rocky Mountains is a major fall migration route with Mount Lorette near Banff, Alberta and the Bridger Mountains near Bozeman, Montana being two noteworthy locations to see large numbers of Golden Eagles.

Northbound spring movement from the wintering grounds starts in late February or

March. In northern Montana, peak movements are during March and a similar pattern is noted for southern Alberta. Movements through the northern Appalachians and Great Lakes probably peak during the latter part of March into April. Many birds are back at northern breeding sites by late March or early April, yet some birds may not have left wintering grounds before mid-latitude birds are on nests. As with the fall migration, the total number of birds passing the major migration spots is small in comparison with western totals. Spring numbers appear to be even less in the east than fall numbers, with regional totals of much less than 100 birds at major sites. Contrast again the Mount Lorette, Alberta site with nearly 4,200 eagles passing during the spring of 1993 and Roger's Pass, Montana showing counts of 900 to 1,600 birds each spring. The same general flight corridors across North America are used during both the spring and fall migration, but specific locations may be favored during one season over another.

BEHAVIOR

The wing beat of the Golden Eagle is slow and ponderous in nature. It is more shallow than that of the Bald Eagle. Soaring Golden Eagles hold their wings flat or in a dihedral, suggestive of Turkey Vultures. It is the soaring flight that is seen so frequently. Because of its heavy reliance on mammals for food, the Golden Eagle hunts both early in the day or late in the afternoon, corresponding with peaks of activity in its food supply. During the nesting season, hunting will certainly go on all day as the demands of the young increase. These eagles will gorge and then fast for days, thus enabling them to survive brief periods of limited food supply. Kills are often made in areas of updraft winds, allowing birds heavily weighted with prey to take off after making the kill or gorging heavily.

The hunting tactics can be grouped into the following strategies:

Perch and Wait

- elevated sites are used to search the terrain and they include trees, power poles, rock bluffs, fences and so forth.

Ground Perching

- occasionally, perching on a mound or low rock is used, followed by a flying attack once the prey is spotted

Low Level Flight

- birds will fly quickly or slowly, low over the terrain, often changing direction and surprising their quarry. The technique is particularly useful over open terrain where the air currents and vagaries of the landscape are used to advantage.

High Level Flight

- this is primarily soaring above the ground at varying heights and descending rapidly to make the strike.

Aerial Attack

- other birds will be attacked in mid flight.

Flushing

- this consists of wing flapping, screaming, and walking around bushes or other places where prey is known to be hiding.

Cooperative Hunting

- two birds will use a variety of the above styles to flush prey towards the partner who will then make the final strike.

Piracy

- eagles have been seen robbing food from one another or from other raptors. They have also snatched ground squirrels flushed by humans walking across a pasture.

Carrion Eating

- the Golden Eagle has been observed feeding on carcasses along with Bald Eagles, ravens, crows and magpies.

Strike, Kill, and Consumption

- the approach to the prey may be with flapping flight or a descent followed by a rapid glide or combinations of these. The strike is often upwind and usually in areas of updrafts. As the quarry is reached, a foot is extended and the prey clutched tightly. The second foot may also be used. If the animal is small, it is simply lifted up and flight continues unabated. Larger animals may cause an abrupt halt to the flight as both eagle and prey struggle on the ground. The head is grabbed as quickly as possible and then the other talons are driven into the lungs or soft parts of the body, causing the animal to bleed to death or die from lack of oxygen. The beak is generally not used for killing or fighting with the prey. Once all struggling has ceased, the prey is torn apart with the beak.

During the nesting season, territorial defense is evident. Bald Eagles will be escorted or chased from the nesting area. At other times such as in winter, Bald and Golden eagles may share the same roost tree and will certainly tolerate one another when gorging at large carcasses. Golden Eagles are felt to be dominant in carrion-feeding situations. Nesting Golden Eagles seldom tolerate the presence of another raptor nest, close to their own nest and may opportunistically kill them during encounters. Nests as close as 0.7 miles (1.1 kilometers) apart have been documented, but internest distances of up to 6 miles (9.6 kilometers) have been documented. Golden Eagles are felt to be wary and shy of human beings and will tend to avoid contact.

In the western United States, the home range of the Golden Eagle varies from 4.5 to 63 square miles (11.7 to 163 square kilometers) with habitat types and prey densities being important determinants of the ultimate territory size.

Although the flight displays of the Golden Eagle resemble those of buteos, the relationship to courtship is rather less certain. The following displays have been described and may have some function in terms of maintaining the pair bond or territorial defense:

High Circling/Mock Attacks

- several birds may circle together and engage in aerial chases, dives, rolls and presentation of talons, synchronized flight and rapid wingbeat flight.

Sky Dance

- this is also referred to as "undulating flight" as the birds fly up and down with amplifications that increase with higher flight. Other flight antics may be used as well such, as rolls and dives. Most observers feel that this is used as a territorial defense mechanism.

Tumbling

- this consists of near-vertical high-speed descents with folded wings. Sometimes, two birds will lock talons and tumble towards earth, only to break free into flight seconds before they might strike the ground.

The home ranges are large and defense would be impossible. However, individual nest sites are spaced apart and maintained with the use of some of the aforementioned flight behavior. Aerial attacks are also made in order to drive away intruders if they venture too close to the nest. Copulation occurs occasionally when the purpose is clearly not for

reproduction. Clutches may be laid and incubation underway such that the purpose of the act may be to maintain the pair bond, amongst other things.

Human disturbance around nests has been frequently documented as the cause for nest failure. From recoveries of dead, banded birds, the average length of life was about 20 months, and the oldest bird lived for 11 years. Other studies have shown that birds found dead ranged in age from four months to four years. Mortality is highest amongst young birds, and the prime reason is assumed to be inexperience. In Scotland, it was shown that 75 percent of eagles were dead before reaching sexual maturity. Thus, it takes a pair of adults 10 years to produce enough young to replace themselves, and the North American situation has been considered comparable. Captive birds have laid eggs up until their 28th year and have lived as long as 48 years.

Mortality in nestlings has been caused by nest abandonment by the adults, human disturbance, heat stress, trichomoniasis, falling out of the nest, falling rocks and death by sibling attack. Mortality in flying birds has been caused by shooting, poisoning, electrocution, predation, disease and accidentally being caught in traps for fur-bearing mammals. Shooting eagles to protect livestock undoubtedly continues today, but historically, this practice accounted for the loss of many thousands of birds. There is extensive documentation of eagle bounties, attempts at extermination, shooting from aircraft, and general persecution. Statistics show that in parts of Texas alone, at least 1000 eagles per year were killed for a period of 20 years, and in other parts of the west, similar numbers seem likely. In British Columbia, in 1922 alone, over 7,000 eagles were shot for bounty money. Many were likely Bald Eagles, but Golden Eagles undoubtedly were also victims.

ADAPTATIONS

The hind talon is well-developed, thus enabling the Golden Eagle to handle larger-than-expected prey on occasion.

HABITAT

Solitude and the Golden Eagle seems to go hand in hand, although it certainly is found along the edge of habitation in the heavily populated interior valleys of British Columbia. Open country is preferred but it can be found over forests in migration. Arid, sloping valleysides, benchlands or flatlands cut by canyons, gullies or outcrops are preferred over flat, featureless terrain. Tundra and alpine country, deserts, southern coastal areas, eastern bogs, logged openings, grasslands, and early seral stages of forested lands, are all used. Thick, heavy, extensive areas of coniferous forests are mostly avoided, except perhaps by birds of passage. Cliffs with ledges for nesting are an important part of the summer habitat, but trees will be used as nest sites. In general, hilly or mountainous terrain is preferred over flatlands due in part to the advantageous lift gained from the air currents over broken terrain. Winter habitats include the arid, shrub-steppe country of the mid-western states and in general are similar in physical appearance to the summering areas. In migration, mountain ridges are preferred in order to benefit from drafts and other beneficial air currents. Key attributes of the habitats include nesting ledges or large trees, perches such as large trees, knolls or large rocks, and broken terrain subject to varied air currents providing lift.

VOICE

The vocalizations are limited and variously generalized as screams, yelps or yaps. When close to one another, the adults will utter slow yelps that have been phonetically described

as "kee-yelp, che-owp" or "ki-ah." Single syllable "kleek" or mellow "culp" sounds are described. The "culp" notes may be given by birds of all ages. Captive, restrained birds give a shrill "ki-ki-ki-ki" scream. "Kaa kaa kaa kaa culp culp culp" sounds may be given as adults approach the nest with food and shriller versions may be given by the eaglet in the nest. Over 5,000 "yelps" were given by one eaglet after being given food and before showing any interest in eating it.

Screams have been described as low, rasping "kee-au-augh", while other vocalizations include cheeps, grunts, "boop" notes and clucky notes. One female was said to have sung a melodious song reminiscent of that of the wild Turkey. Eaglet sounds are variations of the yelping and "ki-ki-ki-ki" notes of the adults, but at different pitches. Interestingly, different observers have used adjectives as disparate as "rather pathetic" to "real blistering serenades" to describe different vocalizations of the Golden Eagle.

FOODS

On average, an adult eagle consumes eight to 12 ounces (227 to 340 grams) of food per day throughout the year. Consumption is not likely to be consistent each day, with periods of gorging versus fasting, depending upon availability of prey. Winter consumption is likely greater than during the summer.

In terms of total biomass, the principal foods of Golden Eagles are rodents, hares and rabbits. The mammalian component of eagle diets as noted from many studies, varies from 70 to 97 percent, with birds variably being another major component. A review of North American literature revealed that 52 species of mammals, 48 birds, five reptiles and two fishes have been recorded in the diets of the Golden Eagle. Insects, such as the Mormon cricket, is also documented as a prey item.

Specifically, some species documented include black-tailed jackrabbit, white-tailed jackrabbit, Nuttall's cottontail, yellow-bellied marmot, hoary marmot, arctic ground squirrel, ground squirrels (*Spermophilus* species), prairie dog, snowshoe hare, mule deer, white-tailed deer, Dall sheep (lambs), pronghorn (fawns), young mountain goats, mountain sheep and mountain caribou, livestock (young or carrion), red fox, arctic fox (young), coyote, opossum, skunk, red squirrel, muskrat, mink, woodchuck, wood rat, microtines, deer mice, Whooping Crane, Wild Turkey, Trumpeter Swan, Great Blue Heron, ptarmigan, grouse, pheasant, Gray Partridge, Chukar, Sage Grouse, Horned Lark, Red-tailed Hawk, Broad-winged Hawk, Barred Owl, Common Raven, Common Crow, Common Loon, American Bittern, Black Duck, various snake species (particularly gopher snakes), horned lizard, leopard frog, box turtle, and fish such as suckers and perch.

Carrion is also eaten and includes a wide range of species including domestic animals that died for reasons other than eagle attack. Much has been written about Golden Eagle attacks on domestic stock. That such depredation occurs is undoubtedly true, but the degree depends upon the availability of natural food supply, ranching practices, weather, and a variety of other factors. Sound animal management practices reduce the losses to eagles to very low levels.

NESTING

Nest sites may be on cliff faces, dirt banks, in deciduous or coniferous trees, on the ground or on man-made structures. The choice of location varies geographically and clearly depends upon the availability of certain features. Cliff faces and large trees are the most commonly-used nest sites and some pairs will alternate between the two types. Where possible, sites which avoid either excessive heat or excessive cold are chosen. Southerly-facing sites at northern latitudes are warmer and northerly-facing sites at southern latitudes

are cooler and there is some evidence to indicate that there are preferences shown where the opportunity arises. Tree nests are often near the edges of openings such as fields or clear cuts. Nest sites may be used for many years by a succession of occupants.

Typically, the nest is comprised of large, dry sticks that are gathered from the ground or may be broken from a tree. The nest lining material varies geographically but it is of much finer material than the structural items. Rootlets, eucalyptus leaves, moss, rabbit fur, shrub twigs, yucca roots, dried grass, and conifer branchlets have all been used to line nests. Curious items that have been incorporated into nests include cow bones, deer antlers, barbed wire, burlap bags, rags, paper and rubbish and even a hat. Nests vary in size but may initially be around three feet (0.9 meters) in diameter. Over the years, additions and repairs may result in nests as large as eight feet (2.4 meters) in diameter. The height may vary from several feet and beyond. The building of several nests is common with up to 12 nests being built by a single pair. Pairs averaged six nests in Idaho.

The clutch size varies from one to five (rarely) and more typically two to three eggs. They are about 3.1 inches (78.7 millimeters) long and 2.3 inches (58.4 millimeters) wide. The base color varies from white to cream and is variably spotted or blotched with browns, chestnut-red, or pale gray. Some may be almost unmarked and they are non-glossy. The laying interval is likely between 90 and 120 hours with incubation starting as the first egg is laid. Although the Golden Eagle is single-brooded, replacement clutches may be laid in the event of loss of the original. The interval before relaying varies from 24 to 28 days. Egg-laying may begin during February at the extreme southern parts of the range while in the north, egg production may not occur until mid-June. March and April are common months for laying by non-migratory birds.

Incubation is primarily by the female with food being brought to her by the male. She feeds at a nearby plucking site. The male will relieve the female for periods during the afternoon but she probably does all of the incubating during the evening hours. Brooding of the young is by the female and occasionally by the male. Fresh greenery is brought to the nest by both sexes.

The incubation period is from 41 to 45 days, although it is variably reported in the literature. Earlier estimates of 30 to 35 days were likely incorrect. The long interval between the laying of each egg leads to young of different sizes. Fledging occurs at 72 to 84 days, but has been reported as 59 to 70 days. At about seven days, the nestling can sit up, stretch its neck and chirp for food. At 14 days, crawling is possible and the white down is well-developed. By 28 days, the chicks can waddle, hiss and raise their wings in threat displays. By 42 days, hostile threat capabilities are much better developed and the young can feed themselves. At 49 days, they will use both feet and wings in order to move around. By days 56 through 65, strength increases, mobility improves continually and vocalizations have become more complex. Mantling over prey is evident. The female sleeps away from the nest from about day 40 onwards. Siblicide is well-documented in the Golden Eagle, and it generally occurs when the young are less than 21 days old.

Flying young remain dependent upon their parents for about 11 weeks after fledging. In migrant populations, the entire family may begin migration together whereas in more southerly resident populations, the young may remain well into the fall or winter near the parents' territory. The existence of what appear to be family groups on the winter range suggests that the families could stay intact until the start of the next breeding cycle.

The breeding success for Golden Eagles is variable and probably follows major food source fluctuations. The number of young fledged per nest varies from 1.2 to 1.8 in different parts of the United States.

CONSERVATION

The Golden Eagle is not only sensitive to human disturbance, but also to land use changes that disrupt natural food supplies and nesting sites. The western populations are doing better in the continental United States than are the eastern populations. Population estimates for North America do not appear to be reliable due to large gaps in knowledge across Canada and remote parts of Alaska. An upper limit of 70,000 for the continent has been suggested, but one estimate for the United States below the 49th parallel was only 18,500 birds. It would seem that there is a need for the authorities to resolve the basic issue of population size.

In eastern North America, the few eagles that are breeding there appear to prey on animals at the top of food chains that accumulate pesticides. This is more the case there than in the west where small mammal prey do not accumulate pesticides to the same degree. The acidification of eastern lakes is a threat to the continued health of the ecosystems hunted extensively by eagles in the east. Populations in 1986 were considered either endangered or threatened in a number of eastern states.

A summary report in 1981 suggested that the Golden Eagle population was reproductively stable and that the main threat to this species may well be habitat change. Human disturbance was a major factor in nesting failures. Future management strategies for eagles will likely revolve around certain key initiatives such as:

- controlling human activities around nesting areas; increasing public awareness to minimize harassment and killing
- working closely with land owners and agencies to minimize habitat destruction
- land use practices and attempts to eliminate the mammalian prey base
- modifying power line design to eliminate electrocution as a source of mortality
- relocating nests to new sites when original sites are threatened
- rehabilitating altered land after practices such as strip mining
- leaving abandoned mine and quarry walls as nest sites

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Crested Caracara

Polyborus plancus

GENERAL DESCRIPTION

The Crested Caracara, with its large bicolored and crested head, long neck, long legs, and diagnostic orange-red face make it one of the more distinctive raptors in North America. Sexes are similar in appearance. It is a highly opportunistic predator that feeds both on carrion and live prey, and a variety of records give testament to the tremendous flexibility of its hunting skills. The core of the bird's range extends from Mexico to Tierra del Fuego, excluding high elevations in the Andes. In the United States, it can be found in areas of open prairie in three disjunct regions; central Florida, southeastern Texas, and south-central Arizona. The only viable, but apparently decreasing population, lives in Florida.

SIZE

The Crested Caracara is slightly dimorphic, that is females are a bit larger than males. Overall length for both sexes averages 23 inches (58 centimeters). Average wing length of the male is 15.5 inches (393.5 millimeters) while the female averages 15.4 inches (391 millimeters). For both sexes the wingspan averages 49 inches (1250 millimeters). Average body weight of the male is 1.8 pounds (834 grams) and for the female it is 2.1 pounds (953 grams).

MORPHS

The Crested Caracara has only one definitive plumage type. There is no evidence of color-morph shifts within its range as is evident in other raptors such as the Red-tailed Hawk.

SPECIFIC DESCRIPTION

Adult - Perched

- distinct black head with crest, long neck, and long yellow legs
- cere, eye ring, facial skin from pale yellow to orange-red
- center of upper back and around to breast white with fine bars
- back and wings dark brown or black
- black belly that appears in a wide band
- narrow bars on tail with terminal band five inches wide
- undertail coverts rufous

Immature - Perched

- long neck and pinkish, yellowish to gray legs
- back and crown brown
- streaks on upper back
- black cap streaked with brown
- nape and breast buffy, and streaked with brown
- cere, facial skin, and eye ring less vibrant, often gray to pinkish
- upper parts and wing coverts tipped in buff and white giving a spotted appearance

Adult - Flight

- crested head, long neck, and decurved wing profile

- neck and throat white
- wing lining, secondaries and inner primaries all brown to black
- outer primaries show white windows barred against the black
- white under the tail
- white tail with very wide terminal tail band and many narrow bands above
- all-black belly that appears like a wide band
- finely barred white breast
- long rounded wings similar in shape to eagle wing
- soars on flat wings
- glides on slightly down-turned wings
- active flight is slow, steady, and methodical

Immature - Flight

- similar to adults but shows more brown and streaking
- crested head, long neck, and decurved wing profile
- neck and throat buffy
- streaks on breast
- outer primaries show white windows barred against the black
- all-dark belly that appears like a wide band
- tail with many narrow bands and very wide terminal band

SIMILAR SPECIES

The Crested Caracara is so distinctive that it should not be easily confused with any other North American bird of prey. At a distance, in flight, the Black Vulture and Common Black-Hawk may be mistaken for a Crested Caracara but the length of neck and tail patterns can be used to separate them.

OTHER NAMES

The Crested Caracara is also known regionally as the "Audubon's" Caracara, "Common" Caracara, "Guadalupe" Caracara, Mexican Buzzard, and Mexican Eagle.

ETYMOLOGY

The genus name, *Polyborus*, is from the Greek word with the suffix "poly" meaning "many or varied" and "borus" meaning "gluttonous." The specific name, *Plancus*, is derived from Latin and means "flat footed." Thus, the full scientific name refers to the sometimes ambulatory lifestyle of this bird - a "varied gluttonous" and "flat-footed" bird!

MYTHOLOGY

The Crested Caracara was important in the mythology of the Aztecs. When one of their tribes, the Tenocha, observed a Caracara with a snake in its mouth atop a cactus, they believed it to be an omen and built a very elegant city called Tenochitlan there. Cortez destroyed Tenochitlan in 1521 and the area is now occupied by Mexico City.

In present day Ecuador and Peru there is a popular myth that if domestic fowl are mated with a Crested Caracara, their progeny will be ferocious fighters.

RANGE

In North America, the Crested Caracara is non-migratory and present within its range year-round. Throughout the year a few individuals may wander into adjacent states. It is

most common in central Florida, less so along the Gulf Coast of southern Texas to southwestern Louisiana, and rare in south-central Arizona.

BEHAVIOR

The Crested Caracara, with its opportunistic lifestyle, deploys a number of hunting strategies. When hunting, or searching for carrion (probably whichever comes first), while on the wing, it will fly at low to moderate heights hoping to surprise prey. Unlike vultures which cannot fly until mid morning because thermals have not developed, the Crested Caracara is able to fly at daybreak allowing access to carrion earlier than their competitors. In fact, in Texas and Florida, the Crested Caracara is seen early in the morning scouring the roadways looking for animals killed in the night.

It does not appear to be good bird hunter, with many of its successful kills being on sick or injured birds. When hunting larger birds, like the Cattle Egret, it will often hunt cooperatively in pairs. The Crested Caracara raids nests, eating any eggs and chicks. It is a well known pirate. For example, in southern Texas, it will mob incoming Brown Pelicans with food forcing them to drop their catch. It employs this technique on crows, and other raptors as well. In Mexico, as farmers plough their fields, a dozen or more Crested Caracaras will follow behind, preying on any exposed lizards, rodents, or birds. This species will tear apart rotting logs in search of insects as well as scratching among dung. It is commonly found on southern livestock farms and slaughterhouses. It is an expert at killing goats and sheep, especially the new-born and young. With new-born, the Crested Caracara will hunt cooperatively, attempting to separate the kid or lamb from the mother, peck the eyeballs out and then kill with the beak. At a pig slaughterhouse in Mexico up to 150 were observed in one afternoon. It also fishes in shallow water.

The Crested Caracara is assumed to have long term pair bonds but there are too few observations for this to be substantiated. The display involves a ritual prey item lifted up and down in its beak each time the mate approaches (which sex does what is unclear). After this, they will stand at approximately a 45 degree angle of each other and call while tossing their heads back until the crowns rests on the upper backs. This call is also used in conflict situations.

In Florida, one home range was estimated at 20 square miles (55 square kilometers). This is not a migratory species and movements are usually made by dispersing young.

There is no information how long Crested Caracaras live in the wild but a captive bird lived for 30 years.

ADAPTATIONS

The long legs and flat talons of this species permits running after quick prey and scratching for insects. The significance of the facial skin, being able to change from yellow to bright red, is not well understood but it no doubt plays a role in communication.

HABITAT

This is an open country bird of the tropics and subtropics inhabiting pastureland, cultivated areas, and semi-deserts. It is found in arid and moist areas but shows a preference for the former. In the United States, it inhabits open natural prairies with scattered clumps of trees and ponds, cultivated lands, and livestock areas.

VOICE

A variety of calls have been described by different observers. The Crested Caracara has a diagnostic "Rattle - Call - With - Head -Toss", similar to "cre-a-ak cro-ak crea-ak." When it is carrying food, or nest material, it will give a short "wuck" or "gwuck." Sometimes a harsh "cruk", repeated in rapid succession at increasing pitch followed by a "purring" is uttered. The significance of this call remains unexplained.

FOOD

The list for this versatile opportunist is quite extensive and includes such items as eggs, nestlings, small birds, wading birds, mice, rats, rabbits, fish, young lambs and goats, bullfrogs, lizards, young alligators, insects, crayfish, shellfish, and most types of carrion.

PELLETS

No information is available for North America.

NESTING

This species often builds its nest in the crown of a tree which provides a commanding view of the surrounding countryside. It has been known to nest among palmetto, pine, and giant cacti. The nest is quite large and bulky and the nest bowl is deep. The nest material is composed of sticks, vines, twigs, and dung. At times it will share the nest with smaller birds such as the Great-tailed Grackle.

Among the family Falconidae the Crested Caracara is the only species which builds a nest.

The clutch size ranges between two and four eggs but two or three eggs are most common. The eggs are sub-elliptical or somewhat elongated in shape. The shell itself is smooth and appears to have two layers of colors. An inner layer may be pale to a brownish sometimes covered with fine blotches and an outer layer with patches of darker brown. The eggs average 2.3 inches (59.2 millimeters) in length and 1.8 inches (46.7 millimeters) in width.

The incubation period is 30 to 32 days, and the age at first flight is 42 to 56 days.

CONSERVATION

The Crested Caracara is declining throughout its range, probably because of habitat loss to agriculture and increasing direct mortality with vehicles. It was on the National Audubon Society's Blue List from 1972 to 1979 and again in 1981. It was also listed as a Species of Special Concern from 1982 to 1986. It has not nested in Arizona since 1960, and is considered a vagrant in New Mexico. In Texas, there is evidence that the population has declined although some recent observations might suggest otherwise.

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American Kestrel

Falco sparverius

GENERAL DESCRIPTION

The American Kestrel is a small, familiar falcon of open country, with a wide distribution across North America. It is one of our smallest hawks, with pronounced plumage differences between males and females. Immature kestrels are unique among North American birds of prey in having different male and female plumages. The kestrel is often seen perched atop power poles or hydro lines. It is a graceful flier, and commonly hovers in one spot, examining the ground below for insect or rodent prey. When perched, it commonly bobs its tail up and down.

Both sexes are quite colorful. The male has slate blue wings, a reddish-brown back sparsely barred with black, a white face marked with a heavy black bar below the eye and another behind the cheek, white to buffy orange (mostly in adult male) underparts sparsely marked with black spots and a reddish-brown tail with a wide black subterminal band. The female has reddish-brown wings, barred with black like her back, and a reddish-brown tail banded with black. Her pale underparts are streaked with brown. Both birds are slightly larger than robins or about the size of a jay.

SIZE

The American Kestrel is the smallest North American falcon and one of the smallest hawks on the continent. Females are slightly larger than males. Lengths average 10 inches (25 centimeters) for females and nine inches (24 centimeters) for males. Wingspans average 22 inches (57 centimeters) for females and 21 inches (55 centimeters) for males. Weights average 0.3 pounds (120 grams) for females and 0.2 pounds (111 grams) for males.

MORPHS

There are no morphs. The female and male differ in plumage and are easily told apart. Albinism is rare.

SPECIFIC DESCRIPTION

Adult Male - Perched

- small falcon usually found in open country
- when perched bobs its tail up and down
- two well-defined dark facial stripes or mustache marks and white cheeks
- blue-gray crown with rufous patch
- buffy to rufous breast and reddish-brown back with some dark barring on lower parts
- various sized black spots, mainly on flanks and middle areas of underbody
- blue-gray on upper wings
- reddish-brown tail with wide dark band near white tip

Adult Female - Perched

- similar to male but upperparts dark reddish-brown, evenly barred or blotched with black
- dull blue-gray crown with rufous patch
- underparts buffy, streaked with reddish brown

- reddish-brown tail with many narrow dark bands; the subterminal, or last band, usually wider

Immature Male - Perched

- similar to adult male but with heavier barring on back, white breast streaked with black, and black shaft streaks on crown patch

Immature Female - Perched

- similar to adult female but with final dark bar on tail no wider than any other bar. This may be difficult to see in the field.

Adult Male - Flight

- long pointed wings; often hovers
- reddish or rufous back with blue wings
- underwings appear pale with bright white spots along trailing edge of primaries
- reddish-brown tail with wide dark band near white tip
- two moustache stripes

Adult Female - Flight

- long pointed or "sickle-shaped" wings; often hovers
- uniformly reddish-brown above with dark spotting
- similar to male but has reddish-brown tail with many narrow dark bands; subterminal, or last band, often widest
- rusty brown streaked underparts
- rusty-brown back barred with black
- lacks the bright white spots on trailing edge of primary feathers
- two mustache stripes

Immature Male - Flight

- similar to adult male but breast and immediate below with short blackish streaks
- upper back to nape with numerous dark bars

Immature Female - Flight

- like adult female
- bar near tip of tail not well defined like in adult female

SIMILAR SPECIES

The American Kestrel could be confused with three other hawks. The Merlin is also a small falcon but both sexes have narrow pale bands on a dark tail and lacks the light spots on the trailing edge of the male kestrel's underwing. The female kestrel is much rustier in color than a Merlin. The Black-shouldered Kite also frequents open country but is whitish with large black patches at the bend of the underwing. The Peregrine Falcon is a much larger falcon. The adult Peregrine is slate blue-gray with no rufous on the head or back. Its chest is white or light buffy, with a barred belly and a dark tail with non-contrasting pale thin bands. The immature Peregrine Falcon is heavily streaked below, has darker underwings and a darker tail. It lacks any hint of rust or rufous.

OTHER NAMES

The American Kestrel was formerly known as "Sparrow Hawk." It has also been called the "Desert Sparrow Hawk", "Eastern Sparrow Hawk", "Little Kestrel", "Little Sparrow Hawk", and "wind hover" which is a common folk name for the related Eurasian Kestrel (*Falco tinnunculus*).

ETYMOLOGY

The scientific name *Falco sparverius* translates into "sickle" (Latin = *falx*) and "pertaining to a sparrow" (Latin = *sparverius*). The "sickle" refers to this species' typically falcon-shaped wings, beak, and talons. The "sparrow" reference is to the bird's former common name, "Sparrow Hawk. "

MYTHOLOGY

Although no mythology has been recorded, the American Kestrel was probably kept as a pet by some Indian tribes including the Paiutes. American Kestrel remains have often been discovered in the sacred burial bundles of Plains Indians.

RANGE

In North America, it breeds from western and central Alaska, southern Yukon, western Mackenzie, northern Alberta, northern Saskatchewan, northern Manitoba, northern Ontario, southern Quebec, New Brunswick, Prince Edward Island, Nova Scotia, and Newfoundland; south to Baja California, most of the Gulf Coast, and most of Florida.

It is present year-round within its breeding range from southern British Columbia, Washington, southern Idaho, most of Wyoming, northeastern Colorado, northwestern Kansas, Nebraska, northwestern Iowa, southern Wisconsin, southern Michigan, and southern Ontario to western Maine and south through most of the southern United States. It winters along the Gulf Coast of Texas and Louisiana and southern peninsular Florida.

There are 14 recognized subspecies of this falcon, two of which occur in North America. These are *F. s. sparverius* which breeds over much of North America, and *F.s. paulus* which breeds from northeastern Texas across southern Louisiana, southern Mississippi, most of Florida, to South Carolina.

The American Kestrel is also resident on the Bahamas and Antilles and locally in the Central American highlands including eastern Honduras and northeastern Nicaragua. It is widespread in South America.

MIGRATION

The American Kestrel leaves its northern South American and Central American wintering areas in February, and its wintering areas in the southern states from mid February (California) through April (Florida). It departs wintering areas in southern Canada in April.

Postbreeding adults and fledglings disperse from their nesting areas in northern United States and Canada in July. Local concentrations occur within the general breeding range where food is plentiful.

Autumn migrants move through Canada and the northern United States from late August to mid November with the bulk passing in September. Birds wintering in southern Central America to Panama arrive beginning in mid October.

Females tend to migrate earlier than males, at least in eastern North America, though there is overlap. The situation in western North America is not known. The American Kestrel makes over-water crossings and occasionally feed en route on the wing on small birds.

BEHAVIOR

The American Kestrel has a buoyant, active flight style. It is the only North American falcon to habitually hover with rapidly beating wings, keeping its head motionless while scanning the ground for prey. The kestrel commonly perches along fence lines and powerlines. It glides with flat wings or with wrists lower than the body and wingtips curved upward. It occasionally soars in circles with its tail spread and its wings flat.

The American Kestrel uses several hunting techniques and is flexible in its prey selection. It will hover over one spot as described above. When prey is sighted the kestrel may partly fold its wings and drop lower once or several times before striking. When the prey disappears the falcon will glide in a semicircle before turning back into the wind to hover again. It will also soar in circles, or figure eights, using the same stooping tactics as when hovering. The kestrel commonly hunts from elevated perch sites, waiting for prey to move on the ground. The kestrel bobs its head and pumps its tail just before attacking. Other prey capture techniques include direct pursuit flight, landing and flushing prey from the ground (especially grasshoppers), then taking them in flight, capturing flying insects from an elevated perch, and nest robbing including the burrows of Bank Swallows and the nests of Cliff Swallows. It is also an occasional bat catcher, taking bats from their tree roosts, or striking bats in flight from above or as the bats leave or enter caves. The kestrel will kill and cache food items.

The American Kestrel is migratory over much of the northern half of its North American breeding range. Returning individuals commonly re-establish territories held the previous year. In one study, a pair nested in the same tree for six consecutive years. On the wintering ground there may be sexual differences in habitat use with males hunting more densely vegetated ground than females. Because it feeds on both insects and vertebrates, the American Kestrel maintains fairly high population densities. It has a small breeding home range, from 1.76 to 2.10 square miles (0.68 to 0.81 square kilometres) in one study. Territory size has been estimated at 269 to 321 acres (109 to 130 hectares) with much larger wintering home ranges.

The American Kestrel occasionally robs one another. This species has also been known to rob a shrike. Kestrels sometimes harass other hawks in flight during migration, over the kestrel's winter territories, or commonly over the kestrel's breeding territory. The American Kestrel will vigorously defend its nest against other cavity nesters.

The American Kestrel forms pairs in which the bond is strong, tending toward permanence. Courtship begins shortly after the male establishes a territory. In early courtship, he may give the "dive display", a series of climbs and dives 33 to 66 feet (10 to 20 meters) with 3-5 "klee" notes given near the peak of each climb. He may present the female with food during courtship feeding. He may entice her to the nest site by calling. He may "flutter-glide" toward her with quick and shallow wing beats while carrying food and she may also beg for food by flutter-gliding. The female initiates copulation by bowing with her tail in line with her body or slightly raised.

The American Kestrel is not long-lived. The oldest banded wild bird was 11 years and seven months old while a captive lived 14 years. A mortality rate average of 57 percent was found. First year mortality rates have declined since 1945 with a decrease in shooting. Major causes of death include collision with traffic, illegal shooting, and predation by other raptors, including the Red-tailed Hawk, Northern Goshawk, Cooper's Hawk, Peregrine Falcon,

Barn Owl, and Great Horned Owl. Other causes of death have included dying from cold weather, pesticide poisoning, being trapped in chimneys, drowning in water tanks, colliding with wires and windows, electrocution on power lines, and being trapped in fresh tar on a resurfaced road. In Kentucky, black rat snakes are suspected of killing both young and adults at the nest.

ADAPTATIONS

Both sexes take turns incubating their eggs, a very rare situation among North American birds of prey where the female usually incubates exclusively. Both sexes develop bare oval patches on each side of their breasts where the warm bare skin can contact the eggs for warming.

The American Kestrel is very adaptable in its prey selection and can rapidly change its hunting techniques depending upon the availability of local prey. It is attracted to grass fires where it hunts along the edges of the fire, capturing escaping prey.

The American Kestrel has adapted well to nest boxes. In one program, nest boxes were fixed to the backs of signs along a freeway thus allowing kestrels to breed in areas formerly devoid of nest sites.

HABITAT

The American Kestrel frequents open and partially open countryside including agricultural lands, transportation corridors such as freeways and highways, meadows, fields, open areas on mountainsides, prairies, plains, and deserts. In migration, it also may occur around beaches, ocean spits, estuaries, alpine meadows, airfields, and open urban areas.

It requires a cavity, natural or manmade, for nesting and will nest in bird boxes, holes in trees (excavated by other birds and natural), on cliffs and in the crevices of buildings. It generally requires a few prominent elevated perches for its hunting, although it can hunt without these, depending upon availability of local prey.

In winter, open or semi-open habitats are used, with the male apparently forced into brushy habitat by the larger female.

VOICE

The American Kestrel has three basic vocalizations - the "klee" or "killy", the "whine", and the "chitter." The "klee" or "killy" is usually delivered as a rapid series - "killy, killy, killy, killy" when the kestrel is upset or excited. It is used at the apex of the dive display, during fights with other kestrels, and after unsuccessful hunting attempts.

The "whine" may last as long as one to two minutes and may be single or treble. The more intense the situation, the more likely the "whine" will move toward the treble extreme. "Whines" are given during courtship feeding and copulation. The treble whine is heard from breeding females and fledged hungry young.

The "chitter" is the most frequent vocalization in male - female interactions. Its volume and duration depends upon the stress or excitement of the situation. It is associated with friendly approaches and bodily contact between the sexes during breeding season. Occasionally a "chitter" follows a "whine."

Calling occurs throughout the day. Nestlings at two weeks can produce all three vocalizations. Female kestrels tend to have slightly lower pitched and harsher voices than

males.

FOODS

The American Kestrel captures a very wide range of prey species, but insects (particularly grasshoppers and allied species) are the primary prey, followed by small mammals (especially voles and cotton rats), birds (usually small birds or nestlings), small reptiles, and some amphibians. Insect prey is quite varied but the kestrel takes mostly grasshoppers, dragonflies, crickets, June beetles, katydids, and possibly weevils. Mammals include many open country species such as young ground squirrels, and voles, as well as woodrats, pocket gophers, squirrels, chipmunks, weasels, cotton rats, house mice and deer mice. Birds include many open country species such as meadowlarks, Horned Larks, Brown-headed Cowbirds, Mourning Doves, quail, swallows, swifts, wren, Bushtit, European Starling, and poultry chicks. Reptiles include small lizards, and snakes. Amphibians include frogs, toads and tadpoles. Other food, only rarely taken, includes crayfish, centipedes, scorpions, spiders, snails, earthworms and carrion. The kestrel's diet varies geographically. One Arizona study showed kestrels consuming birds at 35 percent (biomass) of their total diet while a Utah study revealed 57 percent (biomass) for birds.

PELLETS

The pellet is elongated and elliptical often tapering to a point at either or both ends. The usual rate of production is a pellet per day but larger consumption may increase the rate.

NESTING

The nest site is generally a hole or cavity in a tree, snag, cliff or a crevice in a building. The number of suitable breeding cavities limits this species' breeding density. The American Kestrel often selects a very narrow cavity, possibly as predator deterrents. The cavity may be natural or bird excavated. The former nest holes of the Northern Flicker are commonly used. Nest boxes are readily used. The kestrel prefers nest boxes on poles and rarely uses those on live trees. At least three studies have shown birds prefer nest openings with southern or eastern exposures. Pairs nesting in boxes on poles have much higher nesting success than pairs using boxes on trees. No nest is built inside. In nest boxes sawdust and wood shavings may be a suitable substrate for the eggs.

The eggs number three to seven but average four to six. The eggs are typically short elliptical in shape and are white or pinkish-white with an even covering of fine spots and flecks of brown shades, occasionally concentrating as a ring or a cap. The eggs average 1.38 inches (35 millimeters) in length by 1.14 inches (29 millimeters) in width. Extreme measurements are 1.54 inches (39 millimeters) long and 1.02 inches (26 millimeters) wide.

The female does most of the incubating, with the male often taking short turns in morning, evening and possibly at night. In captivity, eggs can be switched from one nest to another. Even Wood Duck eggs have been incubated by captive female kestrels. Incubation ranges from 26 to 32 days with an average of 28 to 29 days. Nestlings become noisy between day 11 and 14. The young take their first flight between days 26 and 31. Early fledgling behavior varies. Broods typically stay together for a week or two. Some broods remain close to the nest area for a week or two while others travel throughout the parents' home range. Generally, young do not disperse more than 0.6 miles (one kilometer) away from the nest area until two to four weeks old. Young disperse as hunting skills develop. Occasionally groups of older juveniles from various broods join together into flocks. The American Kestrel is double-brooded, particularly in the southern United States, in areas of abundant small mammals. Replacement clutches can be laid.

CONSERVATION

The American Kestrel's North American population has been estimated at 1.2 million pairs, with the Central and South American populations possibly equally as large. It is possible that with the clearing of parts of North America for agriculture that the American Kestrel has increased in the last two hundred years. The southeastern race, *F. s. paulus*, is in serious decline (an 82 percent reduction since the early 1940s in north central Florida) probably due to habitat loss and loss of nest sites, and has been listed in Florida as "threatened." Threats to the species as a whole include loss of nest sites, pesticide poisoning (including dieldrin and DDT among others), and death through collisions with vehicles as well as shooting.

The species responds very well to nest box programs which can dramatically increase nesting densities in areas where kestrels were formerly scarce. Nest boxes may also increase the number of wintering kestrels by acting as shelters and roost sites. The American Kestrel is an adaptable species which can survive in suburban areas, given proper nesting sites.

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Merlin

Falco columbarius

GENERAL DESCRIPTION

The Merlin is a small falcon of open country or forested edge. Although about the same size as an American Kestrel, the Merlin is a bird-hunter, taking whichever small bird is locally abundant. Depending upon race, the male has pale blue-gray (Prairie race), medium blue-gray Taiga) or blackish (Black) upperparts. Its underparts are lightly streaked in the Prairie race to very heavily streaked in the Black race. It has a conspicuously banded tail, the main field mark for this species. Seen from below, the dark underwings are heavily spotted with white to tawny, the latter especially evident on females and immatures. The female and immature are similar but with brown replacing the blue-gray or black. The Merlin has a diagnostic direct flight pattern with strong wing beats. It is also very vocal especially around the nest, and very pugnacious, often attacking and harassing other birds, even other birds of prey.

SIZE

The Merlin is the second smallest falcon in North America and one of the smallest hawks on the continent. Females are noticeably larger than males. Lengths average 11 inches (29 centimeters) for females and 10 inches (26 centimeters) for males. Wingspans average 25 inches (64 centimeters) for females and 22 inches (57 centimeters) for males. Weights average 7.4 ounces (210 grams) for females and 5.4 ounces (155 grams) for males.

MORPHS

Although the three subspecies differ in color, and each sex has its own plumage, there are no morphs. Immatures of all races are similar, if not identical, to adult females.

SPECIFIC DESCRIPTION

Adult Male Taiga (columbarius) - Perched

- small falcon with buffy narrow eyebrow and weak moustache mark
- throat without streaks
- medium bluish-gray back
- underparts distinctly streaked with brown
- black tail banded with three narrow white bands and wider terminal tail band
- leg feathers rusty colored, a male trait in all races

Adult Female and Immature Taiga (columbarius) - Perched

- like male but back brownish, not blue-gray
- underparts sandy with distinct brown streaks that appear thicker than in male
- three or usually four buffy narrow bands on tail with wider terminal white tail band
- leg feathers creamy colored as rest of underparts

Adult Male Taiga - Flight

- heavily streaked underparts
- small dark falcon with pointed wing tips
- white bands on black tail

- dark underwings checkered or spotted with white
- rusty leg feathers

Adult Female and Immature Taiga - Flight

- uniform, dark, tawny spotted underwings
- narrow pale bands on dark tail
- heavily streaked underparts on buffy base color

Note: The immatures of each subspecies, either perched or in flight, are very similar to the female of the each respectable race.

SIMILAR SPECIES

In size, the Merlin closely resembles both the American Kestrel and the European Kestrel (vagrant in North America) but lacks the rusty plumage of either species. The Peregrine Falcon is larger than the Merlin. The Peregrine Falcon also shows a prominent moustache mark on the cheek and, in adults, usually a pale breast contrasting with a barred lower chest and belly. Immature Peregrine Falcons from the Northwest are dark like the Black Merlin and may be distinguished when perched by a heavy mustache (helmet-like) and wing tips that reach the tip of the tail. The Prairie Falcon is superficially similar to the pale Prairie Merlin but is larger, has black "wing pits" and median coverts and a dark mustache. The Sharp-shinned Hawk is similar in size but is an accipiter, flying in a characteristic flap-flap-flap-glide style. It has short, rounded wings red or yellow eyes, and equal width light and dark tail bands.

OTHER NAMES

The Merlin was formerly known as the Pigeon Hawk. The Taiga Merlin (F.c. columbarius) is also known as the "Eastern Merlin" (formerly Eastern Pigeon Hawk) and "Northern Merlin." The Black Merlin (F.c. suckleyi) is also known as "Suckley's Merlin." The Prairie Merlin (F.c. richardsonii) is also known as "Richardson's Merlin."

ETYMOLOGY

The scientific name *Falco columbarius* translates into "sickle" (from the Latin *falx*) and "pertaining to a dove or pigeon" (from the Latin *columbarius*). This refers to the Merlin's supposed resemblance to a pigeon in flight.

MYTHOLOGY

The Merlin does not appear in mythology in North America.

RANGE

The Merlin breeds from northwest Alaska, northern Yukon, northwest and central Mackenzie, south Keewatin, northern Manitoba, northern Ontario, northern Quebec, Labrador and Newfoundland, south to southern Alaska, southwest British Columbia, central Washington, central Oregon, Idaho, Montana, northern Wyoming, eastern North Dakota, western Nebraska, northern Minnesota, southern Ontario, southern Quebec, New Brunswick, and Nova Scotia. It formerly occurred, or rarely occurs, in eastern Montana, western North Dakota, eastern Iowa, northern Wisconsin, northern Ohio, and northern Michigan.

It winters in western North America from south-central Alaska, coastal British Columbia, coastal Washington, Oregon, southern Idaho, southern Wyoming, Colorado southward to Mexico and Central America, and across the southern states from Texas, southern Louisiana,

southern Mississippi, southern Alabama, southern Georgia, Florida and along the coastal eastern seaboard north to Connecticut. Birds from eastern Canada winter in the West Indies and the Caribbean.

Since the 1960s the Prairie Merlin has occurred sparsely year --round in the northern Great Plains: southern Alberta, southern Saskatchewan, Montana, eastern Idaho, northern Wyoming, western North Dakota, and western South Dakota. It is also resident on the Pacific coast from southeastern Alaska to central Washington.

Throughout the world the Merlin breeds across the northern hemisphere from northern Canada and east across northern Europe and Asia

There are 10 recognized subspecies of the Merlin, three of which occur in North America. The distribution for this subspecies is as follows.

F. C. Columbarius (Taiga Merlin) - breeds throughout most of North America except for the areas occupied by other races. It is highly migratory wintering south to Peru.

MIGRATION

The Merlin arrives at its breeding areas from late February (Saskatchewan) to late March or mid April (Alaska). Spring migration peaks in late April at Cape May, New Jersey. Males precede females to the breeding areas. Postbreeding adults and fledglings leave their breeding areas in early August. Females leave before males. At Cape May, the peak fall movement occurs from September 20 to October 10. A general flyway for Merlins from west-central Canada east of the Rockies has been proposed along the eastern edge of the Rocky Mountains.

BEHAVIOR

Unlike the American Kestrel, the Merlin does not hover. Its flight is direct, the rapid wingbeats shallow and fluttery at times, creating a diagnostic flight pattern often linked with the bird's characteristic "ki-ki-ki-ki-ki" call. It occasionally soars with wings flat and tail fanned. Wing beats during hunting flight are deep and powerful but more rapid than a Peregrine or a Prairie falcon. The average flight speed has been estimated at about 30 miles per hour (48 kilometers per hour). During migration Merlins appear to migrate much of the day, including in pre-dawn darkness and late in the day. It will migrate on days of light rain when other hawks do not. It will also migrate across stretches of open water, including the ocean, flying low over the waves. Young Merlins are often fairly tame during the first month or two of life, sometimes flying close to people.

The Merlin hunts mostly in early morning and late afternoon. Most prey is captured in mid-air after the Merlin has spied it from a prominent perch overlooking an expanse. It will also coarse over the landscape using hills, dikes, and trees for concealment. Dives or "stoops" from a height are uncommon. The Merlin will engage in a series of short stoops after escaping prey. It will also engage in aerial chases when its prey attempts to out-fly it. The famous "ringing flight" occurs when the prey (classically a European Skylark in Europe) seeks to escape by rising higher and higher in circles with the Merlin close behind. Co-operative hunting between two Merlins has been seen. The species is an opportunistic feeder taking flying insects on the wing, hunting bats at the cave mouth and using other birds (such as a Northern Harrier), people, hunting dogs, or vehicles as "beaters", flushing prey for the falcon to pursue. At a plucking post the Merlin stands on its prey, kills it by biting the neck, and typically discards the head, feathers, legs and wings. After feeding it wipes its beak and cleans its feet with its beak and may rotate in place, kneading its feet. Like the American Kestrel, the Merlin will cache prey for later consumption.

Home range sizes vary in nesting season from 8.9 square miles (23 square kilometers) in Montana to 3.1 square miles (8 square kilometers) in Saskatchewan. Resident and immigrant males in Saskatoon differ in breeding season home range size - 2.3 square miles (6 square kilometers) for residents and 12.7 square miles (33 square kilometers) for immigrants. Home range sizes are much smaller where prey is abundant. Males appear to have a stronger fidelity to the same territory year after year than females. Fidelity to the territory is a well known and long-lived phenomenon in Europe. Differences in site fidelity may be a function of the availability of nest sites. The Merlin is fairly social for a falcon. Pairs wintering together have been reported, as have migrations in loose groups and occasional communal roosts..

In early fall, young Merlins may occasionally hunt and migrate with young Sharp-shinned Hawks without much animosity, which is odd since Merlins are well known harassers of other migrating hawks. In migration, Peregrine Falcons sometimes rob Merlins. Once a Merlin struck and killed a Red-tailed Hawk. In defense of a nest, a Merlin has killed a crow, and in Alaska the species has chased Golden Eagles, Common Ravens, Gyrfalcons, Black-billed Magpies, and Willow Ptarmigan from its territory. In Europe, Fieldfares (large thrushes) often nest within the same grove with a pair of nesting Merlins.

Courtship behavior is complex. The male engages in "power flying" with deep wingbeats, showing alternate views of his ventral and dorsal surfaces while giving tics. Power flying is often done at territorial boundaries by neighbouring males. The male may also "power dive", like the above display, but terminating in a u-shaped climb. This display is advertisement and territorial defense. Sometimes both sexes dive together. Both male and female show the "rocking glide", a less intense version of power flying with no flapping. Males use it to attract females. Females use it as a threat against other females. Males also "flutter fly" near their perched mates, typically around the nest site. "Ki-ki-ki-" vocalizations are given which the female may answer. Both sexes "high soar" near the nest, a territorial display. The male may "slow land" with stiff legs and a bowed head as a terminal component of other displays. It may also be given before or after copulation. The "ki-ki-ki" vocalization may accompany it. A female may "food beg" with whining. Males may transfer food to females in the air, to a perch, or from perch to perch, giving "tics" or "ki-ki-ki" calls. At the nest, both sexes may give "tic" calls and the male may settle with arched back, drooped and trembling wings and a fanned tail. Before mating the male may bow, fan its tail and stare at the female while chattering. The female solicits copulation by bowing and fanning her tail.

The Merlin seldom lives longer than eight years. First year birds may have a mortality rate as high as 60 to 70 percent. The maximum mortality rate for breeding birds in Saskatoon was 29 percent. In one study, collisions with vehicles and windows (43 percent), shooting (7 percent), poisoning (2 percent), predation by cats (2 percent) and weather (1 percent) were the known agents of mortality.

ADAPTATIONS

Merlins breeding along the extreme northern edge of their range in Canada may nest on the ground in areas where trees are scarce. Further investigations are needed of this possible adaptation, but ground nesting does occur in some European parts of this species' range.

Merlins have adapted well to the human settlement of the Northern Great Plains. During the last twenty years small but growing breeding and wintering populations have become established in prairie cities like Saskatoon (an increase from one pair in 1971 to 27 pairs in 1987) where the Merlins take mainly House Sparrows. They breed in old crow nests in large shade and coniferous trees. Similar urban populations exist in Regina, Moose Jaw, Calgary and Edmonton and may be spreading across Canada. Urban birds tend to accept the near

presence of human beings more calmly than birds in the country. Urban birds roost in tall conifers with large, thick crowns. Such trees have only recently reached such a size in the northern Great Plains. This may explain why Merlins now winter in the area.

HABITAT

The Merlin inhabits both open country, including grasslands and prairies, where it nests in aspen, cottonwood, and shelterbelt groves, and coniferous forests of northern Canada where it is found near open areas like forest edges, fragmented woods, bogs, and lakes where it often nests near water. Merlins along the northwestern coast also inhabit coniferous forests, frequenting edges such as beaches, estuaries, and rivers. Increasingly, Merlins occur in urban forested parks and cemeteries in prairie Canada and the interior of British Columbia and Ontario where House Sparrows, and other birds provide plentiful prey. In migration, and winter, the Merlin is found in open woodlands, moorlands, marshes, deserts, and along seacoasts.

VOICE

The Merlin has a limited vocal repertoire. The "ki-ki-ki" or "kek-kek-kek" call is repeated rapidly in a number of territorial or aggressive situations, by either sex, becoming more rapid and intense with increasing agitation. During courtship, both sexes "chutter" when ready to mate. The female gives a "whine" while food-begging from the male. An indefinite series of "tic" or chip calls can be given in courtship or when mates are out of sight of each other. The male's voice is higher than the females in these vocalizations. When cold, nestlings "peep", and when alarmed they "chirp".

FOOD

The Merlin is primarily a hunter of small to medium-sized birds, generally under 1.8 ounces (50 grams). However, it is an opportunistic feeder and will take small numbers of mammals, insects, and reptiles. The principal prey is usually a locally abundant bird such as; Horned Lark, Lark Bunting, or Vesper Sparrow in Montana; Horned Lark, longspurs, and House Sparrow in Saskatchewan; or Savannah Sparrow in northern Manitoba. Other birds taken include grouse, Rock Doves, jays, kinglets, thrushes, American Pipits, vireos, warblers, and various sparrows. Large birds, like doves, are probably taken by inexperienced young Merlins. Mammals taken include bats, squirrels, pocket gophers, mice and voles. Other prey items include lizards, snakes, toads, frogs, dragonflies, and other large insects. Insects are common in the diet of immature Merlins during their first summer and fall.

PELLETS

Pellets are usually cast in the early morning and contain the feather and skeletal remains from the previous day's prey. Like most falcons, Merlins use plucking posts.

NESTING

The Merlin uses both coniferous and deciduous trees as nest sites. It does not build a nest, but usually uses an old crow, jay, or hawk nest. Occasionally it will nest atop a magpie nest. The Merlin rarely uses tree cavities, cliff crevices, or the ground. Ground nesting females usually make a scrape. The same nests are rarely used for two consecutive years although the Merlin can be very faithful to general nesting areas, returning to the same park or woodlot for many years.

Clutch sizes range from two to seven eggs, but averages four to five. Each egg is of a short elliptical, oval, or short oval in shape. The shell is smooth but without gloss. Taiga

Merlin eggs have a whitish ground color with reddish-brown spots and blotches covering the shell and sometimes forming a ring at the larger end. The egg averages 1.6 inches (40.0 millimeters) in length and 1.5 inches (31.7 millimeters) in width. The Prairie Merlin's eggs are similar to those of the Taiga Merlin but averages 1.6 inches (40.9 millimeters) in length and 1.3 inches (31.8 millimeters) in width.

The Black Merlin often has the darkest eggs which may be totally covered with various shades of brown. They average 1.6 inches (40.6 millimeters) in length and 1.2 inches (31.6 millimeters) in width.

Both sexes incubate but the male spends far less at it than the female (seven to 15 percent in one study). The male hunts for both himself and the incubating female. Incubation lasts 28 to 31 days. On average, male and female chicks require 1.4 ounces (40 grams) and 1.8 ounces (52 grams) of food a day, respectively. The male does most of the hunting for the chicks but the female feeds them. Females may begin hunting when the chicks are about three weeks old. About 29 days after hatching, the young fledge. Both adults feed the young near the nest site for one to four weeks. The young become independent at about five weeks.

The Merlin is single-brooded, but replacement of destroyed early clutches has been recorded. The Merlin vigorously defends its nest. At one nest, a female Merlin struck and instantaneously killed a passing American Crow.

CONSERVATION

Insecticide poisoning caused by DDT and its metabolite DDE presumably caused eggshell thinning and some reproductive failures among North American Merlins in the 1960s. Although most Merlin populations are now reproducing well following the DDT ban of the early 1970s, some North American birds are still being affected and chemically poisoned. PCBs, and possibly mercury, remain a concern, particularly in Great Britain, where the Merlin is the most heavily contaminated of British raptors.

Shooting caused 7 percent mortality of Merlins in Saskatoon, Saskatchewan. The Merlin also occasionally dies from collisions with vehicular traffic.

Habitat loss on the Great Plains, due to cutting of vegetation around prairie sloughs and potholes, may be balanced off by the Merlin's recent "invasion" of prairie cities. Merlins can be bred in captivity and it is possible that local populations could be established or built up by the release of Merlins into suitable urban areas. Six released in Regina may have been the basis for the current population of about twenty pairs.

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Merlin - Taiga

Falco columbarius

GENERAL DESCRIPTION

The Merlin is a small falcon of open country or forested edge. Although about the same size as an American Kestrel, the Merlin is a bird-hunter, taking whichever small bird is locally abundant. Depending upon race, the male has pale blue-gray (Prairie race), medium blue-gray Taiga) or blackish (Black) upperparts. Its underparts are lightly streaked in the Prairie race to very heavily streaked in the Black race. It has a conspicuously banded tail, the main field mark for this species. Seen from below, the dark underwings are heavily spotted with white to tawny, the latter especially evident on females and immatures. The female and immature are similar but with brown replacing the blue-gray or black. The Merlin has a diagnostic direct flight pattern with strong wing beats. It is also very vocal especially around the nest, and very pugnacious, often attacking and harassing other birds, even other birds of prey.

SIZE

The Merlin is the second smallest falcon in North America and one of the smallest hawks on the continent. Females are noticeably larger than males. Lengths average 11 inches (29 centimeters) for females and 10 inches (26 centimeters) for males. Wingspans average 25 inches (64 centimeters) for females and 22 inches (57 centimeters) for males. Weights average 7.4 ounces (210 grams) for females and 5.4 ounces (155 grams) for males.

MORPHS

Although the three subspecies differ in color, and each sex has its own plumage, there are no morphs. Immatures of all races are similar, if not identical, to adult females.

SPECIFIC DESCRIPTION

Adult Male Taiga (columbarius) - Perched

- small falcon with buffy narrow eyebrow and weak moustache mark
- throat without streaks
- medium bluish-gray back
- underparts distinctly streaked with brown
- black tail banded with three narrow white bands and wider terminal tail band
- leg feathers rusty colored, a male trait in all races

Adult Female and Immature Taiga (columbarius) - Perched

- like male but back brownish, not blue-gray
- underparts sandy with distinct brown streaks that appear thicker than in male
- three or usually four buffy narrow bands on tail with wider terminal white tail band
- leg feathers creamy colored as rest of underparts

Adult Male Taiga - Flight

- heavily streaked underparts
- small dark falcon with pointed wing tips
- white bands on black tail

- dark underwings checkered or spotted with white
- rusty leg feathers

Adult Female and Immature Taiga - Flight

- uniform, dark, tawny spotted underwings
- narrow pale bands on dark tail
- heavily streaked underparts on buffy base color

Note: The immatures of each subspecies, either perched or in flight, are very similar to the female of the each respectable race.

SIMILAR SPECIES

In size, the Merlin closely resembles both the American Kestrel and the European Kestrel (vagrant in North America) but lacks the rusty plumage of either species. The Peregrine Falcon is larger than the Merlin. The Peregrine Falcon also shows a prominent moustache mark on the cheek and, in adults, usually a pale breast contrasting with a barred lower chest and belly. Immature Peregrine Falcons from the Northwest are dark like the Black Merlin and may be distinguished when perched by a heavy mustache (helmet-like) and wing tips that reach the tip of the tail. The Prairie Falcon is superficially similar to the pale Prairie Merlin but is larger, has black "wing pits" and median coverts and a dark mustache. The Sharp-shinned Hawk is similar in size but is an accipiter, flying in a characteristic flap-flap-flap-glide style. It has short, rounded wings red or yellow eyes, and equal width light and dark tail bands.

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VOICE

The Merlin has a limited vocal repertoire. The "ki-ki-ki" or "kek-kek-kek" call is repeated rapidly in a number of territorial or aggressive situations, by either sex, becoming more rapid and intense with increasing agitation. During courtship, both sexes "chutter" when ready to mate. The female gives a "whine" while food-begging from the male. An indefinite series of "tic" or chip calls can be given in courtship or when mates are out of sight of each other. The male's voice is higher than the females in these vocalizations. When cold, nestlings "peep", and when alarmed they "chirp".

FOOD

The Merlin is primarily a hunter of small to medium-sized birds, generally under 1.8 ounces (50 grams). However, it is an opportunistic feeder and will take small numbers of mammals, insects, and reptiles. The principal prey is usually a locally abundant bird such as; Horned Lark, Lark Bunting, or Vesper Sparrow in Montana; Horned Lark, longspurs, and House Sparrow in Saskatchewan; or Savannah Sparrow in northern Manitoba. Other birds taken include grouse, Rock Doves, jays, kinglets, thrushes, American Pipits, vireos, warblers, and various sparrows. Large birds, like doves, are probably taken by inexperienced young Merlins. Mammals taken include bats, squirrels, pocket gophers, mice and voles. Other prey items include lizards, snakes, toads, frogs, dragonflies, and other large insects. Insects are common in the diet of immature Merlins during their first summer and fall.

PELLETS

Pellets are usually cast in the early morning and contain the feather and skeletal remains from the previous day's prey. Like most falcons, Merlins use plucking posts.

NESTING

The Merlin uses both coniferous and deciduous trees as nest sites. It does not build a nest, but usually uses an old crow, jay, or hawk nest. Occasionally it will nest atop a magpie nest. The Merlin rarely uses tree cavities, cliff crevices, or the ground. Ground nesting females usually make a scrape. The same nests are rarely used for two consecutive years although the Merlin can be very faithful to general nesting areas, returning to the same park or woodlot for many years.

Clutch sizes range from two to seven eggs, but averages four to five. Each egg is of a short elliptical, oval, or short oval in shape. The shell is smooth but without gloss. Taiga

Merlin eggs have a whitish ground color with reddish-brown spots and blotches covering the shell and sometimes forming a ring at the larger end. The egg averages 1.6 inches (40.0 millimeters) in length and 1.5 inches (31.7 millimeters) in width. The Prairie Merlin's eggs are similar to those of the Taiga Merlin but averages 1.6 inches (40.9 millimeters) in length and 1.3 inches (31.8 millimeters) in width.

The Black Merlin often has the darkest eggs which may be totally covered with various shades of brown. They average 1.6 inches (40.6 millimeters) in length and 1.2 inches (31.6 millimeters) in width.

Both sexes incubate but the male spends far less at it than the female (seven to 15 percent in one study). The male hunts for both himself and the incubating female. Incubation lasts 28 to 31 days. On average, male and female chicks require 1.4 ounces (40 grams) and 1.8 ounces (52 grams) of food a day, respectively. The male does most of the hunting for the chicks but the female feeds them. Females may begin hunting when the chicks are about three weeks old. About 29 days after hatching, the young fledge. Both adults feed the young near the nest site for one to four weeks. The young become independent at about five weeks.

The Merlin is single-brooded, but replacement of destroyed early clutches has been recorded. The Merlin vigorously defends its nest. At one nest, a female Merlin struck and instantaneously killed a passing American Crow.

CONSERVATION

Insecticide poisoning caused by DDT and its metabolite DDE presumably caused eggshell thinning and some reproductive failures among North American Merlins in the 1960s. Although most Merlin populations are now reproducing well following the DDT ban of the early 1970s, some North American birds are still being affected and chemically poisoned. PCBs, and possibly mercury, remain a concern, particularly in Great Britain, where the Merlin is the most heavily contaminated of British raptors.

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Habitat loss on the Great Plains, due to cutting of vegetation around prairie sloughs and potholes, may be balanced off by the Merlin's recent "invasion" of prairie cities. Merlins can be bred in captivity and it is possible that local populations could be established or built up by the release of Merlins into suitable urban areas. Six released in Regina may have been the basis for the current population of about twenty pairs.

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Merlin - Prairie

Falco columbarius

GENERAL DESCRIPTION

The Merlin is a small falcon of open country or forested edge. Although about the same size as an American Kestrel, the Merlin is a bird-hunter, taking whichever small bird is locally abundant. Depending upon race, the male has pale blue-gray (Prairie race) , medium blue-gray Taiga) or blackish (Black) upperparts. Its underparts are lightly streaked in the Prairie race to very heavily streaked in the Black race. It has a conspicuously banded tail, the main field mark for this species. Seen from below, the dark underwings are heavily spotted with white to tawny, the latter especially evident on females and immatures. The female and immature are similar but with brown replacing the blue-gray or black. The Merlin has a diagnostic direct flight pattern with strong wing beats. It is also very vocal especially around the nest, and very pugnacious, often attacking and harassing other birds, even other birds of prey.

SIZE

The Merlin is the second smallest falcon in North America and one of the smallest hawks on the continent. Females are noticeably larger than males. Lengths average 11 inches (29 centimeters) for females and 10 inches (26 centimeters) for males. Wingspans average 25 inches (64 centimeters) for females and 22 inches (57 centimeters) for males. Weights average 7.4 ounces (210 grams) for females and 5.4 ounces (155 grams) for males.

MORPHS

Although the three subspecies differ in color, and each sex has its own plumage, there are no morphs. Immatures of all races are similar, if not identical, to adult females.

SPECIFIC DESCRIPTION

Adult Male Prairie (richardsonii) - Perched

- like a very pale version of the Taiga
- light blue-gray back
- fine brown streaks on underparts
- moustache absent or faint
- tail bands are pale blue-gray on top of tail, white on underside
- three or four alternating white and gray to dark bands on tail; widest at tip
- leg feathers are a pale rusty-orange

Adult Female Prairie (richardsonii) - Perched

- like Taiga adult female and similar to Prairie adult male; back is a light sandy-brown with grayish hue
- white to creamy leg feathers
- underparts streaked reddish-brown
- brown tail with three or four wide bands; white terminal tip to tail
- pale tail bands are wider than in other Merlin races

Immature Prairie (richardsonii) - Perched

- like Prairie female
- tail like adult female Prairie

Adult Male Prairie - Flight

- orangish leg feathers prominently banded
- narrowly streaked underparts
- overall paleness contrasting with banded tail
- back is light blue-gray
- underwing paler than in other races, uniformly pale

Adult Female and Immature Prairie - Flight

- underwing pale colored
- overall paleness contrasting with banded tail; 3 to 4 very pronounced pale tail bands
- back is sandy-brown

Note: The immatures of each subspecies, either perched or in flight, are very similar to the female of the each respectable race.

SIMILAR SPECIES

In size, the Merlin closely resembles both the American Kestrel and the European Kestrel (vagrant in North America) but lacks the rusty plumage of either species. The Peregrine Falcon is larger than the Merlin. The Peregrine Falcon also shows a prominent moustache mark on the cheek and, in adults, usually a pale breast contrasting with a barred lower chest and belly. Immature Peregrine Falcons from the Northwest are dark like the Black Merlin and may be distinguished when perched by a heavy mustache (helmet-like) and wing tips that reach the tip of the tail. The Prairie Falcon is superficially similar to the pale Prairie Merlin but is larger, has black "wing pits" and median coverts and a dark mustache. The Sharp-shinned Hawk is similar in size but is an accipiter, flying in a characteristic flap-flap-flap-glide style. It has short, rounded wings red or yellow eyes, and equal width light and dark tail bands.

OTHER NAMES

The Merlin was formerly known as the Pigeon Hawk. The Taiga Merlin (*F.c. columbarius*) is also known as the "Eastern Merlin" (formerly Eastern Pigeon Hawk) and "Northern Merlin." The Black Merlin (*F.c. suckleyi*) is also known as "Suckley's Merlin." The Prairie Merlin (*F.c. richardsonii*) is also known as "Richardson's Merlin."

ETYMOLOGY

The scientific name *Falco columbarius* translates into "sickle" (from the Latin *falx*) and "pertaining to a dove or pigeon" (from the Latin *columbarius*). This refers to the Merlin's supposed resemblance to a pigeon in flight.

MYTHOLOGY

The Merlin does not appear in mythology in North America.

RANGE

The Merlin breeds from northwest Alaska, northern Yukon, northwest and central Mackenzie, south Keewatin, northern Manitoba, northern Ontario, northern Quebec, Labrador and Newfoundland, south to southern Alaska, southwest British Columbia, central

Washington, central Oregon, Idaho, Montana, northern Wyoming, eastern North Dakota, western Nebraska, northern Minnesota, southern Ontario, southern Quebec, New Brunswick, and Nova Scotia. It formerly occurred, or rarely occurs, in eastern Montana, western North Dakota, eastern Iowa, northern Wisconsin, northern Ohio, and northern Michigan.

It winters in western North America from south-central Alaska, coastal British Columbia, coastal Washington, Oregon, southern Idaho, southern Wyoming, Colorado southward to Mexico and Central America, and across the southern states from Texas, southern Louisiana, southern Mississippi, southern Alabama, southern Georgia, Florida and along the coastal eastern seaboard north to Connecticut. Birds from eastern Canada winter in the West Indies and the Caribbean.

Since the 1960s the Prairie Merlin has occurred sparsely year --round in the northern Great Plains: southern Alberta, southern Saskatchewan, Montana, eastern Idaho, northern Wyoming, western North Dakota, and western South Dakota. It is also resident on the Pacific coast from southeastern Alaska to central Washington.

Throughout the world the Merlin breeds across the northern hemisphere from northern Canada and east across northern Europe and Asia

There are 10 recognized subspecies of the Merlin, three of which occur in North America. The distribution for this subspecies is as follows

F. c. richardsonii (Prairie Merlin) - breeds from the aspen groves of south prairie Canada to Montana and western South Dakota, occasionally or rarely to western Nebraska and western North Dakota, and may remain resident or migrate south to southern Central America.

MIGRATION

The Merlin arrives at its breeding areas from late February (Saskatchewan) to late March or mid April (Alaska). Spring migration peaks in late April at Cape May, New Jersey. Males precede females to the breeding areas. Postbreeding adults and fledglings leave their breeding areas in early August. Females leave before males. At Cape May, the peak fall movement occurs from September 20 to October 10. A general flyway for Merlins from west-central Canada east of the Rockies has been proposed along the eastern edge of the Rocky Mountains.

BEHAVIOR

Unlike the American Kestrel, the Merlin does not hover. Its flight is direct, the rapid wingbeats shallow and fluttery at times, creating a diagnostic flight pattern often linked with the bird's characteristic "ki-ki-ki-ki-ki" call. It occasionally soars with wings flat and tail fanned. Wing beats during hunting flight are deep and powerful but more rapid than a Peregrine or a Prairie falcon. The average flight speed has been estimated at about 30 miles per hour (48 kilometers per hour). During migration Merlins appear to migrate much of the day, including in pre-dawn darkness and late in the day. It will migrate on days of light rain when other hawks do not. It will also migrate across stretches of open water, including the ocean, flying low over the waves. Young Merlins are often fairly tame during the first month or two of life, sometimes flying close to people.

The Merlin hunts mostly in early morning and late afternoon. Most prey is captured in mid-air after the Merlin has spied it from a prominent perch overlooking an expanse. It will also coarse over the landscape using hills, dikes, and trees for concealment. Dives or "stoops" from a height are uncommon. The Merlin will engage in a series of short stoops

after escaping prey. It will also engage in aerial chases when its prey attempts to out-fly it. The famous "ringing flight" occurs when the prey (classically a European Skylark in Europe) seeks to escape by rising higher and higher in circles with the Merlin close behind. Co-operative hunting between two Merlins has been seen. The species is an opportunistic feeder taking flying insects on the wing, hunting bats at the cave mouth and using other birds (such as a Northern Harrier), people, hunting dogs, or vehicles as "beaters", flushing prey for the falcon to pursue. At a plucking post the Merlin stands on its prey, kills it by biting the neck, and typically discards the head, feathers, legs and wings. After feeding it wipes its beak and cleans its feet with its beak and may rotate in place, kneading its feet. Like the American Kestrel, the Merlin will cache prey for later consumption.

Home range sizes vary in nesting season from 8.9 square miles (23 square kilometers) in Montana to 3.1 square miles (8 square kilometers) in Saskatchewan. Resident and immigrant males in Saskatoon differ in breeding season home range size - 2.3 square miles (6 square kilometers) for residents and 12.7 square miles (33 square kilometers) for immigrants. Home range sizes are much smaller where prey is abundant. Males appear to have a stronger fidelity to the same territory year after year than females. Fidelity to the territory is a well known and long-lived phenomenon in Europe. Differences in site fidelity may be a function of the availability of nest sites. The Merlin is fairly social for a falcon. Pairs wintering together have been reported, as have migrations in loose groups and occasional communal roosts..

In early fall, young Merlins may occasionally hunt and migrate with young Sharp-shinned Hawks without much animosity, which is odd since Merlins are well known harassers of other migrating hawks. In migration, Peregrine Falcons sometimes rob Merlins. Once a Merlin struck and killed a Red-tailed Hawk. In defense of a nest, a Merlin has killed a crow, and in Alaska the species has chased Golden Eagles, Common Ravens, Gyrfalcons, Black-billed Magpies, and Willow Ptarmigan from its territory. In Europe, Fieldfares (large thrushes) often nest within the same grove with a pair of nesting Merlins.

Courtship behavior is complex. The male engages in "power flying" with deep wingbeats, showing alternate views of his ventral and dorsal surfaces while giving tics. Power flying is often done at territorial boundaries by neighbouring males. The male may also "power dive", like the above display, but terminating in a u-shaped climb. This display is advertisement and territorial defense. Sometimes both sexes dive together. Both male and female show the "rocking glide", a less intense version of power flying with no flapping. Males use it to attract females. Females use it as a threat against other females. Males also "flutter fly" near their perched mates, typically around the nest site. "Ki-ki-ki-" vocalizations are given which the female may answer. Both sexes "high soar" near the nest, a territorial display. The male may "slow land" with stiff legs and a bowed head as a terminal component of other displays. It may also be given before or after copulation. The "ki-ki-ki" vocalization may accompany it. A female may "food beg" with whining. Males may transfer food to females in the air, to a perch, or from perch to perch, giving "tics" or "ki-ki-ki" calls. At the nest, both sexes may give "tic" calls and the male may settle with arched back, drooped and trembling wings and a fanned tail. Before mating the male may bow, fan its tail and stare at the female while chattering. The female solicits copulation by bowing and fanning her tail.

The Merlin seldom lives longer than eight years. First year birds may have a mortality rate as high as 60 to 70 percent. The maximum mortality rate for breeding birds in Saskatoon was 29 percent. In one study, collisions with vehicles and windows (43 percent), shooting (7 percent), poisoning (2 percent), predation by cats (2 percent) and weather (1 percent) were the known agents of mortality.

ADAPTATIONS

Merlins breeding along the extreme northern edge of their range in Canada may nest on

the ground in areas where trees are scarce. Further investigations are needed of this possible adaptation, but ground nesting does occur in some European parts of this species' range.

Merlins have adapted well to the human settlement of the Northern Great Plains. During the last twenty years small but growing breeding and wintering populations have become established in prairie cities like Saskatoon (an increase from one pair in 1971 to 27 pairs in 1987) where the Merlins take mainly House Sparrows. They breed in old crow nests in large shade and coniferous trees. Similar urban populations exist in Regina, Moose Jaw, Calgary and Edmonton and may be spreading across Canada. Urban birds tend to accept the near presence of human beings more calmly than birds in the country. Urban birds roost in tall conifers with large, thick crowns. Such trees have only recently reached such a size in the northern Great Plains. This may explain why Merlins now winter in the area.

HABITAT

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Merlin - Black

Falco columbarius

GENERAL DESCRIPTION

The Merlin is a small falcon of open country or forested edge. Although about the same size as an American Kestrel, the Merlin is a bird-hunter, taking whichever small bird is locally abundant. Depending upon race, the male has pale blue-gray (Prairie race) , medium blue-gray Taiga) or blackish (Black) upperparts. Its underparts are lightly streaked in the Prairie race to very heavily streaked in the Black race. It has a conspicuously banded tail, the main field mark for this species. Seen from below, the dark underwings are heavily spotted with white to tawny, the latter especially evident on females and immatures. The female and immature are similar but with brown replacing the blue-gray or black. The Merlin has a diagnostic direct flight pattern with strong wing beats. It is also very vocal especially around the nest, and very pugnacious, often attacking and harassing other birds, even other birds of prey.

SIZE

The Merlin is the second smallest falcon in North America and one of the smallest hawks on the continent. Females are noticeably larger than males. Lengths average 11 inches (29 centimeters) for females and 10 inches (26 centimeters) for males. Wingspans average 25 inches (64 centimeters) for females and 22 inches (57 centimeters) for males. Weights average 7.4 ounces (210 grams) for females and 5.4 ounces (155 grams) for males.

MORPHS

Although the three subspecies differ in color, and each sex has its own plumage, there are no morphs. Immatures of all races are similar, if not identical, to adult females.

SPECIFIC DESCRIPTION

Adult Male Black (suckleyi) - Perched

- a small, blackish falcon
- top of head unstreaked; no light eyebrow line; dark cheeks
- uniform dark brown back showing a blue-gray cast only in good light
- very heavily streaked underparts
- dark, unbanded or faintly banded tail with narrow whitish tip
- dark rusty leg feathers

Adult Female and Immature Black (suckleyi) - Perched

- like the male but does not have grayish cast or hue to a very dark brown back
- creamy colored leg feathers

Adult Male Black - Flight

- underwings uniformly dark
- overall dark appearance
- light tail bands rarely conspicuous
- rusty leg feathers

Adult Female and Immature Black - Flight

- similar to adult male but lacks rusty leg feathers
- very uniform dark undersides
- little or no tail banding
- underwing very dark, little spotting

Note: The immatures of each subspecies, either perched or in flight, are very similar to the female of the each respectable race.

SIMILAR SPECIES

In size, the Merlin closely resembles both the American Kestrel and the European Kestrel (vagrant in North America) but lacks the rusty plumage of either species. The Peregrine Falcon is larger than the Merlin. The Peregrine Falcon also shows a prominent moustache mark on the cheek and, in adults, usually a pale breast contrasting with a barred lower chest and belly. Immature Peregrine Falcons from the Northwest are dark like the Black Merlin and may be distinguished when perched by a heavy mustache (helmet-like) and wing tips that reach the tip of the tail. The Prairie Falcon is superficially similar to the pale Prairie Merlin but is larger, has black "wing pits" and median coverts and a dark mustache. The Sharp-shinned Hawk is similar in size but is an accipiter, flying in a characteristic flap-flap-flap-glide style. It has short, rounded wings red or yellow eyes, and equal width light and dark tail bands.

OTHER NAMES

The Merlin was formerly known as the Pigeon Hawk. The Taiga Merlin (F.c. columbarius) is also known as the "Eastern Merlin" (formerly Eastern Pigeon Hawk) and "Northern Merlin." The Black Merlin (F.c. suckleyi) is also known as "Suckley's Merlin." The Prairie Merlin (F.c. richardsonii) is also known as "Richardson's Merlin."

ETYMOLOGY

The scientific name *Falco columbarius* translates into "sickle" (from the Latin *falx*) and "pertaining to a dove or pigeon" (from the Latin *columbarius*). This refers to the Merlin's supposed resemblance to a pigeon in flight.

MYTHOLOGY

The Merlin does not appear in mythology in North America.

RANGE

The Merlin breeds from northwest Alaska, northern Yukon, northwest and central Mackenzie, south Keewatin, northern Manitoba, northern Ontario, northern Quebec, Labrador and Newfoundland, south to southern Alaska, southwest British Columbia, central Washington, central Oregon, Idaho, Montana, northern Wyoming, eastern North Dakota, western Nebraska, northern Minnesota, southern Ontario, southern Quebec, New Brunswick, and Nova Scotia. It formerly occurred, or rarely occurs, in eastern Montana, western North Dakota, eastern Iowa, northern Wisconsin, northern Ohio, and northern Michigan.

It winters in western North America from south-central Alaska, coastal British Columbia, coastal Washington, Oregon, southern Idaho, southern Wyoming, Colorado southward to Mexico and Central America, and across the southern states from Texas, southern Louisiana, southern Mississippi, southern Alabama, southern Georgia, Florida and along the coastal eastern seaboard north to Connecticut. Birds from eastern Canada winter in the West Indies

and the Caribbean.

Since the 1960s the Prairie Merlin has occurred sparsely year --round in the northern Great Plains: southern Alberta, southern Saskatchewan, Montana, eastern Idaho, northern Wyoming, western North Dakota, and western South Dakota. It is also resident on the Pacific coast from southeastern Alaska to central Washington.

Throughout the world the Merlin breeds across the northern hemisphere from northern Canada and east across northern Europe and Asia

There are 10 recognized subspecies of the Merlin, three of which occur in North America. These are:

F. c. Suckleyi (Black Merlin) - breeds along the Pacific coast from Sitka, Alaska south to northwestern Oregon. It occasionally winters south to California and New Mexico.

MIGRATION

The Merlin arrives at its breeding areas from late February (Saskatchewan) to late March or mid April (Alaska). Spring migration peaks in late April at Cape May, New Jersey. Males precede females to the breeding areas. Postbreeding adults and fledglings leave their breeding areas in early August. Females leave before males. At Cape May, the peak fall movement occurs from September 20 to October 10. A general flyway for Merlins from west-central Canada east of the Rockies has been proposed along the eastern edge of the Rocky Mountains.

BEHAVIOR

Unlike the American Kestrel, the Merlin does not hover. Its flight is direct, the rapid wingbeats shallow and fluttery at times, creating a diagnostic flight pattern often linked with the bird's characteristic "ki-ki-ki-ki" call. It occasionally soars with wings flat and tail fanned. Wing beats during hunting flight are deep and powerful but more rapid than a Peregrine or a Prairie falcon. The average flight speed has been estimated at about 30 miles per hour (48 kilometers per hour). During migration Merlins appear to migrate much of the day, including in pre-dawn darkness and late in the day. It will migrate on days of light rain when other hawks do not. It will also migrate across stretches of open water, including the ocean, flying low over the waves. Young Merlins are often fairly tame during the first month or two of life, sometimes flying close to people.

The Merlin hunts mostly in early morning and late afternoon. Most prey is captured in mid-air after the Merlin has spied it from a prominent perch overlooking an expanse. It will also coarse over the landscape using hills, dikes, and trees for concealment. Dives or "stoops" from a height are uncommon. The Merlin will engage in a series of short stoops after escaping prey. It will also engage in aerial chases when its prey attempts to out-fly it. The famous "ringing flight" occurs when the prey (classically a European Skylark in Europe) seeks to escape by rising higher and higher in circles with the Merlin close behind. Co-operative hunting between two Merlins has been seen. The species is an opportunistic feeder taking flying insects on the wing, hunting bats at the cave mouth and using other birds (such as a Northern Harrier), people, hunting dogs, or vehicles as "beaters", flushing prey for the falcon to pursue. At a plucking post the Merlin stands on its prey, kills it by biting the neck, and typically discards the head, feathers, legs and wings. After feeding it wipes its beak and cleans its feet with its beak and may rotate in place, kneading its feet. Like the American Kestrel, the Merlin will cache prey for later consumption.

Home range sizes vary in nesting season from 8.9 square miles (23 square kilometers) in

Montana to 3.1 square miles (8 square kilometers) in Saskatchewan. Resident and immigrant males in Saskatoon differ in breeding season home range size - 2.3 square miles (6 square kilometers) for residents and 12.7 square miles (33 square kilometers) for immigrants. Home range sizes are much smaller where prey is abundant. Males appear to have a stronger fidelity to the same territory year after year than females. Fidelity to the territory is a well known and long-lived phenomenon in Europe. Differences in site fidelity may be a function of the availability of nest sites. The Merlin is fairly social for a falcon. Pairs wintering together have been reported, as have migrations in loose groups and occasional communal roosts..

In early fall, young Merlins may occasionally hunt and migrate with young Sharp-shinned Hawks without much animosity, which is odd since Merlins are well known harassers of other migrating hawks. In migration, Peregrine Falcons sometimes rob Merlins. Once a Merlin struck and killed a Red-tailed Hawk. In defense of a nest, a Merlin has killed a crow, and in Alaska the species has chased Golden Eagles, Common Ravens, Gyrfalcons, Black-billed Magpies, and Willow Ptarmigan from its territory. In Europe, Fieldfares (large thrushes) often nest within the same grove with a pair of nesting Merlins.

Courtship behavior is complex. The male engages in "power flying" with deep wingbeats, showing alternate views of his ventral and dorsal surfaces while giving tics. Power flying is often done at territorial boundaries by neighbouring males. The male may also "power dive", like the above display, but terminating in a u-shaped climb. This display is advertisement and territorial defense. Sometimes both sexes dive together. Both male and female show the "rocking glide", a less intense version of power flying with no flapping. Males use it to attract females. Females use it as a threat against other females. Males also "flutter fly" near their perched mates, typically around the nest site. "Ki-ki-ki-" vocalizations are given which the female may answer. Both sexes "high soar" near the nest, a territorial display. The male may "slow land" with stiff legs and a bowed head as a terminal component of other displays. It may also be given before or after copulation. The "ki-ki-ki" vocalization may accompany it. A female may "food beg" with whining. Males may transfer food to females in the air, to a perch, or from perch to perch, giving "tics" or "ki-ki-ki" calls. At the nest, both sexes may give "tic" calls and the male may settle with arched back, drooped and trembling wings and a fanned tail. Before mating the male may bow, fan its tail and stare at the female while chattering. The female solicits copulation by bowing and fanning her tail.

The Merlin seldom lives longer than eight years. First year birds may have a mortality rate as high as 60 to 70 percent. The maximum mortality rate for breeding birds in Saskatoon was 29 percent. In one study, collisions with vehicles and windows (43 percent), shooting (7 percent), poisoning (2 percent), predation by cats (2 percent) and weather (1 percent) were the known agents of mortality.

ADAPTATIONS

Merlins breeding along the extreme northern edge of their range in Canada may nest on the ground in areas where trees are scarce. Further investigations are needed of this possible adaptation, but ground nesting does occur in some European parts of this species' range.

Merlins have adapted well to the human settlement of the Northern Great Plains. During the last twenty years small but growing breeding and wintering populations have become established in prairie cities like Saskatoon (an increase from one pair in 1971 to 27 pairs in 1987) where the Merlins take mainly House Sparrows. They breed in old crow nests in large shade and coniferous trees. Similar urban populations exist in Regina, Moose Jaw, Calgary and Edmonton and may be spreading across Canada. Urban birds tend to accept the near presence of human beings more calmly than birds in the country. Urban birds roost in tall conifers with large, thick crowns. Such trees have only recently reached such a size in the

northern Great Plains. This may explain why Merlins now winter in the area.

HABITAT

The Merlin inhabits both open country, including grasslands and prairies, where it nests in aspen, cottonwood, and shelterbelt groves, and coniferous forests of northern Canada where it is found near open areas like forest edges, fragmented woods, bogs, and lakes where it often nests near water. Merlins along the northwestern coast also inhabit coniferous forests, frequenting edges such as beaches, estuaries, and rivers. Increasingly, Merlins occur in urban forested parks and cemeteries in prairie Canada and the interior of British Columbia and Ontario where House Sparrows, and other birds provide plentiful prey. In migration, and winter, the Merlin is found in open woodlands, moorlands, marshes, deserts, and along seacoasts.

VOICE

The Merlin has a limited vocal repertoire. The "ki-ki-ki" or "kek-kek-kek" call is repeated rapidly in a number of territorial or aggressive situations, by either sex, becoming more rapid and intense with increasing agitation. During courtship, both sexes "chutter" when ready to mate. The female gives a "whine" while food-begging from the male. An indefinite series of "tic" or chip calls can be given in courtship or when mates are out of sight of each other. The male's voice is higher than the females in these vocalizations. When cold, nestlings "peep", and when alarmed they "chirp".

FOOD

The Merlin is primarily a hunter of small to medium-sized birds, generally under 1.8 ounces (50 grams). However, it is an opportunistic feeder and will take small numbers of mammals, insects, and reptiles. The principal prey is usually a locally abundant bird such as; Horned Lark, Lark Bunting, or Vesper Sparrow in Montana; Horned Lark, longspurs, and House Sparrow in Saskatchewan; or Savannah Sparrow in northern Manitoba. Other birds taken include grouse, Rock Doves, jays, kinglets, thrushes, American Pipits, vireos, warblers, and various sparrows. Large birds, like doves, are probably taken by inexperienced young Merlins. Mammals taken include bats, squirrels, pocket gophers, mice and voles. Other prey items include lizards, snakes, toads, frogs, dragonflies, and other large insects. Insects are common in the diet of immature Merlins during their first summer and fall.

PELLETS

Pellets are usually cast in the early morning and contain the feather and skeletal remains from the previous day's prey. Like most falcons, Merlins use plucking posts.

NESTING

The Merlin uses both coniferous and deciduous trees as nest sites. It does not build a nest, but usually uses an old crow, jay, or hawk nest. Occasionally it will nest atop a magpie nest. The Merlin rarely uses tree cavities, cliff crevices, or the ground. Ground nesting females usually make a scrape. The same nests are rarely used for two consecutive years although the Merlin can be very faithful to general nesting areas, returning to the same park or woodlot for many years.

Clutch sizes range from two to seven eggs, but averages four to five. Each egg is of a short elliptical, oval, or short oval in shape. The shell is smooth but without gloss. Taiga Merlin eggs have a whitish ground color with reddish-brown spots and blotches covering the shell and sometimes forming a ring at the larger end. The egg averages 1.6 inches (40.0

millimeters) in length and 1.5 inches (31.7 millimeters) in width. The Prairie Merlin's eggs are similar to those of the Taiga Merlin but averages 1.6 inches (40.9 millimeters) in length and 1.3 inches (31.8 millimeters) in width.

The Black Merlin often has the darkest eggs which may be totally covered with various shades of brown. They average 1.6 inches (40.6 millimeters) in length and 1.2 inches (31.6 millimeters) in width.

Both sexes incubate but the male spends far less at it than the female (seven to 15 percent in one study). The male hunts for both himself and the incubating female. Incubation lasts 28 to 31 days. On average, male and female chicks require 1.4 ounces (40 grams) and 1.8 ounces (52 grams) of food a day, respectively. The male does most of the hunting for the chicks but the female feeds them. Females may begin hunting when the chicks are about three weeks old. About 29 days after hatching, the young fledge. Both adults feed the young near the nest site for one to four weeks. The young become independent at about five weeks.

The Merlin is single-brooded, but replacement of destroyed early clutches has been recorded. The Merlin vigorously defends its nest. At one nest, a female Merlin struck and instantaneously killed a passing American Crow.

CONSERVATION

Insecticide poisoning caused by DDT and its metabolite DDE presumably caused eggshell thinning and some reproductive failures among North American Merlins in the 1960s. Although most Merlin populations are now reproducing well following the DDT ban of the early 1970s, some North American birds are still being affected and chemically poisoned. PCBs, and possibly mercury, remain a concern, particularly in Great Britain, where the Merlin is the most heavily contaminated of British raptors.

Shooting caused 7 percent mortality of Merlins in Saskatoon, Saskatchewan. The Merlin also occasionally dies from collisions with vehicular traffic.

Habitat loss on the Great Plains, due to cutting of vegetation around prairie sloughs and potholes, may be balanced off by the Merlin's recent "invasion" of prairie cities. Merlins can be bred in captivity and it is possible that local populations could be established or built up by the release of Merlins into suitable urban areas. Six released in Regina may have been the basis for the current population of about twenty pairs.

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Aplomado Falcon

Falco femoralis

GENERAL DESCRIPTION

The Aplomado Falcon is a colorful, long-tailed, and long yellow-legged falcon which inhabits open grassland areas. It is a predator of small to medium-sized birds and, during large infestations, feeds on insects. The pair bond appears to be strong in this species, with observations of co-operative hunting both in and outside of the breeding season. It is about the size of a Cooper's Hawk and a little smaller than the Prairie Falcon. When perched, its yellow legs and long tail are distinctive. At one time the Aplomado Falcon regularly nested in southeastern Arizona, southern New Mexico, and southern Texas, but the last confirmed nest attempt in North America occurred in 1952. Factors which led to the decline of this population are not well understood, but encroachment of mesquite forest into historical nesting areas, major scientific collecting of adults and eggs in the 1920s, and changing agricultural practices are probably the main reasons.

Today, there is a continual effort by government biologists and interested conservation groups to re-introduce the Aplomado Falcon into areas of south Texea through captive and release, and hacking programs.

SIZE

The Aplomado Falcon exhibits reversed size dimorphism. That is females are larger than males. This trend is commonly found in the genus Falco. Average body length of the male is 15 inches (37 centimeters) while the female averages 17 inches (43 centimeters). Average wingspan of the male is 32 inches (81 centimeters) and the female is 38 inches (97 centimeters). Average weight of the male is 9.3 ounces (265 grams) and the female is 13.8 ounces (391 grams).

MORPHS

Two morphs occur within this species, namely the white-breasted color morph and the cinnamon color phase. These morphs represent extremes on a continuum and there is great individual variation as to the amount of white or cinnamon on the forehead and underparts. The immature shows more streaking on the breast and is more tawny overall.

SPECIFIC DESCRIPTION

Adult - Perched

- back appears dark brown to black or lead gray, depending on light
- breast is white which is unmarked in males and with slight dark streaking in females
- tarsi are strikingly yellow with black talons
- black cap, black eyeline, and black mustache contrast with white eyebrow and white cheek patch
- long barred tail
- dark cummerbund
- belly and flanks cinnamon

Immature - Perched

- similar to adult but has browner back and vertical streaking on the breast. Streaking is

heaviest in females.

- contrasting cinnamon with brown facial patterns.

Adult - Flight

- has typical falcon silhouette of long, narrow curved wings and long tail.
- underwing is quite uniform and dark
- similar to Prairie Falcon but lacks dark patches on wing and dark cummerbund is prominent.
- wings when seen from above are generally dark with a white trailing edge
- tail is strongly barred black and white
- active, rapid, direct flight

Immature - Flight

- streaked breast; heaviest in female
- long tail strongly barred
- long narrow wings with white tipped secondaries.
- prominent white band on trailing edge of secondaries.

SIMILAR SPECIES

The Aplomado Falcon can be confused with other members of its genus such as the American Kestrel, Merlin, Prairie Falcon, and Peregrine Falcon. A careful examination of the striking characters of the Aplomado Falcon, such as the white eyebrow, black eyeline, dark cummerbund, and long tail should provide positive identification. The flight pattern is relatively shallow suggesting a kestrel, yet the Aplomado Falcon is larger. Sometimes the Mississippi Kite is often confused with a juvenile Aplomado Falcon.

OTHER NAMES

None is known.

ETYMOLOGY

The name does not translate easily from the Latin. The genus *Falco* means "sickle" and species *femorialis* translates into "referring to the thighs." Hence, we have the "Sickle hawk with notable thighs!" In Spanish, "aplomado" means "leadened-gray", a reference to the falcon's back.

MYTHOLOGY

None is known.

RANGE

The Aplomado Falcon formerly bred in southeastern Arizona, New Mexico, and southern Texas. Today, it has virtually disappeared from North America and is only rarely seen, mainly in southern and western Texas and southeastern Arizona. It last bred on the continent in 1952 in New Mexico.

BEHAVIOR

Although few studies have been done on the behavior of the Aplomado Falcon, some extremely interesting observations have been noted. The Aplomado Falcon typically occurs

in pairs throughout the calendar year, and is often seen hunting in tandem when birds are their quarry. The male initiates the exploratory foraging trip and attempts to locate and flush prey through low level flights and uttering "chip" calls. The female will then join the male and together they will work on exposing the prey, usually through a series of alternating stoops and dives. This species is a tremendously fast flyer and is able to chase down in level flight prey species such as doves and Killdeers. When the Aplomado Falcon is hunting birds in tandem, it has a success rate of 44 percent; when hunting solo, success drops to 19 percent. Unlike other bird-eating raptors which have large breeding home ranges, the Aplomado Falcon forages primarily within 500 yards (500 meters) of its nest tree.

The Aplomado Falcon also forages on insects. This tends to be a solitary hunt and the strategy employs a slow gliding flight interspersed with hovering. During high infestations of insects, many are killed and eaten in a single flight.

The Aplomado Falcon makes use of cache sites and these areas are defended aggressively, even when no prey is contained in the cache. Cache sites are varied ranging from ground sites, grass clumps, to crooks and crevices in trees.

The Aplomado Falcon is not migratory, but may withdraw locally from its breeding areas. The falcon's breeding home range is estimated at about 180 acres (80 hectares) which is small for a bird-eating falcon of this size.

Complete documentation of the courtship of the Aplomado Falcon is lacking. It is not known unequivocally whether birds found together outside of the breeding season are mated, or if it is a relationship established strictly for hunting purposes. Apparently males will courtship feed females and when nestlings are present both adults feed the young. The larger female stays within close proximity to the nest site throughout the breeding season and she will defend the area against intruders.

ADAPTATIONS

The bill of the Aplomado Falcon, like other falcons is toothed and notched. This helps to break the cervical vertebrae of their prey. The tooth may also be of benefit in catching insects since insect-eating kites have similar notches. The flight pattern, coupled with the high wing loading, requires a rapid turn over of the wings permitting very fast flight. The nose in falcons is equipped with bony tubercles, which are believed to function as air baffles in high speed flight. The Aplomado Falcon has relatively long legs for falcons which permit them to chase after prey in thick cover.

HABITAT

The Aplomado Falcon once inhabited the open grasslands of the southern United States which had patches of yucca and mesquite trees scattered throughout. It has also been recorded in oak and pine savannas, coastal deserts, and even marshes. Its decline has been associated with an increase in tall and heavy grasses which have afforded prey species considerable cover.

In Mexico, the Aplomado Falcon inhabits a variety of habitats including savanna and logged areas. In one study nest sites were compared with other vacant sites and it was discovered that nesting areas with sparsely distributed large trees were preferred.

VOICE

Verbal communication appears important in tandem foraging situations, where male and female call back to each other in single "chip" notes. Interactions with other members of

the species, or with predators, provoke a rapid "kek-kek-kek-kek" call which varies in length.

FOODS

The Aplomado Falcon forages mainly on birds and at times may feed on insects. Over 50 bird species have been documented in the diet of this falcon with a range in size from the hummingbird to the Chacalacha. The majority of the prey are in the size range of the robin. In one detailed study, it was demonstrated that birds made up 97 percent of the diet with the main prey items being White-winged Doves, Great-tailed Grackles, Groove-billed Anis, and Yellow-billed Cuckoos.

Common insects in the diet include moths and beetles. Other incidental prey items include bats, mice, rodents, lizards, and fish.

PELLETS

No documentation.

NESTING

Falcons do not build their own nests, rather they usurp deserted nests built by other raptors and corvids. The Aplomado Falcon uses abandoned nests of ravens, caracaras, or kites usually located in a low tree or yucca plant. Clutch size ranges from two to four eggs and is usually three eggs. The incubation period is about 32 days and the age of first flight occurs between 28 and 35 days.

CONSERVATION

The decline of the Aplomado Falcon preceded the high level use of DDT and Dieldrin and it is believed to have been the result of conversion of habitat into farmlands, and encroachment of woody vegetation into the desert grasslands, and uncontrolled egg-collecting in the early years. None-the-less, there is still significant amounts of suitable habitat, such as savannah grasslands with yucca, mesquite, and cacti so its absence is a bit of a mystery. Recent efforts to reintroduce Aplomado Falcons into Arizona and Texas have begun, and the bird is being sighted in parts of its traditional range.

In coastal Mexico, eggs of the Aplomado Falcon are carrying alarmingly high concentrations of pesticides.

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Peregrine Falcon

Falco peregrinus

GENERAL DESCRIPTION

The Peregrine Falcon is a cosmopolitan species and one of only four living species that has achieved a worldwide distribution without the help of humans. In North America, the population is comprised of three races, all fairly similar in appearance, but with clinal variations that result in differences in plumage and size between the races that are often distinguishable in the field. Other individuals are not safely assignable to races from field observations.

The race *Falco peregrinus anatum* is commonly referred to as the "Continental" Peregrine Falcon, *Falco peregrinus pealei* as "Peale's" Peregrine Falcon, and *Falco peregrinus tundrius* as "Tundra" Peregrine Falcon.

The Peregrine Falcon is a medium to large falcon that is generally darkly hooded in appearance with a dark back and upper tail and light, heavily barred and spotted underparts. The side of the face has a prominent dark mustache patch set beside a variably white cheek. Juveniles are generally dark brown, heavily streaked birds with some variations between races. More than any other falcon, this is a bird of many habitats including coastal marine environments, temperate forests, arctic tundra, arid deserts and open country of all descriptions with suitable tall cliffs for nesting.

SIZE

Of all of the North American falcons, only the Gyrfalcon exceeds this medium-sized raptor in size. It is about the same size as the Prairie Falcon or a large American Crow. The males and females are similar in size with females averaging perhaps 15 percent larger. Females vary from 18 to 21 inches (46 to 53 centimeters) in length with wingspans from 38 to 44 inches (97 to 112 centimeters). Weights vary from 1.5 to 2.7 pounds (680 to 1,225 grams). Males vary in length from 15 to 18 inches (38 to 46 centimeters) with wingspans from 34 to 39 inches (86 to 99 centimeters). Male weights range from 1.1 to 1.8 pounds (499 to 816 grams).

MORPHS AND MOLTS

There are no distinctive colour morphs of the Peregrine Falcon but each race differs somewhat from the other. Further, individuals of the same race can show some variation within a range. If the *F. p. anatum* race were taken as the standard, *F. p. pealei* tends to be larger and darker overall whereas *F. p. tundrius* is similar in size but generally lighter. Variations within races can make field separation uncertain. The timing of the molt varies with the breeding cycle and happens earlier at southern latitudes. The female begins molting during egg laying but the males not for sometime afterwards. Completion of the molt takes from 4.5 to six months such that the final changes may be completed on the wintering grounds. By day 40, nestlings have attained the full juvenal plumage. The molt towards the first basic plumage is quite variable but generally starts during the summer of the second calendar year and lasts late into that year or January of the third year. Once the basic plumage has been attained, this is the first definitive (adult) plumage.

SPECIFIC DESCRIPTION

Adult Continental (*anatum*) - Perched

Note: male and female plumages are very similar. Differences are subtle, and where applicable, are listed below.

HEAD

- upper portions and part of sides blackish and sometimes with narrow whitish band across the forehead
- sides of face blackish below the eye (malar patch)
- the chin and throat are white
- the beak is bluish-gray with a dark tip and yellowish base
- the cere and eyering are yellow
- the eye is very dark
- in females the soft part coloring may be more muted and the whitish-buff of the nape may be more visible

BODY

- the upper breast is plain white
- the lower breast and belly varies from a tawny buff to grayish with black streaks in the center and transverse bars, chevrons and spots lower down. The barring is heaviest on the flanks and thighs.
- the back is variably dark bluish-gray or slatey with slightly paler rump
- in females the underparts may be more buffy and more heavily marked black and the sides, flanks and thighs may be more grayish with wider barring

WINGS

- the upper surface is the same as the back with some darker barring evident on the greater coverts
- the primaries are black towards the tips which reach the tip of the tail

TAIL

- the upper side is light bluish gray or may be darker and is tipped whitish and has up to 12 black cross bars
- the under surface is paler with less evident patterning
- the undertail coverts are pale with black spots or barring

LEGS

- the legs and feet are yellowish with black talons

Immature Continental (anatum) - Perched

HEAD

- the crown and nape are variably dark brownish chestnut
- variations of buffy-rufous streaking, buffy forehead, pale eyestreak.
- a dark brown cheek patch is evident
- the beak is bluish-gray with a dark tip as in the adults
- the cere and eye ring, or orbital skin, may be bluish, greenish or muted yellow
- the eye is very dark brown

BODY

- the background color of the underparts is a rufous-buff with heavy dark brown streaks broadening to chevrons on the flanks and undertail coverts
- immatures are streaked as opposed to barred as in adults
- the upperparts are variably darkish brown with the buffy margin of the feathers limited

WINGS

- the upper parts are similar to the back and the primaries are also dark brown as opposed to black in the adults
- the tips do not quite reach the tip of the tail

TAIL

- the upper surface is the same as the back or darker with discontinuous pale tawny barring
- the underside is paler and the undertail coverts are rufous-buff with heavy dark streaking

LEGS

- the legs and feet are variably bluish to yellowish with black talons

Adult Continental (anatum) - Flight

- a medium to large falcon with uniform spotted and barred light grayish underwing with no evidence of two tonal variation as in Gyrfalcon or Prairie Falcon
- the underparts appear heavily barred except for the white upper breast and throat
- the back appears dark
- the body is heavy and broad with long wings that appear relatively narrow compared to other large falcons

Immature Continental (anatum) - Flight

- overall, a dark brown falcon with lighter, streaked underparts
- the tail is slightly longer than that of adults
- underwing is uniform dark coloration

SIMILAR SPECIES

The Peregrine Falcon is closest in size and weight to the Prairie Falcon but has a darker back and more prominent mustache mark with overall markings being more contrasty and less brownish. Large female Peregrine Falcons overlap small male Gyrfalcons in size but the latter species although highly variable, tends to be more evenly colored and lacking the boldness in the mustache mark. Juveniles are more similar and Peregrine Falcons and Gyrfalcons are easily confused at greater distances. Both gray-morph and dark-morph Gyrfalcons have two-toned underwings whereas the underwing of the Peregrine Falcon is uniform.

Soaring Peregrine Falcons have similarities to soaring Broad-winged Hawks and not infrequently, Northern Harriers and Mississippi Kites are mistaken for Peregrines.

OTHER NAMES

The Peregrine Falcon is commonly known as the "Duck Hawk" but also as "Peale's Peregrine" (pealei race), "Tundra Peregrine" (tundrius race), "Big-footed Falcon", "Bullet Hawk", "Pinnacle Hawk", and "Sea Hawk."

ETYMOLOGY

The genus Falco is of Latin origins and means "sickle." This may be in reference to the shape of the beak or more likely the talons of all falcons. The species name peregrinus is Latin for "wandering" or "foreign." The components of the word are per for through and ager meaning field or land. Thus, we can infer "across country" from the complete word or the

falcon that wanders from place to place across the land.

MYTHOLOGY

None is known for North America.

RANGE

Collectively, the range of the three North American subspecies once occupied most of the continent with absences throughout much of the Canadian prairies, northern Ontario, Quebec and the southeastern United States. Today, the distribution of naturally breeding Peregrine Falcons that have not been reintroduced is restricted to the western cordillera north to Alaska including the coast, the Canadian Territories, and the tundra regions. Wintering birds can be found throughout North America but resident populations are restricted largely to the northwestern coastline.

Worldwide, there are from 19 to 22 races recognized but only 3 occur in North America. The distribution for this species is as follows.

Continental Peregrine Falcon (*Falco peregrinus anatum*)

This race formerly bred south of the tundra across the Northwest Territories, the Yukon, and inland Alaska south throughout the western cordillera to southern Arizona, New Mexico, and western Texas. It also occurred along the Pacific coast to southern Baja and northern interior Mexico. Through the central United States, the range included South Dakota, Nebraska, and Kansas eastward throughout all of the eastern states and south to the northern portions of Mississippi, Alabama and Georgia. The range extended northward into eastern Canada except Newfoundland. Large areas of northern Quebec, Ontario and most of Manitoba and Saskatchewan were devoid of this race. Despite gaps in the range, Florida and Newfoundland are the only political units that were not within the historical breeding range of Continental (*anatum*) Peregrine Falcons.

Throughout the 1950s and 1960s, the *anatum* race suffered major population declines such that by 1970, no known populations existed in eastern North America south of the boreal forest. The Canadian population was essentially eliminated south of 60 degrees latitude and east of the Rocky Mountains. In 1975, the population in the continental United States west of the Mississippi River had dropped to 62 known pairs although in 1980 a total of 145 pairs was recorded. This change was likely due to improved survey methods and the population still extended south in the cordillera to Arizona and New Mexico but in fewer locations than historically. Releases of captive bred birds continue to change the distribution of known nesting locations within the historical range but numbers have not reached original levels and the extent of the breeding range today is less than it was, particularly in the eastern portion of the continent.

The winter range for the *anatum* race includes much of northern, eastern and western Canada and then south at least to the Gulf of Mexico coastline. Some birds are essentially resident within the breeding range.

MIGRATION

Of the three North American races, *pealei* is the only one that is essentially resident and does not migrate, although recent evidence suggests that some individuals move southwards along the west coast as far as California. *tundrius* is highly migratory, leaving the high arctic and moving as far as South America, overflying resident populations of *anatum* that remain in the southern portions of their range. Enroute to the southern United

States, the more northerly populations of *anatum* also appear to overfly birds that remain in portions of the range. Perhaps due to the problems associated with distinguishing all individuals of the three races in the field, migration studies have not speculated upon differences in migration timing, patterns or routes between the various races. Most banding studies refer only to geographic origins of birds without speculation about which races are involved. Much of the following discussion relates to *tundrius* and *anatum* but makes no attempts to distinguish them, so comments apply interchangeably unless otherwise noted. Some writers feel that the majority of birds seen on migration are of the *tundrius* form.

Post-breeding migrants from the northern populations reach southern Canada from mid-August through early September with the bulk of migrants passing the mid-United States east coast from about September 20 through October 20. Along the Appalachian Mountains, the fall migration extends from mid-August through mid-November, peaking in late September and early October. Along the west coast, autumn migration begins about mid-August and is well underway by mid-September with a peak at the latitude of Washington state during the first 10 days of October. This compares favorably with peaks along the eastern seaboard in Maryland and Virginia. Peak movements in California occur during late October and early November. Banding returns indicate that some immature *pealei* move from British Columbia at least as far south as California and perhaps Baja. Both *F. p. tundrius* and *F. p. anatum* move south from Alaska and some use a coastal route but the phenomenon is not well understood. The preferred route for most individuals of these races appears to be inland through Washington.

The Gulf coast of Texas is a fall staging area for races other than *pealei* with birds building up from late September through the first half of October. Most have passed by November 8. Migrant tundra birds from North America are in South America from early November to about the end of March.

Fall migration routes have a very strong south or southeasterly trend as birds move to the eastern seaboard or Gulf coast of the United States. Individuals banded in Alaska and many other points eastward in the Canadian north have shown strong tendencies to move to the east coast between southern New York and Virginia and then following a southwesterly route to the Gulf coast or perhaps departing the southern mainland and moving over water to the Caribbean Islands and beyond to South America. Other birds banded in Alaska and similar places in northern Canada appear to follow inland routes that take them more directly to the Texas Gulf coast and then southwards through central America to their ultimate destination. In addition to this southeasterly tendency, some *tundrius* and *anatum* birds from Alaska move directly south along the Alaska-British Columbia coast or inland across British Columbia converging in the Pacific Northwest region of Washington and southern British Columbia. Some may winter here or carry on coastally or inland to southern California. Some juvenile *pealei* birds follow a coastal route to southern California as well.

The spring migration of Peregrines is undoubtedly underway during March at southern latitudes with a heavy movement along the Gulf coast during April and May. Birds arrive in southern Canada as early as mid-April in some years with the heaviest movement in central Alberta being from May 4 to 23. In southern Ontario, the usual peak is April 15 to May 5. Arrival on the northern Alaskan breeding grounds is probably after mid-May but Yukon birds are somewhat earlier. A spring movement along the west coast through Washington State occurs from late March through early May. The peak is likely in April, coinciding with the major movement of shorebirds along the coast.

Spring migration routes are not as well known or defined as the fall routes. The Texas coast near Padre Island is a major spring staging area during April as birds are thought to be following the middle-American stem from South America. At Padre Island, the Gulf coast turns eastward which competes with the preferred direction for migrants. Routes to northern

breeding grounds are felt to be fairly direct with the eastern seaboard not experiencing the concentrations of falcons that occurs during the fall. A significant portion of the northern breeding population of Peregrines is felt to utilize this relatively small area of south Texas and northeastern Mexico.

BEHAVIOR

The Peregrine has long been known for its fast flight during diving attacks, but it does exhibit other flight modes. Normal flapping flight speed is about 25 to 40 miles per hour (40 to 64 kilometers per hour) with a rate of about four wingbeats per second. The flap is quite shallow and seems to undulate down the wing in pulses. Descriptors such as fluid, rhythmic, and elastic have also been used for this flight style. When conditions are optimal, birds will soar with the tail spread and take advantage of thermals. But it is perhaps the high speed stoop that stirs the imagination. Recorded speeds of 170 to 220 miles per hour (272 to 352 kilometers per hour) in an angled dive are cited by some researchers with theoretical maximums of 245 miles per hour (392 kilometers per hour) attainable but others suggest the maximum is closer to 110 to 130 miles per hour (176 to 208 kilometers per hour). More normal strike speeds are probably around these lower limits. Perching on elevated sites is used as a hunting tactic, but at other times, low perches such as fence posts, logs on mud flats, humps on open ground, trees, cliff faces or buildings may be used. General intolerance of human activities near nest sites seems to be the norm, but birds using buildings in cities indicate some adaptive capability.

The hunting tactics are grouped into 14 basic categories but combinations are usually used to effect a kill. Hunting is done during the day and may occur at dusk or in the early morning. Nocturnal hunting has been suggested but evidence is lacking. Some studies indicate that different races of the Peregrine Falcon will employ certain tactics over others, depending upon the preferred prey base, size of the falcon and other differences that influence hunting success.

Perch and Wait

- most hunting seems to be of this type where a high promontory, tree or other perch is used to survey the countryside and to launch an attack at the prey.

Soaring and Stooping

- from high elevation flight, the Peregrine Falcon will spot flying prey and stoop upon them at great speed. The resulting collision usually stuns and may kill the victim.

Straightaway Flight

- prey species are simply overtaken with fast flight and picked from the air by the falcon's talons with this particular technique. The victims are often small and may be killed and eaten while the falcon is still flying.

Low Level Hunting (contouring)

- birds will fly low over the ground, hiding behind bushes, hills or other objects in order to effect a surprise attack on unsuspecting prey. Falcons hunting over the ocean will use waves to hide behind as well.

Accipiter Method

- occasionally in forested regions, the Peregrine Falcon will remain concealed in or below the forest canopy and then rise closely to birds perched above.

Fishing

- the Peregrine Falcon has been observed to snatch Arctic Grayling from shallow water.

Piracy

- like the Gyrfalcon, the Peregrine Falcon has been known to follow dogs, human beings and Northern Harriers and then to attack prey flushed by these "beaters." This falcon has also been seen stealing fish from an Osprey and is known to rob other Peregrine Falcons.

Cooperative Hunting

- occasionally, mated pairs will hunt together and one will maneuver prey into position for the other to strike.

Bat Catching

- utilizing the stoop or straightaway pursuit, the Peregrine Falcon will capture bats much as they do other flying prey of similar size.

Cannibalism

- the Peregrine Falcon has been seen to eat its own eggs when accidentally broken, but it is not known whether this was an action to keep the nest clean, to benefit nutritionally, or both.

Nest Robbing

- there have been a few observations of pre-flight young being taken, particularly of colonial nesting species.

Insect Hawking

- the aerial pursuit and capture of large insects is seldom reported but juveniles appear to engage in this more frequently than do adults.

Carrion Eating

- rarely, the Peregrine Falcon has been seen feeding upon dead birds apparently killed by some other source.

Pursuit on Foot

- observations have been made of birds walking on the ground chasing insects and fiddler crabs have been taken by birds walking through a marshy area.

The high speed stoop of the Peregrine Falcon will often kill prey upon impact. High speed passes using the feet to strike a blow to the victim's head are also used. A bite to the neck is used to dispatch prey whether or not it has died from the initial contact. If they are not being taken back to the nest, small victims may be consumed in mid-flight and aerial feeding is not uncommon amongst Peregrine Falcons that hunt at sea. Larger animals may be taken to a plucking site during the breeding season or they may be consumed near the killing site. Before delivering prey to his mate or nestlings, the male often eats the head. Although it can go for several days without feeding, the Peregrine Falcon will consume up to one-quarter to one-third of a pound of food per day. In Alaska, it was estimated that parents and their brood require the equivalent of 100 ptarmigan or ducks or about 2,000 songbirds during the four month nesting period. Virtually all prey is dismantled before consumption.

The Peregrine Falcon will "flight bathe" by splashing into water and rising up immediately to keep on flying. Usually, birds walk into shallow water and splash and douse themselves until thoroughly wet. They will drink and then fly off to a perch to dry. Long grass wet with dew is also used to bathe and salt water is avoided. A common posture for drying is with the back to the sun and the wings and tail partially spread. Wing flapping and feather shaking is common during the drying process.

Nest defense is well-developed in the Peregrine Falcon but it does not seem to have developed the pugnacious reputation of the Prairie Falcon. Territorial defense includes a

range of pursuit, attack and strike behavior along with vocal chitterings. Opponents may lock talons and tumble earthwards and rarely, death may occur during such encounters. The Peregrine Falcon will attack eagles with vigor and possibly all buteos are pursued, particularly the Rough-legged Hawk. Great Horned Owls will take Peregrine Falcon young and in return, the falcons will strike and occasionally kill Great Horned Owls when discovered. Ravens and Peregrines often scrap over the possession of nesting cliffs but the Raven can be a wily and formidable adversary, often inflicting injury to the attacker.

The Peregrine Falcon is a solitary nester but the presence of suitable habitat and an abundant food supply has resulted in densities of *F. p. pealei* as high as one nest per mile (1.6 kilometers) of coastline. Three pairs within one-half mile (0.8 kilometer) in an inland location in southern British Columbia were recorded for *F. p. anatum* in 1906. Other locations in northern Canada have inter-nest distances ranging from two to 12 miles (3.2 to 19.2 kilometers) but in Britain, nests as close as 300 feet (93 meters) have been recorded. During the pre-pesticide era, population densities in the United States may have ranged from one pair for every 500 to 20,000 square miles (1,295 to 51,800 square kilometers) but home ranges are more likely in the range of 20 to 50 square miles (51.8 to 129.5 square kilometers) per pair. Territorial defense occurs generally within 300 to 1,500 feet (93 to 465 meters) of the nest, depending upon the identity of the approaching species.

Except in resident populations where the nesting territory may be occupied year round, the males arrive at the eyrie about one week prior to the females. He advertises his presence with noisy high circling flights and high perching displays. Arrival of the female initiates an elaborate, spectacular series of aerial performances that can last for two to four weeks and culminate in formation of the pair bond. In the early phase of courtship, activities include high-circling above the nest site, high-perching, the undulating sky dance consisting of steep dives and pullouts, aerial "kissing" where the beaks touch, slow flights with wings held high and feed out to land at the ledge, and a variety of postures, bowing, cooperative hunting and nest defense behaviors and vocalizations. Later, various displays occur on the nesting ledge by both sexes that include bowing, variations of walking, scraping, and vocalizations. The female selects the scrape to be used for the eggs. Food-related begging, aerial displays and vocalizations by the female indicates that she wants the male to feed her, which he may do for up to four weeks prior to egg-laying. The female indicates readiness for copulation by tipping forward and uttering "eechip" calls and watching the male. He has various displays and calls that he uses to induce copulation interest. Copulation occurs several times per day for several weeks prior to egg-laying. Lifelong monogamy has been suggested but this may only occur in some pairs and has been questioned as the norm for most populations. Lost mates are replaced.

The potential longevity in the wild and for captured birds has been suggested as 20 years. The average life expectancy for birds that survive to breeding age is five to six years. The first year mortality has been estimated as high as 60 percent or more in some populations, with much of this not taking place on the breeding grounds. Population mortality rates of 25 to 30 percent have been noted. Causes include shooting on the wintering grounds for taxidermy, random shooting by hunters, electrocution on power poles, predation, density-related territorial disputes, organochlorine pesticide effects, natural attrition, accidents, and so forth.

ADAPTATIONS

The diet of the Peregrine Falcon, although highly avian in composition, shows more variety than any other North American falcon. As well, it has shown a remarkable ability to adapt to a wide variety of habitats and climates worldwide. It has been suggested that one limitation has been the need to nest in a location which includes the combination of an abundant prey base in proximity to large areas of open air space for high speed aerial

pursuits. The prey species must be willing to cross these open spaces in order to be vulnerable to capture by Peregrines.

HABITAT

In all seasons, the Peregrine Falcon is a bird of open spaces. Historically, it has bred in a wide variety of habitats ranging from desertlike conditions through temperate forest and arctic tundra. A common factor in all habitats is the presence of suitable nesting cliffs, often near rivers or bodies of water, but the mere presence of these physical conditions does not guarantee the presence of Peregrine Falcons. *F. p. anatum* occupies North America from the treeline south to Mexico and its habitats include or historically included coniferous and deciduous woodlands with open spaces, open grassland and shrub-steppe country as well as a variety of other intermediate variations. Hunting tends to take place above the forest canopy as opposed to inside the forest as with accipiters. *F. p. tundrius* is a bird of the treeless open spaces above treeline in the Canadian and Alaskan arctic. It occupies areas far from the ocean in the harsher northern climates. On the west coast of North America, *F. p. pealei* is a bird of the cool, temperate rainforests at the interface with the sea. It hunts over the ocean and does not occur inland, preferring islands to even the mainland coast.

The breeding habitat of all races includes cliffs of rock or dirt but there are populations that will use trees as nest sites. The presence of water is also a common element and it may be in the form of rivers, large lakes or oceans. Rarely, Peregrine Falcons have become resident around large, metropolitan cities. Wintering habitats for migrant birds are also diverse and may only require a prey base with suitable perching sites. Migrating falcons can be found almost anywhere but show preferences for open places such as beaches, sand dunes, river deltas or other non-treed areas where prey species congregate and would find escape difficult.

VOICE

There is much variation in the descriptions of the Peregrine Falcon's voice but all might be thought of in terms of variations of several basic calls. The voice of the male is higher than that of the female. "Cacking" is the most commonly described call and is used in nest defense or as a rapid fire scream during an attack. When perched high during courtship or when the female is ready to copulate, either sex may give the "waik" call. "Eeechip" is used during mutual courtship and breeding displays as well as during some aggressive and fighting circumstances. When making the nest scrape, "chuckles" are uttered and when begging for food a "treble-whine" is given. "Eep-eep-eep" is used during aggressive chase, "upchip" when the female is ready to copulate and "chitter" for copulation readiness. When she is not ready for copulation, the female utters a "chup-chup" and when mounting for copulation, the male gives the "chutter" call. When being threatened with attack, the "treble-whine", and "chitter" are used. Most calls are used in various contexts and relate to advertising, display, copulation, feeding and territorial defense.

FOODS

The primary food of the Peregrine Falcon is birds, and more than 250 species worldwide have been recorded as prey. Other items include small mammals (bats, rodents), insects, fish, crabs, slugs and rarely carrion. *F. p. pealei* concentrates upon seabirds, and particularly alcids, such as auklets and murrelets, but will take ducks, storm-petrels, and shorebirds amongst others. *F. p. tundrius* concentrates on smaller birds such as passerines and shorebirds but is quite capable of dispatching ptarmigan or ducks. In times of high rodent numbers, this race will exploit the mammal component very successfully. *F. p. anatum*, on the breeding territory or in migration along with *tundrius*, utilizes many forest species that venture into open country or birds of the open spaces such as Rock Doves, jays, flickers,

blackbirds, swallows, pheasants, and so forth. In North America, food studies have shown birds to occupy an average of 98 percent of the diet of all Peregrine Falcons studied. Species represented in large numbers were Rock Doves, Mourning Doves, Crested Auklets, Least Auklets, Ancient Murrelets, Common Snipes, Gray Jays, and Lapland Longspurs. Shorebirds have been a large component of diets in some locations.

PELLETS

The pellets are elongated and blunt-ended and range from 1.5 to 2 inches (38.1 Millimeters) long by 1 inch (25.4 millimeters) in diameter. They may contain feathers, fur, chitin, claws or bits of vegetation but never bones. Digestive juices seem to eliminate all prey bones. Pellets are regurgitated once per day and may accumulate at nest sites, plucking posts or below perches.

NESTING

The preferred nest sites are on cliffs, steep banks or rocky islets and are often close to water. Ledges on tall buildings and trees have been used as well as quarries, church towers, bridges and assorted other sites such as hummocks, dirt slopes or dykes. The most common nest in North America is a scrape on a rocky ledge, often with a bit of an overhang and some dirt or debris on the ledge to scrape a laying site. The site is not necessarily on the highest cliff face in the area. If alternate sites are available, mated pairs may rotate amongst several over the course of years. Nest sites are traditional and some have been used for hundreds of years.

Tree-nesting has been infrequently documented in North America, such that a small population of pealei using old Bald Eagle nests and tree cavities along the coast of British Columbia is of interest. Six such nests within 15 miles (24 kilometers) of each other suggests the possibility of a genetically-related population that has adopted the strategy in the absence of suitable cliffs and the presence of large numbers of alcids nesting at the same sites.

The clutch size varies from three to four eggs. Rarely, clutches have reached seven eggs. The egg-laying interval is normally 48 hours but it may extend to 72 hours and can take place anytime during the day. The Peregrine Falcon is single-brooded, but replacement clutches may be initiated within two to three weeks and as many as four replacements have been noted in wild birds. By removing clutches, a female may be induced to lay up to 20 eggs. The egg ground color varies from creamy through browns and reddish, overlain by dots and blotches of warm browns with considerable variation. The shell is smooth and the eggs are subelliptical in shape. In the largest race, *F. P. pealei*, egg size ranged from 1.91 to 2.28 inches (48.5 to 58 millimeters) in length and 1.54 to 1.69 inches (39.1 to 43 millimeters) in width and averaged 2.10 inches (53.3 millimeters) long and 1.60 inches (40.6 millimeters) wide. Eggs for *F. p. anatum* ranged from 1.91 to 2.24 inches (48.5 to 57 millimeters) in length and 1.52 to 1.71 inches (38.5 to 43.5 millimeters) in width and averaged 2.09 inches (53.23 millimeters) long and 1.62 inches (41.26 millimeters) wide. Eggs of the race *F. p. tundrius* average slightly smaller.

The age at first breeding is generally two years. The males arrive at the nest site first and following the laying of the last egg, incubation is mainly by the female. Captive males have incubated for up to one-quarter of the daylight hours. The male hunts for the female and the young as most of the brooding of the nestlings is done by the female. He will cache food nearby and the female will retrieve it during her brief forays from the nest. The incubation period varies from 33 to 35 days. Nestlings are brooded continuously for 10 to 14 days after which the downy feathers are well-developed and brooding time decreases steadily. Activity outside of the nest by the young increases by about day 28 and fledging

occurs from 40 to 49 days after hatching. Once the young are on the wing, there is close association for up to 60 days in some populations. Behavior during this period is varied and includes feeding, hunting, aerial acrobatics and practice flights. In some cases, the onset of migration may terminate the family bond, but it is not universally so. Young have been seen with parents as far south as the Gulf coast of Texas.

CONSERVATION

The abrupt decline of primarily the *anatum* and *tundrius* races of North American Peregrine Falcons between the 1940s and 1970 has been well-documented. Declines elsewhere in the world were noted and the effects of various pesticides have been studied extensively and documented as a major cause of the declines. Recovery in parts of the former range was rapid where there was a healthy remnant population left such as in the arid southwestern United States. Reintroduction of captive bred birds has been undertaken in portions of the range in the continental United States and Canada but not without some controversy about the action. By 1985, recovery in many of the world populations was documented but some were still in trouble, including parts of the Yukon, the northern Rocky Mountains, the Northwest Territories, Colorado, and Texas. Despite some inadequately answered questions about the details of the pesticide impacts, the fate of released birds, and the state of our knowledge about the population dynamics of Peregrine Falcons, there is optimism that the future for this falcon is a positive one. Population estimates vary, but there was likely 2,800 to 3,800 breeding pairs in North America during the mid 1980s.

Conservation efforts will likely focus around a number of key initiatives such as:

- the provision of suitable nest sites in developed parts of North America where a suitable prey base exists
- a better understanding and possible manipulation of gene flow between small populations that are reproductively isolated from other groups due to the Peregrine Falcon's tendency to return to its natal area to breed
- techniques to successfully introduce birds into areas that are re-colonizing slowly due to the strong philopatric tendencies of Peregrine Falcons
- understanding the details of the new gene pool and racial characteristics of the falcons introduced to the range formerly occupied by *P. f. anatum* prior to the pesticide era declines. The new birds are from a different genetic background and will evolve differently from the original occupants.
- better understanding and efforts to conserve Peregrine Falcons in other continents where our knowledge is limited. Places like South America, Russia, India, China, and Japan are little-known at the present time.
- continued education in North America and the world to prevent the slaughter of raptors by hunters and collectors
- continued monitoring and careful management of the known populations so that other threats to their survival such as the loss of habitat for their prey base does not become an even greater problem than the pesticide impacts.

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Peregrine Falcon - Continental

Falco peregrinus

GENERAL DESCRIPTION

The Peregrine Falcon is a cosmopolitan species and one of only four living species that has achieved a worldwide distribution without the help of humans. In North America, the population is comprised of three races, all fairly similar in appearance, but with clinal variations that result in differences in plumage and size between the races that are often distinguishable in the field. Other individuals are not safely assignable to races from field observations.

The race *Falco peregrinus anatum* is commonly referred to as the "Continental" Peregrine Falcon, *Falco peregrinus pealei* as "Peale's" Peregrine Falcon, and *Falco peregrinus tundrius* as "Tundra" Peregrine Falcon.

The Peregrine Falcon is a medium to large falcon that is generally darkly hooded in appearance with a dark back and upper tail and light, heavily barred and spotted underparts. The side of the face has a prominent dark mustache patch set beside a variably white cheek. Juveniles are generally dark brown, heavily streaked birds with some variations between races. More than any other falcon, this is a bird of many habitats including coastal marine environments, temperate forests, arctic tundra, arid deserts and open country of all descriptions with suitable tall cliffs for nesting.

SIZE

Of all of the North American falcons, only the Gyrfalcon exceeds this medium-sized raptor in size. It is about the same size as the Prairie Falcon or a large American Crow. The males and females are similar in size with females averaging perhaps 15 percent larger. Females vary from 18 to 21 inches (46 to 53 centimeters) in length with wingspans from 38 to 44 inches (97 to 112 centimeters). Weights vary from 1.5 to 2.7 pounds (680 to 1,225 grams). Males vary in length from 15 to 18 inches (38 to 46 centimeters) with wingspans from 34 to 39 inches (86 to 99 centimeters). Male weights range from 1.1 to 1.8 pounds (499 to 816 grams).

MORPHS AND MOLTS

There are no distinctive colour morphs of the Peregrine Falcon but each race differs somewhat from the other. Further, individuals of the same race can show some variation within a range. If the *F. p. anatum* race were taken as the standard, *F. p. pealei* tends to be larger and darker overall whereas *F. p. tundrius* is similar in size but generally lighter. Variations within races can make field separation uncertain. The timing of the molt varies with the breeding cycle and happens earlier at southern latitudes. The female begins molting during egg laying but the males not for sometime afterwards. Completion of the molt takes from 4.5 to six months such that the final changes may be completed on the wintering grounds. By day 40, nestlings have attained the full juvenal plumage. The molt towards the first basic plumage is quite variable but generally starts during the summer of the second calendar year and lasts late into that year or January of the third year. Once the basic plumage has been attained, this is the first definitive (adult) plumage.

SPECIFIC DESCRIPTION

Adult Continental (*anatum*) - Perched

Note: male and female plumages are very similar. Differences are subtle, and where applicable, are listed below.

HEAD

- upper portions and part of sides blackish and sometimes with narrow whitish band across the forehead
- sides of face blackish below the eye (malar patch)
- the chin and throat are white
- the beak is bluish-gray with a dark tip and yellowish base
- the cere and eyering are yellow
- the eye is very dark
- in females the soft part coloring may be more muted and the whitish-buff of the nape may be more visible

BODY

- the upper breast is plain white
- the lower breast and belly varies from a tawny buff to grayish with black streaks in the center and transverse bars, chevrons and spots lower down. The barring is heaviest on the flanks and thighs.
- the back is variably dark bluish-gray or slatey with slightly paler rump
- in females the underparts may be more buffy and more heavily marked black and the sides, flanks and thighs may be more grayish with wider barring

WINGS

- the upper surface is the same as the back with some darker barring evident on the greater coverts
- the primaries are black towards the tips which reach the tip of the tail

TAIL

- the upper side is light bluish gray or may be darker and is tipped whitish and has up to 12 black cross bars
- the under surface is paler with less evident patterning
- the undertail coverts are pale with black spots or barring

LEGS

- the legs and feet are yellowish with black talons

Immature Continental (anatum) - Perched

HEAD

- the crown and nape are variably dark brownish chestnut
- variations of buffy-rufous streaking, buffy forehead, pale eyestreak.
- a dark brown cheek patch is evident
- the beak is bluish-gray with a dark tip as in the adults
- the cere and eye ring, or orbital skin, may be bluish, greenish or muted yellow
- the eye is very dark brown

BODY

- the background color of the underparts is a rufous-buff with heavy dark brown streaks broadening to chevrons on the flanks and undertail coverts
- immatures are streaked as opposed to barred as in adults
- the upperparts are variably darkish brown with the buffy margin of the feathers limited

WINGS

- the upper parts are similar to the back and the primaries are also dark brown as opposed to black in the adults
- the tips do not quite reach the tip of the tail

TAIL

- the upper surface is the same as the back or darker with discontinuous pale tawny barring
- the underside is paler and the undertail coverts are rufous-buff with heavy dark streaking

LEGS

- the legs and feet are variably bluish to yellowish with black talons

Adult Continental (anatum) - Flight

- a medium to large falcon with uniform spotted and barred light grayish underwing with no evidence of two tonal variation as in Gyrfalcon or Prairie Falcon
- the underparts appear heavily barred except for the white upper breast and throat
- the back appears dark
- the body is heavy and broad with long wings that appear relatively narrow compared to other large falcons

Immature Continental (anatum) - Flight

- overall, a dark brown falcon with lighter, streaked underparts
- the tail is slightly longer than that of adults
- underwing is uniform dark coloration

SIMILAR SPECIES

The Peregrine Falcon is closest in size and weight to the Prairie Falcon but has a darker back and more prominent mustache mark with overall markings being more contrasty and less brownish. Large female Peregrine Falcons overlap small male Gyrfalcons in size but the latter species although highly variable, tends to be more evenly colored and lacking the boldness in the mustache mark. Juveniles are more similar and Peregrine Falcons and Gyrfalcons are easily confused at greater distances. Both gray-morph and dark-morph Gyrfalcons have two-toned underwings whereas the underwing of the Peregrine Falcon is uniform.

Soaring Peregrine Falcons have similarities to soaring Broad-winged Hawks and not infrequently, Northern Harriers and Mississippi Kites are mistaken for Peregrines.

OTHER NAMES

The Peregrine Falcon is commonly known as the "Duck Hawk" but also as "Peale's Peregrine" (pealei race), "Tundra Peregrine" (tundrius race), "Big-footed Falcon", "Bullet Hawk", "Pinnacle Hawk", and "Sea Hawk."

ETYMOLOGY

The genus Falco is of Latin origins and means "sickle." This may be in reference to the shape of the beak or more likely the talons of all falcons. The species name peregrinus is Latin for "wandering" or "foreign." The components of the word are per for through and ager meaning field or land. Thus, we can infer "across country" from the complete word or the

falcon that wanders from place to place across the land.

MYTHOLOGY

None is known for North America.

RANGE

Collectively, the range of the three North American subspecies once occupied most of the continent with absences throughout much of the Canadian prairies, northern Ontario, Quebec and the southeastern United States. Today, the distribution of naturally breeding Peregrine Falcons that have not been reintroduced is restricted to the western cordillera north to Alaska including the coast, the Canadian Territories, and the tundra regions. Wintering birds can be found throughout North America but resident populations are restricted largely to the northwestern coastline.

Worldwide, there are from 19 to 22 races recognized but only 3 occur in North America. The distribution for this species is as follows.

Continental Peregrine Falcon (*Falco peregrinus anatum*)

This race formerly bred south of the tundra across the Northwest Territories, the Yukon, and inland Alaska south throughout the western cordillera to southern Arizona, New Mexico, and western Texas. It also occurred along the Pacific coast to southern Baja and northern interior Mexico. Through the central United States, the range included South Dakota, Nebraska, and Kansas eastward throughout all of the eastern states and south to the northern portions of Mississippi, Alabama and Georgia. The range extended northward into eastern Canada except Newfoundland. Large areas of northern Quebec, Ontario and most of Manitoba and Saskatchewan were devoid of this race. Despite gaps in the range, Florida and Newfoundland are the only political units that were not within the historical breeding range of Continental (*anatum*) Peregrine Falcons.

Throughout the 1950s and 1960s, the *anatum* race suffered major population declines such that by 1970, no known populations existed in eastern North America south of the boreal forest. The Canadian population was essentially eliminated south of 60 degrees latitude and east of the Rocky Mountains. In 1975, the population in the continental United States west of the Mississippi River had dropped to 62 known pairs although in 1980 a total of 145 pairs was recorded. This change was likely due to improved survey methods and the population still extended south in the cordillera to Arizona and New Mexico but in fewer locations than historically. Releases of captive bred birds continue to change the distribution of known nesting locations within the historical range but numbers have not reached original levels and the extent of the breeding range today is less than it was, particularly in the eastern portion of the continent.

The winter range for the *anatum* race includes much of northern, eastern and western Canada and then south at least to the Gulf of Mexico coastline. Some birds are essentially resident within the breeding range.

MIGRATION

Of the three North American races, *pealei* is the only one that is essentially resident and does not migrate, although recent evidence suggests that some individuals move southwards along the west coast as far as California. *tundrius* is highly migratory, leaving the high arctic and moving as far as South America, overflying resident populations of *anatum* that remain in the southern portions of their range. Enroute to the southern United

States, the more northerly populations of *anatum* also appear to overfly birds that remain in portions of the range. Perhaps due to the problems associated with distinguishing all individuals of the three races in the field, migration studies have not speculated upon differences in migration timing, patterns or routes between the various races. Most banding studies refer only to geographic origins of birds without speculation about which races are involved. Much of the following discussion relates to *tundrius* and *anatum* but makes no attempts to distinguish them, so comments apply interchangeably unless otherwise noted. Some writers feel that the majority of birds seen on migration are of the *tundrius* form.

Post-breeding migrants from the northern populations reach southern Canada from mid-August through early September with the bulk of migrants passing the mid-United States east coast from about September 20 through October 20. Along the Appalachian Mountains, the fall migration extends from mid-August through mid-November, peaking in late September and early October. Along the west coast, autumn migration begins about mid-August and is well underway by mid-September with a peak at the latitude of Washington state during the first 10 days of October. This compares favorably with peaks along the eastern seaboard in Maryland and Virginia. Peak movements in California occur during late October and early November. Banding returns indicate that some immature *pealei* move from British Columbia at least as far south as California and perhaps Baja. Both *F. p. tundrius* and *F. p. anatum* move south from Alaska and some use a coastal route but the phenomenon is not well understood. The preferred route for most individuals of these races appears to be inland through Washington.

The Gulf coast of Texas is a fall staging area for races other than *pealei* with birds building up from late September through the first half of October. Most have passed by November 8. Migrant tundra birds from North America are in South America from early November to about the end of March.

Fall migration routes have a very strong south or southeasterly trend as birds move to the eastern seaboard or Gulf coast of the United States. Individuals banded in Alaska and many other points eastward in the Canadian north have shown strong tendencies to move to the east coast between southern New York and Virginia and then following a southwesterly route to the Gulf coast or perhaps departing the southern mainland and moving over water to the Caribbean Islands and beyond to South America. Other birds banded in Alaska and similar places in northern Canada appear to follow inland routes that take them more directly to the Texas Gulf coast and then southwards through central America to their ultimate destination. In addition to this southeasterly tendency, some *tundrius* and *anatum* birds from Alaska move directly south along the Alaska-British Columbia coast or inland across British Columbia converging in the Pacific Northwest region of Washington and southern British Columbia. Some may winter here or carry on coastally or inland to southern California. Some juvenile *pealei* birds follow a coastal route to southern California as well.

The spring migration of Peregrines is undoubtedly underway during March at southern latitudes with a heavy movement along the Gulf coast during April and May. Birds arrive in southern Canada as early as mid-April in some years with the heaviest movement in central Alberta being from May 4 to 23. In southern Ontario, the usual peak is April 15 to May 5. Arrival on the northern Alaskan breeding grounds is probably after mid-May but Yukon birds are somewhat earlier. A spring movement along the west coast through Washington State occurs from late March through early May. The peak is likely in April, coinciding with the major movement of shorebirds along the coast.

Spring migration routes are not as well known or defined as the fall routes. The Texas coast near Padre Island is a major spring staging area during April as birds are thought to be following the middle-American stem from South America. At Padre Island, the Gulf coast turns eastward which competes with the preferred direction for migrants. Routes to northern

breeding grounds are felt to be fairly direct with the eastern seaboard not experiencing the concentrations of falcons that occurs during the fall. A significant portion of the northern breeding population of Peregrines is felt to utilize this relatively small area of south Texas and northeastern Mexico.

BEHAVIOR

The Peregrine has long been known for its fast flight during diving attacks, but it does exhibit other flight modes. Normal flapping flight speed is about 25 to 40 miles per hour (40 to 64 kilometers per hour) with a rate of about four wingbeats per second. The flap is quite shallow and seems to undulate down the wing in pulses. Descriptors such as fluid, rhythmic, and elastic have also been used for this flight style. When conditions are optimal, birds will soar with the tail spread and take advantage of thermals. But it is perhaps the high speed stoop that stirs the imagination. Recorded speeds of 170 to 220 miles per hour (272 to 352 kilometers per hour) in an angled dive are cited by some researchers with theoretical maximums of 245 miles per hour (392 kilometers per hour) attainable but others suggest the maximum is closer to 110 to 130 miles per hour (176 to 208 kilometers per hour). More normal strike speeds are probably around these lower limits. Perching on elevated sites is used as a hunting tactic, but at other times, low perches such as fence posts, logs on mud flats, humps on open ground, trees, cliff faces or buildings may be used. General intolerance of human activities near nest sites seems to be the norm, but birds using buildings in cities indicate some adaptive capability.

The hunting tactics are grouped into 14 basic categories but combinations are usually used to effect a kill. Hunting is done during the day and may occur at dusk or in the early morning. Nocturnal hunting has been suggested but evidence is lacking. Some studies indicate that different races of the Peregrine Falcon will employ certain tactics over others, depending upon the preferred prey base, size of the falcon and other differences that influence hunting success.

Perch and Wait

- most hunting seems to be of this type where a high promontory, tree or other perch is used to survey the countryside and to launch an attack at the prey.

Soaring and Stooping

- from high elevation flight, the Peregrine Falcon will spot flying prey and stoop upon them at great speed. The resulting collision usually stuns and may kill the victim.

Straightaway Flight

- prey species are simply overtaken with fast flight and picked from the air by the falcon's talons with this particular technique. The victims are often small and may be killed and eaten while the falcon is still flying.

Low Level Hunting (contouring)

- birds will fly low over the ground, hiding behind bushes, hills or other objects in order to effect a surprise attack on unsuspecting prey. Falcons hunting over the ocean will use waves to hide behind as well.

Accipiter Method

- occasionally in forested regions, the Peregrine Falcon will remain concealed in or below the forest canopy and then rise closely to birds perched above.

Fishing

- the Peregrine Falcon has been observed to snatch Arctic Grayling from shallow water.

Piracy

- like the Gyrfalcon, the Peregrine Falcon has been known to follow dogs, human beings and Northern Harriers and then to attack prey flushed by these "beaters." This falcon has also been seen stealing fish from an Osprey and is known to rob other Peregrine Falcons.

Cooperative Hunting

- occasionally, mated pairs will hunt together and one will maneuver prey into position for the other to strike.

Bat Catching

- utilizing the stoop or straightaway pursuit, the Peregrine Falcon will capture bats much as they do other flying prey of similar size.

Cannibalism

- the Peregrine Falcon has been seen to eat its own eggs when accidentally broken, but it is not known whether this was an action to keep the nest clean, to benefit nutritionally, or both.

Nest Robbing

- there have been a few observations of pre-flight young being taken, particularly of colonial nesting species.

Insect Hawking

- the aerial pursuit and capture of large insects is seldom reported but juveniles appear to engage in this more frequently than do adults.

Carrion Eating

- rarely, the Peregrine Falcon has been seen feeding upon dead birds apparently killed by some other source.

Pursuit on Foot

- observations have been made of birds walking on the ground chasing insects and fiddler crabs have been taken by birds walking through a marshy area.

The high speed stoop of the Peregrine Falcon will often kill prey upon impact. High speed passes using the feet to strike a blow to the victim's head are also used. A bite to the neck is used to dispatch prey whether or not it has died from the initial contact. If they are not being taken back to the nest, small victims may be consumed in mid-flight and aerial feeding is not uncommon amongst Peregrine Falcons that hunt at sea. Larger animals may be taken to a plucking site during the breeding season or they may be consumed near the killing site. Before delivering prey to his mate or nestlings, the male often eats the head. Although it can go for several days without feeding, the Peregrine Falcon will consume up to one-quarter to one-third of a pound of food per day. In Alaska, it was estimated that parents and their brood require the equivalent of 100 ptarmigan or ducks or about 2,000 songbirds during the four month nesting period. Virtually all prey is dismantled before consumption.

The Peregrine Falcon will "flight bathe" by splashing into water and rising up immediately to keep on flying. Usually, birds walk into shallow water and splash and douse themselves until thoroughly wet. They will drink and then fly off to a perch to dry. Long grass wet with dew is also used to bathe and salt water is avoided. A common posture for drying is with the back to the sun and the wings and tail partially spread. Wing flapping and feather shaking is common during the drying process.

Nest defense is well-developed in the Peregrine Falcon but it does not seem to have developed the pugnacious reputation of the Prairie Falcon. Territorial defense includes a

range of pursuit, attack and strike behavior along with vocal chitterings. Opponents may lock talons and tumble earthwards and rarely, death may occur during such encounters. The Peregrine Falcon will attack eagles with vigor and possibly all buteos are pursued, particularly the Rough-legged Hawk. Great Horned Owls will take Peregrine Falcon young and in return, the falcons will strike and occasionally kill Great Horned Owls when discovered. Ravens and Peregrines often scrap over the possession of nesting cliffs but the Raven can be a wily and formidable adversary, often inflicting injury to the attacker.

The Peregrine Falcon is a solitary nester but the presence of suitable habitat and an abundant food supply has resulted in densities of *F. p. pealei* as high as one nest per mile (1.6 kilometers) of coastline. Three pairs within one-half mile (0.8 kilometer) in an inland location in southern British Columbia were recorded for *F. p. anatum* in 1906. Other locations in northern Canada have inter-nest distances ranging from two to 12 miles (3.2 to 19.2 kilometers) but in Britain, nests as close as 300 feet (93 meters) have been recorded. During the pre-pesticide era, population densities in the United States may have ranged from one pair for every 500 to 20,000 square miles (1,295 to 51,800 square kilometers) but home ranges are more likely in the range of 20 to 50 square miles (51.8 to 129.5 square kilometers) per pair. Territorial defense occurs generally within 300 to 1,500 feet (93 to 465 meters) of the nest, depending upon the identity of the approaching species.

Except in resident populations where the nesting territory may be occupied year round, the males arrive at the eyrie about one week prior to the females. He advertises his presence with noisy high circling flights and high perching displays. Arrival of the female initiates an elaborate, spectacular series of aerial performances that can last for two to four weeks and culminate in formation of the pair bond. In the early phase of courtship, activities include high-circling above the nest site, high-perching, the undulating sky dance consisting of steep dives and pullouts, aerial "kissing" where the beaks touch, slow flights with wings held high and feed out to land at the ledge, and a variety of postures, bowing, cooperative hunting and nest defense behaviors and vocalizations. Later, various displays occur on the nesting ledge by both sexes that include bowing, variations of walking, scraping, and vocalizations. The female selects the scrape to be used for the eggs. Food-related begging, aerial displays and vocalizations by the female indicates that she wants the male to feed her, which he may do for up to four weeks prior to egg-laying. The female indicates readiness for copulation by tipping forward and uttering "eechip" calls and watching the male. He has various displays and calls that he uses to induce copulation interest. Copulation occurs several times per day for several weeks prior to egg-laying. Lifelong monogamy has been suggested but this may only occur in some pairs and has been questioned as the norm for most populations. Lost mates are replaced.

The potential longevity in the wild and for captured birds has been suggested as 20 years. The average life expectancy for birds that survive to breeding age is five to six years. The first year mortality has been estimated as high as 60 percent or more in some populations, with much of this not taking place on the breeding grounds. Population mortality rates of 25 to 30 percent have been noted. Causes include shooting on the wintering grounds for taxidermy, random shooting by hunters, electrocution on power poles, predation, density-related territorial disputes, organochlorine pesticide effects, natural attrition, accidents, and so forth.

ADAPTATIONS

The diet of the Peregrine Falcon, although highly avian in composition, shows more variety than any other North American falcon. As well, it has shown a remarkable ability to adapt to a wide variety of habitats and climates worldwide. It has been suggested that one limitation has been the need to nest in a location which includes the combination of an abundant prey base in proximity to large areas of open air space for high speed aerial

pursuits. The prey species must be willing to cross these open spaces in order to be vulnerable to capture by Peregrines.

HABITAT

In all seasons, the Peregrine Falcon is a bird of open spaces. Historically, it has bred in a wide variety of habitats ranging from desertlike conditions through temperate forest and arctic tundra. A common factor in all habitats is the presence of suitable nesting cliffs, often near rivers or bodies of water, but the mere presence of these physical conditions does not guarantee the presence of Peregrine Falcons. *F. p. anatum* occupies North America from the treeline south to Mexico and its habitats include or historically included coniferous and deciduous woodlands with open spaces, open grassland and shrub-steppe country as well as a variety of other intermediate variations. Hunting tends to take place above the forest canopy as opposed to inside the forest as with accipiters. *F. p. tundrius* is a bird of the treeless open spaces above treeline in the Canadian and Alaskan arctic. It occupies areas far from the ocean in the harsher northern climates. On the west coast of North America, *F. p. pealei* is a bird of the cool, temperate rainforests at the interface with the sea. It hunts over the ocean and does not occur inland, preferring islands to even the mainland coast.

The breeding habitat of all races includes cliffs of rock or dirt but there are populations that will use trees as nest sites. The presence of water is also a common element and it may be in the form of rivers, large lakes or oceans. Rarely, Peregrine Falcons have become resident around large, metropolitan cities. Wintering habitats for migrant birds are also diverse and may only require a prey base with suitable perching sites. Migrating falcons can be found almost anywhere but show preferences for open places such as beaches, sand dunes, river deltas or other non-treed areas where prey species congregate and would find escape difficult.

VOICE

There is much variation in the descriptions of the Peregrine Falcon's voice but all might be thought of in terms of variations of several basic calls. The voice of the male is higher than that of the female. "Cacking" is the most commonly described call and is used in nest defense or as a rapid fire scream during an attack. When perched high during courtship or when the female is ready to copulate, either sex may give the "waik" call. "Eeechip" is used during mutual courtship and breeding displays as well as during some aggressive and fighting circumstances. When making the nest scrape, "chuckles" are uttered and when begging for food a "treble-whine" is given. "Eep-eep-eep" is used during aggressive chase, "upchip" when the female is ready to copulate and "chitter" for copulation readiness. When she is not ready for copulation, the female utters a "chup-chup" and when mounting for copulation, the male gives the "chutter" call. When being threatened with attack, the "treble-whine", and "chitter" are used. Most calls are used in various contexts and relate to advertising, display, copulation, feeding and territorial defense.

FOODS

The primary food of the Peregrine Falcon is birds, and more than 250 species worldwide have been recorded as prey. Other items include small mammals (bats, rodents), insects, fish, crabs, slugs and rarely carrion. *F. p. pealei* concentrates upon seabirds, and particularly alcids, such as auklets and murrelets, but will take ducks, storm-petrels, and shorebirds amongst others. *F. p. tundrius* concentrates on smaller birds such as passerines and shorebirds but is quite capable of dispatching ptarmigan or ducks. In times of high rodent numbers, this race will exploit the mammal component very successfully. *F. p. anatum*, on the breeding territory or in migration along with *tundrius*, utilizes many forest species that venture into open country or birds of the open spaces such as Rock Doves, jays, flickers,

blackbirds, swallows, pheasants, and so forth. In North America, food studies have shown birds to occupy an average of 98 percent of the diet of all Peregrine Falcons studied. Species represented in large numbers were Rock Doves, Mourning Doves, Crested Auklets, Least Auklets, Ancient Murrelets, Common Snipes, Gray Jays, and Lapland Longspurs. Shorebirds have been a large component of diets in some locations.

PELLETS

The pellets are elongated and blunt-ended and range from 1.5 to 2 inches (38.1 Millimeters) long by 1 inch (25.4 millimeters) in diameter. They may contain feathers, fur, chitin, claws or bits of vegetation but never bones. Digestive juices seem to eliminate all prey bones. Pellets are regurgitated once per day and may accumulate at nest sites, plucking posts or below perches.

NESTING

The preferred nest sites are on cliffs, steep banks or rocky islets and are often close to water. Ledges on tall buildings and trees have been used as well as quarries, church towers, bridges and assorted other sites such as hummocks, dirt slopes or dykes. The most common nest in North America is a scrape on a rocky ledge, often with a bit of an overhang and some dirt or debris on the ledge to scrape a laying site. The site is not necessarily on the highest cliff face in the area. If alternate sites are available, mated pairs may rotate amongst several over the course of years. Nest sites are traditional and some have been used for hundreds of years.

Tree-nesting has been infrequently documented in North America, such that a small population of pealei using old Bald Eagle nests and tree cavities along the coast of British Columbia is of interest. Six such nests within 15 miles (24 kilometers) of each other suggests the possibility of a genetically-related population that has adopted the strategy in the absence of suitable cliffs and the presence of large numbers of alcids nesting at the same sites.

The clutch size varies from three to four eggs. Rarely, clutches have reached seven eggs. The egg-laying interval is normally 48 hours but it may extend to 72 hours and can take place anytime during the day. The Peregrine Falcon is single-brooded, but replacement clutches may be initiated within two to three weeks and as many as four replacements have been noted in wild birds. By removing clutches, a female may be induced to lay up to 20 eggs. The egg ground color varies from creamy through browns and reddish, overlain by dots and blotches of warm browns with considerable variation. The shell is smooth and the eggs are subelliptical in shape. In the largest race, *F. P. pealei*, egg size ranged from 1.91 to 2.28 inches (48.5 to 58 millimeters) in length and 1.54 to 1.69 inches (39.1 to 43 millimeters) in width and averaged 2.10 inches (53.3 millimeters) long and 1.60 inches (40.6 millimeters) wide. Eggs for *F. p. anatum* ranged from 1.91 to 2.24 inches (48.5 to 57 millimeters) in length and 1.52 to 1.71 inches (38.5 to 43.5 millimeters) in width and averaged 2.09 inches (53.23 millimeters) long and 1.62 inches (41.26 millimeters) wide. Eggs of the race *F. p. tundrius* average slightly smaller.

The age at first breeding is generally two years. The males arrive at the nest site first and following the laying of the last egg, incubation is mainly by the female. Captive males have incubated for up to one-quarter of the daylight hours. The male hunts for the female and the young as most of the brooding of the nestlings is done by the female. He will cache food nearby and the female will retrieve it during her brief forays from the nest. The incubation period varies from 33 to 35 days. Nestlings are brooded continuously for 10 to 14 days after which the downy feathers are well-developed and brooding time decreases steadily. Activity outside of the nest by the young increases by about day 28 and fledging

occurs from 40 to 49 days after hatching. Once the young are on the wing, there is close association for up to 60 days in some populations. Behavior during this period is varied and includes feeding, hunting, aerial acrobatics and practice flights. In some cases, the onset of migration may terminate the family bond, but it is not universally so. Young have been seen with parents as far south as the Gulf coast of Texas.

CONSERVATION

The abrupt decline of primarily the *anatum* and *tundrius* races of North American Peregrine Falcons between the 1940s and 1970 has been well-documented. Declines elsewhere in the world were noted and the effects of various pesticides have been studied extensively and documented as a major cause of the declines. Recovery in parts of the former range was rapid where there was a healthy remnant population left such as in the arid southwestern United States. Reintroduction of captive bred birds has been undertaken in portions of the range in the continental United States and Canada but not without some controversy about the action. By 1985, recovery in many of the world populations was documented but some were still in trouble, including parts of the Yukon, the northern Rocky Mountains, the Northwest Territories, Colorado, and Texas. Despite some inadequately answered questions about the details of the pesticide impacts, the fate of released birds, and the state of our knowledge about the population dynamics of Peregrine Falcons, there is optimism that the future for this falcon is a positive one. Population estimates vary, but there was likely 2,800 to 3,800 breeding pairs in North America during the mid 1980s.

Conservation efforts will likely focus around a number of key initiatives such as:

- the provision of suitable nest sites in developed parts of North America where a suitable prey base exists
- a better understanding and possible manipulation of gene flow between small populations that are reproductively isolated from other groups due to the Peregrine Falcon's tendency to return to its natal area to breed
- techniques to successfully introduce birds into areas that are re-colonizing slowly due to the strong philopatric tendencies of Peregrine Falcons
- understanding the details of the new gene pool and racial characteristics of the falcons introduced to the range formerly occupied by *P. f. anatum* prior to the pesticide era declines. The new birds are from a different genetic background and will evolve differently from the original occupants.
- better understanding and efforts to conserve Peregrine Falcons in other continents where our knowledge is limited. Places like South America, Russia, India, China, and Japan are little-known at the present time.
- continued education in North America and the world to prevent the slaughter of raptors by hunters and collectors
- continued monitoring and careful management of the known populations so that other threats to their survival such as the loss of habitat for their prey base does not become an even greater problem than the pesticide impacts.

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Peregrine Falcon - Peale's

Falco peregrinus

GENERAL DESCRIPTION

The Peregrine Falcon is a cosmopolitan species and one of only four living species that has achieved a worldwide distribution without the help of humans. In North America, the population is comprised of three races, all fairly similar in appearance, but with clinal variations that result in differences in plumage and size between the races that are often distinguishable in the field. Other individuals are not safely assignable to races from field observations.

The race *Falco peregrinus anatum* is commonly referred to as the "Continental" Peregrine Falcon, *Falco peregrinus pealei* as "Peale's" Peregrine Falcon, and *Falco peregrinus tundrius* as "Tundra" Peregrine Falcon.

The Peregrine Falcon is a medium to large falcon that is generally darkly hooded in appearance with a dark back and upper tail and light, heavily barred and spotted underparts. The side of the face has a prominent dark mustache patch set beside a variably white cheek. Juveniles are generally dark brown, heavily streaked birds with some variations between races. More than any other falcon, this is a bird of many habitats including coastal marine environments, temperate forests, arctic tundra, arid deserts and open country of all descriptions with suitable tall cliffs for nesting.

SIZE

Of all of the North American falcons, only the Gyrfalcon exceeds this medium-sized raptor in size. It is about the same size as the Prairie Falcon or a large American Crow. The males and females are similar in size with females averaging perhaps 15 percent larger. Females vary from 18 to 21 inches (46 to 53 centimeters) in length with wingspans from 38 to 44 inches (97 to 112 centimeters). Weights vary from 1.5 to 2.7 pounds (680 to 1,225 grams). Males vary in length from 15 to 18 inches (38 to 46 centimeters) with wingspans from 34 to 39 inches (86 to 99 centimeters). Male weights range from 1.1 to 1.8 pounds (499 to 816 grams).

MORPHS AND MOLTS

There are no distinctive colour morphs of the Peregrine Falcon but each race differs somewhat from the other. Further, individuals of the same race can show some variation within a range. If the *F. p. anatum* race were taken as the standard, *F. p. pealei* tends to be larger and darker overall whereas *F. p. tundrius* is similar in size but generally lighter. Variations within races can make field separation uncertain. The timing of the molt varies with the breeding cycle and happens earlier at southern latitudes. The female begins molting during egg laying but the males not for sometime afterwards. Completion of the molt takes from 4.5 to six months such that the final changes may be completed on the wintering grounds. By day 40, nestlings have attained the full juvenal plumage. The molt towards the first basic plumage is quite variable but generally starts during the summer of the second calendar year and lasts late into that year or January of the third year. Once the basic plumage has been attained, this is the first definitive (adult) plumage.

SPECIFIC DESCRIPTION

Adult Peale's (*pealei*) - Perched

Note: male and female plumages are very similar. Differences are subtle, and where applicable, are listed below.

HEAD

- upper head and hind neck dark often with a powdery-gray bloom
- dark malar patch sometimes appears to blend somewhat into lighter auricular area due to spotting and marks on this latter area
- throat area white
- beak bluish-gray with dark tip and yellow base
- the cere and eye ring, or orbital area, are pale yellowish
- the eye is very dark brown

BODY

- the underparts range from whitish to light grayish with a pale yellowish overwash
- the upper breast is white or has dark shaftlines on some birds; often heavily spotted, especially on females
- the barring becomes heavier on the lower belly, sides and flanks and is more extensive than in the other races
- the underpart markings become more extensive in the Aleutian Island population
- the upperparts are darker gray than anatum
- the female is essentially similar to the male except that the upper breast and throat markings of the males become large tear-dropped markings in the females; females often heavily spotted

WINGS

- the upper surface is the same as the back
- the primaries are black towards the tips which reach the tip of the tail

TAIL

- the upper side is bluish gray or may be darker and is tipped whitish and has up to 12 black cross bars which are often obscured by a darker ground color
- the under surface is paler with less evident patterning
- the undertail coverts are pale with black spots or barring

LEGS

- the legs and feet are muted yellow with black talons

Immature Peale's (pealei) - Perched

HEAD

- the head color varies from dark brown on the top and hindneck through light, muted brown- buff and frequently with palish streaks extending back from the forehead in dark birds
- the malar patch is dark brown to black and may be interrupted as in tundrius
- the beak is bluish-gray with a dark tip as in the adults
- the cere is grayish to greenish yellow and the eye ring, or orbital skin, may be bluish-white to grayish- blue
- the eye is very dark brown

BODY

- the underparts are similar to anatum but more muted with a yellowish or buffy cast, not rufous.
- heavy bold streaking of dark brown can become so extensive that the lighter ground color is obscured
- the upperparts are very dark with limited buffy feather edgings

WINGS

- the wings are as in anatum but darker overall
- the upper parts are similar to the back and the primaries are also dark brown as opposed to black in the adults
- the tips do not quite reach the tip of the tail

TAIL

- essentially as in anatum
- the upper surface is the same as the back or darker with less or no dark barring
- the underside is paler and the undertail coverts are light with heavy dark streaking

LEGS

- the legs and feet vary from bluish gray or greenish to pale yellowish

Adult Peale's (pealei) - Flight

- a medium to large falcon with heavy spotting on a lightish breast
- the wings look spotted and streaked gray beneath and the top surface is dark overall
- the head looks darkly-hooded with a prominent malar patch and a white cheek patch that can look somewhat obscure
- these are the darkest and grayest of all of the races in North America
- the female is similar to the male in general plumage characters but is larger and can look like a small Gyrfalcon in size

Immature Peale's (pealei) - Flight

- overall, a dark bird that is similar to juvenile anatum but the head may variably be darker and streaked, with an obscure malar patch due to additional dark markings on the side of the head
- dark streaking on the underparts may obscure the lighter ground color
- underwing is uniform dark colored, not two-toned as in gray-morph and dark-morph Gyrfalcons

SIMILAR SPECIES

The Peregrine Falcon is closest in size and weight to the Prairie Falcon but has a darker back and more prominent mustache mark with overall markings being more contrasty and less brownish. Large female Peregrine Falcons overlap small male Gyrfalcons in size but the latter species although highly variable, tends to be more evenly colored and lacking the boldness in the mustache mark. Juveniles are more similar and Peregrine Falcons and Gyrfalcons are easily confused at greater distances. Both gray-morph and dark-morph Gyrfalcons have two-toned underwings whereas the underwing of the Peregrine Falcon is uniform.

Soaring Peregrine Falcons have similarities to soaring Broad-winged Hawks and not infrequently, Northern Harriers and Mississippi Kites are mistaken for Peregrines.

OTHER NAMES

The Peregrine Falcon is commonly known as the "Duck Hawk" but also as "Peale's Peregrine" (pealei race), "Tundra Peregrine" (tundrius race), "Big-footed Falcon", "Bullet Hawk", "Pinnacle Hawk", and "Sea Hawk."

ETYMOLOGY

The genus *Falco* is of Latin origins and means "sickle." This may be in reference to the shape of the beak or more likely the talons of all falcons. The species name *peregrinus* is Latin for "wandering" or "foreign." The components of the word are *per* for through and *ager* meaning field or land. Thus, we can infer "across country" from the complete word or the falcon that wanders from place to place across the land.

MYTHOLOGY

None is known for North America.

RANGE

Collectively, the range of the three North American subspecies once occupied most of the continent with absences throughout much of the Canadian prairies, northern Ontario, Quebec and the southeastern United States. Today, the distribution of naturally breeding Peregrine Falcons that have not been reintroduced is restricted to the western cordillera north to Alaska including the coast, the Canadian Territories, and the tundra regions. Wintering birds can be found throughout North America but resident populations are restricted largely to the northwestern coastline.

Worldwide, there are from 19 to 22 races recognized but only 3 occur in North America. The distribution for this subspecies is as follows.

Peale's Peregrine Falcon (*Falco peregrinus pealei*)

The race has the smallest range in North America has always been occupied by a resident race along the northwestern coast of the continent. It breeds from the Aleutian Islands and nearest mainland areas south to northern Washington and very rarely into northern Oregon state. It occupies the mainland coast and islands throughout the range. Occasionally, individuals of this race have been recorded inland but it is essentially a marine peregrine.

The world breeding range for the Peregrine Falcon includes North America, Mexico, the western regions of South America from Ecuador south to Tierra del Fuego and the Falkland Islands, temperate and boreal Europe eastward throughout the U.S.S.R., Asia, Japan, Korea, and China. Southward, the range continues into Africa, Arabia, India, Australia and other southern islands and archipelagoes. It is the most cosmopolitan of the falcons and occupies all continents except Antarctica and many island groups. Migratory populations extend the range of occurrences to many countries.

MIGRATION

Of the three North American races, *pealei* is the only one that is essentially resident and does not migrate, although recent evidence suggests that some individuals move southwards along the west coast as far as California. *tundrius* is highly migratory, leaving the high arctic and moving as far as South America, overflying resident populations of *anatum* that remain in the southern portions of their range. Enroute to the southern United States, the more northerly populations of *anatum* also appear to overfly birds that remain in portions of the range. Perhaps due to the problems associated with distinguishing all individuals of the three races in the field, migration studies have not speculated upon differences in migration timing, patterns or routes between the various races. Most banding studies refer only to geographic origins of birds without speculation about which races are involved. Much of the following discussion relates to *tundrius* and *anatum* but makes no attempts to distinguish them, so comments apply interchangeably unless otherwise noted.

Some writers feel that the majority of birds seen on migration are of the tundrius form.

Post-breeding migrants from the northern populations reach southern Canada from mid-August through early September with the bulk of migrants passing the mid-United States east coast from about September 20 through October 20. Along the Appalachian Mountains, the fall migration extends from mid-August through mid-November, peaking in late September and early October. Along the west coast, autumn migration begins about mid-August and is well underway by mid-September with a peak at the latitude of Washington state during the first 10 days of October. This compares favorably with peaks along the eastern seaboard in Maryland and Virginia. Peak movements in California occur during late October and early November. Banding returns indicate that some immature pealei move from British Columbia at least as far south as California and perhaps Baja. Both *F. p. tundrius* and *F. p. anatum* move south from Alaska and some use a coastal route but the phenomenon is not well understood. The preferred route for most individuals of these races appears to be inland through Washington.

The Gulf coast of Texas is a fall staging area for races other than pealei with birds building up from late September through the first half of October. Most have passed by November 8. Migrant tundra birds from North America are in South America from early November to about the end of March.

Fall migration routes have a very strong south or southeasterly trend as birds move to the eastern seaboard or Gulf coast of the United States. Individuals banded in Alaska and many other points eastward in the Canadian north have shown strong tendencies to move to the east coast between southern New York and Virginia and then following a southwesterly route to the Gulf coast or perhaps departing the southern mainland and moving over water to the Caribbean Islands and beyond to South America. Other birds banded in Alaska and similar places in northern Canada appear to follow inland routes that take them more directly to the Texas Gulf coast and then southwards through central America to their ultimate destination. In addition to this southeasterly tendency, some *tundrius* and *anatum* birds from Alaska move directly south along the Alaska-British Columbia coast or inland across British Columbia converging in the Pacific Northwest region of Washington and southern British Columbia. Some may winter here or carry on coastally or inland to southern California. Some juvenile pealei birds follow a coastal route to southern California as well.

The spring migration of Peregrines is undoubtedly underway during March at southern latitudes with a heavy movement along the Gulf coast during April and May. Birds arrive in southern Canada as early as mid-April in some years with the heaviest movement in central Alberta being from May 4 to 23. In southern Ontario, the usual peak is April 15 to May 5. Arrival on the northern Alaskan breeding grounds is probably after mid-May but Yukon birds are somewhat earlier. A spring movement along the west coast through Washington State occurs from late March through early May. The peak is likely in April, coinciding with the major movement of shorebirds along the coast.

Spring migration routes are not as well known or defined as the fall routes. The Texas coast near Padre Island is a major spring staging area during April as birds are thought to be following the middle-American stem from South America. At Padre Island, the Gulf coast turns eastward which competes with the preferred direction for migrants. Routes to northern breeding grounds are felt to be fairly direct with the eastern seaboard not experiencing the concentrations of falcons that occurs during the fall. A significant portion of the northern breeding population of Peregrines is felt to utilize this relatively small area of south Texas and northeastern Mexico.

BEHAVIOR

The Peregrine has long been known for its fast flight during diving attacks, but it does exhibit other flight modes. Normal flapping flight speed is about 25 to 40 miles per hour (40 to 64 kilometers per hour) with a rate of about four wingbeats per second. The flap is quite shallow and seems to undulate down the wing in pulses. Descriptors such as fluid, rhythmic, and elastic have also been used for this flight style. When conditions are optimal, birds will soar with the tail spread and take advantage of thermals. But it is perhaps the high speed stoop that stirs the imagination. Recorded speeds of 170 to 220 miles per hour (272 to 352 kilometers per hour) in an angled dive are cited by some researchers with theoretical maximums of 245 miles per hour (392 kilometers per hour) attainable but others suggest the maximum is closer to 110 to 130 miles per hour (176 to 208 kilometers per hour). More normal strike speeds are probably around these lower limits. Perching on elevated sites is used as a hunting tactic, but at other times, low perches such as fence posts, logs on mud flats, humps on open ground, trees, cliff faces or buildings may be used. General intolerance of human activities near nest sites seems to be the norm, but birds using buildings in cities indicate some adaptive capability.

The hunting tactics are grouped into 14 basic categories but combinations are usually used to effect a kill. Hunting is done during the day and may occur at dusk or in the early morning. Nocturnal hunting has been suggested but evidence is lacking. Some studies indicate that different races of the Peregrine Falcon will employ certain tactics over others, depending upon the preferred prey base, size of the falcon and other differences that influence hunting success.

Perch and Wait

- most hunting seems to be of this type where a high promontory, tree or other perch is used to survey the countryside and to launch an attack at the prey.

Soaring and Stooping

- from high elevation flight, the Peregrine Falcon will spot flying prey and stoop upon them at great speed. The resulting collision usually stuns and may kill the victim.

Straightaway Flight

- prey species are simply overtaken with fast flight and picked from the air by the falcon's talons with this particular technique. The victims are often small and may be killed and eaten while the falcon is still flying.

Low Level Hunting (contouring)

- birds will fly low over the ground, hiding behind bushes, hills or other objects in order to effect a surprise attack on unsuspecting prey. Falcons hunting over the ocean will use waves to hide behind as well.

Accipiter Method

- occasionally in forested regions, the Peregrine Falcon will remain concealed in or below the forest canopy and then rise closely to birds perched above.

Fishing

- the Peregrine Falcon has been observed to snatch Arctic Grayling from shallow water.

Piracy

- like the Gyrfalcon, the Peregrine Falcon has been known to follow dogs, human beings and Northern Harriers and then to attack prey flushed by these "beaters." This falcon has also been seen stealing fish from an Osprey and is known to rob other Peregrine Falcons.

Cooperative Hunting

- occasionally, mated pairs will hunt together and one will maneuver prey into position

for the other to strike.

Bat Catching

- utilizing the stoop or straightaway pursuit, the Peregrine Falcon will capture bats much as they do other flying prey of similar size.

Cannibalism

- the Peregrine Falcon has been seen to eat its own eggs when accidentally broken, but it is not known whether this was an action to keep the nest clean, to benefit nutritionally, or both.

Nest Robbing

- there have been a few observations of pre-flight young being taken, particularly of colonial nesting species.

Insect Hawking

- the aerial pursuit and capture of large insects is seldom reported but juveniles appear to engage in this more frequently than do adults.

Carrion Eating

- rarely, the Peregrine Falcon has been seen feeding upon dead birds apparently killed by some other source.

Pursuit on Foot

- observations have been made of birds walking on the ground chasing insects and fiddler crabs have been taken by birds walking through a marshy area.

The high speed stoop of the Peregrine Falcon will often kill prey upon impact. High speed passes using the feet to strike a blow to the victim's head are also used. A bite to the neck is used to dispatch prey whether or not it has died from the initial contact. If they are not being taken back to the nest, small victims may be consumed in mid-flight and aerial feeding is not uncommon amongst Peregrine Falcons that hunt at sea. Larger animals may be taken to a plucking site during the breeding season or they may be consumed near the killing site. Before delivering prey to his mate or nestlings, the male often eats the head. Although it can go for several days without feeding, the Peregrine Falcon will consume up to one-quarter to one-third of a pound of food per day. In Alaska, it was estimated that parents and their brood require the equivalent of 100 ptarmigan or ducks or about 2,000 songbirds during the four month nesting period. Virtually all prey is dismantled before consumption.

The Peregrine Falcon will "flight bathe" by splashing into water and rising up immediately to keep on flying. Usually, birds walk into shallow water and splash and douse themselves until thoroughly wet. They will drink and then fly off to a perch to dry. Long grass wet with dew is also used to bathe and salt water is avoided. A common posture for drying is with the back to the sun and the wings and tail partially spread. Wing flapping and feather shaking is common during the drying process.

Nest defense is well-developed in the Peregrine Falcon but it does not seem to have developed the pugnacious reputation of the Prairie Falcon. Territorial defense includes a range of pursuit, attack and strike behavior along with vocal chitterings. Opponents may lock talons and tumble earthwards and rarely, death may occur during such encounters. The Peregrine Falcon will attack eagles with vigor and possibly all buteos are pursued, particularly the Rough-legged Hawk. Great Horned Owls will take Peregrine Falcon young and in return, the falcons will strike and occasionally kill Great Horned Owls when discovered. Ravens and Peregrines often scrap over the possession of nesting cliffs but the Raven can be a wily and formidable adversary, often inflicting injury to the attacker.

The Peregrine Falcon is a solitary nester but the presence of suitable habitat and an abundant food supply has resulted in densities of *F. p. pealei* as high as one nest per mile (1.6 kilometers) of coastline. Three pairs within one-half mile (0.8 kilometer) in an inland location in southern British Columbia were recorded for *F. p. anatum* in 1906. Other locations in northern Canada have inter-nest distances ranging from two to 12 miles (3.2 to 19.2 kilometers) but in Britain, nests as close as 300 feet (93 meters) have been recorded. During the pre-pesticide era, population densities in the United States may have ranged from one pair for every 500 to 20,000 square miles (1,295 to 51,800 square kilometers) but home ranges are more likely in the range of 20 to 50 square miles (51.8 to 129.5 square kilometers) per pair. Territorial defense occurs generally within 300 to 1,500 feet (93 to 465 meters) of the nest, depending upon the identity of the approaching species.

Except in resident populations where the nesting territory may be occupied year round, the males arrive at the eyrie about one week prior to the females. He advertises his presence with noisy high circling flights and high perching displays. Arrival of the female initiates an elaborate, spectacular series of aerial performances that can last for two to four weeks and culminate in formation of the pair bond. In the early phase of courtship, activities include high-circling above the nest site, high-perching, the undulating sky dance consisting of steep dives and pullouts, aerial "kissing" where the beaks touch, slow flights with wings held high and feed out to land at the ledge, and a variety of postures, bowing, cooperative hunting and nest defense behaviors and vocalizations. Later, various displays occur on the nesting ledge by both sexes that include bowing, variations of walking, scraping, and vocalizations. The female selects the scrape to be used for the eggs. Food-related begging, aerial displays and vocalizations by the female indicates that she wants the male to feed her, which he may do for up to four weeks prior to egg-laying. The female indicates readiness for copulation by tipping forward and uttering "eechip" calls and watching the male. He has various displays and calls that he uses to induce copulation interest. Copulation occurs several times per day for several weeks prior to egg-laying. Lifelong monogamy has been suggested but this may only occur in some pairs and has been questioned as the norm for most populations. Lost mates are replaced.

The potential longevity in the wild and for captured birds has been suggested as 20 years. The average life expectancy for birds that survive to breeding age is five to six years. The first year mortality has been estimated as high as 60 percent or more in some populations, with much of this not taking place on the breeding grounds. Population mortality rates of 25 to 30 percent have been noted. Causes include shooting on the wintering grounds for taxidermy, random shooting by hunters, electrocution on power poles, predation, density-related territorial disputes, organochlorine pesticide effects, natural attrition, accidents, and so forth.

ADAPTATIONS

The diet of the Peregrine Falcon, although highly avian in composition, shows more variety than any other North American falcon. As well, it has shown a remarkable ability to adapt to a wide variety of habitats and climates worldwide. It has been suggested that one limitation has been the need to nest in a location which includes the combination of an abundant prey base in proximity to large areas of open air space for high speed aerial pursuits. The prey species must be willing to cross these open spaces in order to be vulnerable to capture by Peregrines.

HABITAT

In all seasons, the Peregrine Falcon is a bird of open spaces. Historically, it has bred in a wide variety of habitats ranging from desertlike conditions through temperate forest and

arctic tundra. A common factor in all habitats is the presence of suitable nesting cliffs, often near rivers or bodies of water, but the mere presence of these physical conditions does not guarantee the presence of Peregrine Falcons. *F. p. anatum* occupies North America from the treeline south to Mexico and its habitats include or historically included coniferous and deciduous woodlands with open spaces, open grassland and shrub-steppe country as well as a variety of other intermediate variations. Hunting tends to take place above the forest canopy as opposed to inside the forest as with accipiters. *F. p. tundrius* is a bird of the treeless open spaces above treeline in the Canadian and Alaskan arctic. It occupies areas far from the ocean in the harsher northern climates. On the west coast of North America, *F. p. pealei* is a bird of the cool, temperate rainforests at the interface with the sea. It hunts over the ocean and does not occur inland, preferring islands to even the mainland coast.

The breeding habitat of all races includes cliffs of rock or dirt but there are populations that will use trees as nest sites. The presence of water is also a common element and it may be in the form of rivers, large lakes or oceans. Rarely, Peregrine Falcons have become resident around large, metropolitan cities. Wintering habitats for migrant birds are also diverse and may only require a prey base with suitable perching sites. Migrating falcons can be found almost anywhere but show preferences for open places such as beaches, sand dunes, river deltas or other non-treed areas where prey species congregate and would find escape difficult.

VOICE

There is much variation in the descriptions of the Peregrine Falcon's voice but all might be thought of in terms of variations of several basic calls. The voice of the male is higher than that of the female. "Cacking" is the most commonly described call and is used in nest defense or as a rapid fire scream during an attack. When perched high during courtship or when the female is ready to copulate, either sex may give the "waik" call. "Eeechip" is used during mutual courtship and breeding displays as well as during some aggressive and fighting circumstances. When making the nest scrape, "chuckles" are uttered and when begging for food a "treble-whine" is given. "Eep-eep-eep" is used during aggressive chase, "upchip" when the female is ready to copulate and "chitter" for copulation readiness. When she is not ready for copulation, the female utters a "chup-chup" and when mounting for copulation, the male gives the "chutter" call. When being threatened with attack, the "treble-whine", and "chitter" are used. Most calls are used in various contexts and relate to advertising, display, copulation, feeding and territorial defense.

FOODS

The primary food of the Peregrine Falcon is birds, and more than 250 species worldwide have been recorded as prey. Other items include small mammals (bats, rodents), insects, fish, crabs, slugs and rarely carrion. *F. p. pealei* concentrates upon seabirds, and particularly alcids, such as auklets and murrelets, but will take ducks, storm-petrels, and shorebirds amongst others. *F. p. tundrius* concentrates on smaller birds such as passerines and shorebirds but is quite capable of dispatching ptarmigan or ducks. In times of high rodent numbers, this race will exploit the mammal component very successfully. *F. p. anatum*, on the breeding territory or in migration along with *tundrius*, utilizes many forest species that venture into open country or birds of the open spaces such as Rock Doves, jays, flickers, blackbirds, swallows, pheasants, and so forth. In North America, food studies have shown birds to occupy an average of 98 percent of the diet of all Peregrine Falcons studied. Species represented in large numbers were Rock Doves, Mourning Doves, Crested Auklets, Least Auklets, Ancient Murrelets, Common Snipes, Gray Jays, and Lapland Longspurs. Shorebirds have been a large component of diets in some locations.

PELLETS

The pellets are elongated and blunt-ended and range from 1.5 to 2 inches (38.1 Millimeters) long by 1 inch (25.4 millimeters) in diameter. They may contain feathers, fur, chitin, claws or bits of vegetation but never bones. Digestive juices seem to eliminate all prey bones. Pellets are regurgitated once per day and may accumulate at nest sites, plucking posts or below perches.

NESTING

The preferred nest sites are on cliffs, steep banks or rocky islets and are often close to water. Ledges on tall buildings and trees have been used as well as quarries, church towers, bridges and assorted other sites such as hummocks, dirt slopes or dykes. The most common nest in North America is a scrape on a rocky ledge, often with a bit of an overhang and some dirt or debris on the ledge to scrape a laying site. The site is not necessarily on the highest cliff face in the area. If alternate sites are available, mated pairs may rotate amongst several over the course of years. Nest sites are traditional and some have been used for hundreds of years.

Tree-nesting has been infrequently documented in North America, such that a small population of *pealei* using old Bald Eagle nests and tree cavities along the coast of British Columbia is of interest. Six such nests within 15 miles (24 kilometers) of each other suggests the possibility of a genetically-related population that has adopted the strategy in the absence of suitable cliffs and the presence of large numbers of alcids nesting at the same sites.

The clutch size varies from three to four eggs. Rarely, clutches have reached seven eggs. The egg-laying interval is normally 48 hours but it may extend to 72 hours and can take place anytime during the day. The Peregrine Falcon is single-brooded, but replacement clutches may be initiated within two to three weeks and as many as four replacements have been noted in wild birds. By removing clutches, a female may be induced to lay up to 20 eggs. The egg ground color varies from creamy through browns and reddish, overlain by dots and blotches of warm browns with considerable variation. The shell is smooth and the eggs are subelliptical in shape. In the largest race, *F. P. pealei*, egg size ranged from 1.91 to 2.28 inches (48.5 to 58 millimeters) in length and 1.54 to 1.69 inches (39.1 to 43 millimeters) in width and averaged 2.10 inches (53.3 millimeters) long and 1.60 inches (40.6 millimeters) wide. Eggs for *F. p. anatum* ranged from 1.91 to 2.24 inches (48.5 to 57 millimeters) in length and 1.52 to 1.71 inches (38.5 to 43.5 millimeters) in width and averaged 2.09 inches (53.23 millimeters) long and 1.62 inches (41.26 millimeters) wide. Eggs of the race *F. p. tundrius* average slightly smaller.

The age at first breeding is generally two years. The males arrive at the nest site first and following the laying of the last egg, incubation is mainly by the female. Captive males have incubated for up to one-quarter of the daylight hours. The male hunts for the female and the young as most of the brooding of the nestlings is done by the female. He will cache food nearby and the female will retrieve it during her brief forays from the nest. The incubation period varies from 33 to 35 days. Nestlings are brooded continuously for 10 to 14 days after which the downy feathers are well-developed and brooding time decreases steadily. Activity outside of the nest by the young increases by about day 28 and fledging occurs from 40 to 49 days after hatching. Once the young are on the wing, there is close association for up to 60 days in some populations. Behavior during this period is varied and includes feeding, hunting, aerial acrobatics and practice flights. In some cases, the onset of migration may terminate the family bond, but it is not universally so. Young have been seen with parents as far south as the Gulf coast of Texas.

CONSERVATION

The abrupt decline of primarily the anatum and tundrius races of North American Peregrine Falcons between the 1940s and 1970 has been well-documented. Declines elsewhere in the world were noted and the effects of various pesticides have been studied extensively and documented as a major cause of the declines. Recovery in parts of the former range was rapid where there was a healthy remnant population left such as in the arid southwestern United States. Reintroduction of captive bred birds has been undertaken in portions of the range in the continental United States and Canada but not without some controversy about the action. By 1985, recovery in many of the world populations was documented but some were still in trouble, including parts of the Yukon, the northern Rocky Mountains, the Northwest Territories, Colorado, and Texas. Despite some inadequately answered questions about the details of the pesticide impacts, the fate of released birds, and the state of our knowledge about the population dynamics of Peregrine Falcons, there is optimism that the future for this falcon is a positive one. Population estimates vary, but there was likely 2,800 to 3,800 breeding pairs in North America during the mid 1980s.

Conservation efforts will likely focus around a number of key initiatives such as:

- the provision of suitable nest sites in developed parts of North America where a suitable prey base exists
- a better understanding and possible manipulation of gene flow between small populations that are reproductively isolated from other groups due to the Peregrine Falcon's tendency to return to its natal area to breed
- techniques to successfully introduce birds into areas that are re-colonizing slowly due to the strong philopatric tendencies of Peregrine Falcons
- understanding the details of the new gene pool and racial characteristics of the falcons introduced to the range formerly occupied by P. f. anatum prior to the pesticide era declines. The new birds are from a different genetic background and will evolve differently from the original occupants.
- better understanding and efforts to conserve Peregrine Falcons in other continents where our knowledge is limited. Places like South America, Russia, India, China, and Japan are little-known at the present time.
- continued education in North America and the world to prevent the slaughter of raptors by hunters and collectors
- continued monitoring and careful management of the known populations so that other threats to their survival such as the loss of habitat for their prey base does not become an even greater problem than the pesticide impacts.

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Peregrine Falcon - Tundra

Falco peregrinus

GENERAL DESCRIPTION

The Peregrine Falcon is a cosmopolitan species and one of only four living species that has achieved a worldwide distribution without the help of humans. In North America, the population is comprised of three races, all fairly similar in appearance, but with clinal variations that result in differences in plumage and size between the races that are often distinguishable in the field. Other individuals are not safely assignable to races from field observations.

The race *Falco peregrinus anatum* is commonly referred to as the "Continental" Peregrine Falcon, *Falco peregrinus pealei* as "Peale's" Peregrine Falcon, and *Falco peregrinus tundrius* as "Tundra" Peregrine Falcon.

The Peregrine Falcon is a medium to large falcon that is generally darkly hooded in appearance with a dark back and upper tail and light, heavily barred and spotted underparts. The side of the face has a prominent dark mustache patch set beside a variably white cheek. Juveniles are generally dark brown, heavily streaked birds with some variations between races. More than any other falcon, this is a bird of many habitats including coastal marine environments, temperate forests, arctic tundra, arid deserts and open country of all descriptions with suitable tall cliffs for nesting.

SIZE

Of all of the North American falcons, only the Gyrfalcon exceeds this medium-sized raptor in size. It is about the same size as the Prairie Falcon or a large American Crow. The males and females are similar in size with females averaging perhaps 15 percent larger. Females vary from 18 to 21 inches (46 to 53 centimeters) in length with wingspans from 38 to 44 inches (97 to 112 centimeters). Weights vary from 1.5 to 2.7 pounds (680 to 1,225 grams). Males vary in length from 15 to 18 inches (38 to 46 centimeters) with wingspans from 34 to 39 inches (86 to 99 centimeters). Male weights range from 1.1 to 1.8 pounds (499 to 816 grams).

MORPHS AND MOLTS

There are no distinctive colour morphs of the Peregrine Falcon but each race differs somewhat from the other. Further, individuals of the same race can show some variation within a range. If the *F. p. anatum* race were taken as the standard, *F. p. pealei* tends to be larger and darker overall whereas *F. p. tundrius* is similar in size but generally lighter. Variations within races can make field separation uncertain. The timing of the molt varies with the breeding cycle and happens earlier at southern latitudes. The female begins molting during egg laying but the males not for sometime afterwards. Completion of the molt takes from 4.5 to six months such that the final changes may be completed on the wintering grounds. By day 40, nestlings have attained the full juvenal plumage. The molt towards the first basic plumage is quite variable but generally starts during the summer of the second calendar year and lasts late into that year or January of the third year. Once the basic plumage has been attained, this is the first definitive (adult) plumage.

SPECIFIC DESCRIPTION

Adult Tundra (*tundrius*) - Perched

Note: male and female plumages are very similar. Differences are subtle, and where applicable, are listed below.

HEAD

- upper portions and part of sides blackish and always with a narrow whitish band across the forehead
- sides of face blackish below the eye (malar patch) and less extensive than in anatum
- white auricular area behind malar patch more obvious than in anatum and extends higher on the side of the head
- the chin and throat are white
- the beak is bluish-gray with a dark tip and yellowish base
- the cere and eyering are yellow
- the eye is very dark

BODY

- the underparts are more whitish overall than in other races
- the flanks and thighs are more palish gray with lighter and less defined darker barring than in anatum and pealei
- the upperparts are bluish-gray but somewhat lighter than anatum and darkly barred to some degree
- the female is generally darker than the male with heavier ventral barring and more buff in new fall plumage.

WINGS

- the upper surface is the same as the back with some darker barring evident on the greater coverts
- the primaries are black towards the tips
- the wing tips reach the tip of the tail
- overall coloring paler than anatum

TAIL

- the upper side is light bluish gray or may be darker and is tipped whitish and has up to 12 black cross bars, giving a gray-banded look
- some birds may show a brownish cast to the upper surface
- the under surface is paler with less evident patterning
- the undertail coverts are pale with black spots or barring
- overall, the tail is paler than anatum

LEGS

- legs and feet are yellow with black talons

Immature Tundra (tundrius) - Perched

HEAD

- overall lighter than anatum but this is variable depending upon the extent of light edgings to the feathers
- crown is often a pale "blonde" in color
- the light feathering on the upper head may merge with light feathers on the sides and back of the neck
- the dark malar patch can vary from narrow to wide and may be interrupted by a pale, transverse line below the eye
- the auricular area is pale and quite extensive
- the beak is bluish-gray with a dark tip as in the adults
- the cere is gray to greenish yellow and the eye ring, or orbital skin, is bluish-white

- the eye is very dark brown

BODY

- the underparts are paler buff than anatum
- underparts overall are much more narrowly streaked than in other two races
- the streaking on the flanks and thighs is thinner, more linear and paler brown giving a finely streaked appearance as opposed to adult barring
- the upperparts are dark brown but the buffy feather edgings are more extensive than in anatum and have even been likened to the back color of the Prairie Falcon in extreme cases

WINGS

- similar to the back with buffy margins on the coverts
- dark brown toward the tips
- wing tips just short of reaching tip of tail

TAIL

- the upperparts may be conspicuously-banded with a wine-buff color but females may lack this barring
- some individuals have been described as having dark, reddish-brown to strikingly buffy-orange tails

LEGS

- legs and feet vary from pale bluish or greenish to pale yellow with black talons

Adult Tundra (tundrius) - Flight

- a medium to large, dark-backed falcon but the upper surface may appear to be less contrasty between the back and the lighter rump as in anatum
- the underparts appear light and less-heavily barred, the malar patch less extensive and the white cheek patch more extensive than in anatum
- female is generally similar but somewhat darker with heavier barring on undersides

Immature Tundra (tundrius) - Flight

- more variable than other forms and often with a "blonde"-headed look
- back may appear more buffy and occasional "red-tailed" individuals have been noted
- the undersides appear lighter and more finely streaked than the other races

SIMILAR SPECIES

The Peregrine Falcon is closest in size and weight to the Prairie Falcon but has a darker back and more prominent mustache mark with overall markings being more contrasty and less brownish. Large female Peregrine Falcons overlap small male Gyrfalcons in size but the latter species although highly variable, tends to be more evenly colored and lacking the boldness in the mustache mark. Juveniles are more similar and Peregrine Falcons and Gyrfalcons are easily confused at greater distances. Both gray-morph and dark-morph Gyrfalcons have two-toned underwings whereas the underwing of the Peregrine Falcon is uniform.

Soaring Peregrine Falcons have similarities to soaring Broad-winged Hawks and not infrequently, Northern Harriers and Mississippi Kites are mistaken for Peregrines.

OTHER NAMES

The Peregrine Falcon is commonly known as the "Duck Hawk" but also as "Peale's Peregrine" (pealei race), "Tundra Peregrine" (tundrius race), "Big-footed Falcon", "Bullet Hawk", "Pinnacle Hawk", and "Sea Hawk."

ETYMOLOGY

The genus *Falco* is of Latin origins and means "sickle." This may be in reference to the shape of the beak or more likely the talons of all falcons. The species name *peregrinus* is Latin for "wandering" or "foreign." The components of the word are *per* for through and *ager* meaning field or land. Thus, we can infer "across country" from the complete word or the falcon that wanders from place to place across the land.

MYTHOLOGY

None is known for North America.

RANGE

Collectively, the range of the three North American subspecies once occupied most of the continent with absences throughout much of the Canadian prairies, northern Ontario, Quebec and the southeastern United States. Today, the distribution of naturally breeding Peregrine Falcons that have not been reintroduced is restricted to the western cordillera north to Alaska including the coast, the Canadian Territories, and the tundra regions. Wintering birds can be found throughout North America but resident populations are restricted largely to the northwestern coastline.

Worldwide, there are from 19 to 22 races recognized but only 3 occur in North America. The distribution for this subspecies is as follows.

Tundra Peregrine Falcon (*Falco peregrinus tundrius*)

Historically this race occupied the tundra areas of northern Alaska and the Canadian arctic east to Greenland north to about 70 degrees. Similar population declines to *P. f. anatum* caused a restriction of the breeding range within this northern distribution. Population increases will not likely change the known historical range. *Tundrius* populations are highly migratory, wintering from the extreme southern United States south to Chile and Argentina.

MIGRATION

Of the three North American races, *pealei* is the only one that is essentially resident and does not migrate, although recent evidence suggests that some individuals move southwards along the west coast as far as California. *Tundrius* is highly migratory, leaving the high arctic and moving as far as South America, overflying resident populations of *anatum* that remain in the southern portions of their range. Enroute to the southern United States, the more northerly populations of *anatum* also appear to overfly birds that remain in portions of the range. Perhaps due to the problems associated with distinguishing all individuals of the three races in the field, migration studies have not speculated upon differences in migration timing, patterns or routes between the various races. Most banding studies refer only to geographic origins of birds without speculation about which races are involved. Much of the following discussion relates to *tundrius* and *anatum* but makes no attempts to distinguish them, so comments apply interchangeably unless otherwise noted. Some writers feel that the majority of birds seen on migration are of the *tundrius* form.

Post-breeding migrants from the northern populations reach southern Canada from mid-

August through early September with the bulk of migrants passing the mid-United States east coast from about September 20 through October 20. Along the Appalachian Mountains, the fall migration extends from mid-August through mid-November, peaking in late September and early October. Along the west coast, autumn migration begins about mid-August and is well underway by mid-September with a peak at the latitude of Washington state during the first 10 days of October. This compares favorably with peaks along the eastern seaboard in Maryland and Virginia. Peak movements in California occur during late October and early November. Banding returns indicate that some immature pealei move from British Columbia at least as far south as California and perhaps Baja. Both *F. p. tundrius* and *F. p. anatum* move south from Alaska and some use a coastal route but the phenomenon is not well understood. The preferred route for most individuals of these races appears to be inland through Washington.

The Gulf coast of Texas is a fall staging area for races other than pealei with birds building up from late September through the first half of October. Most have passed by November 8. Migrant tundra birds from North America are in South America from early November to about the end of March.

Fall migration routes have a very strong south or southeasterly trend as birds move to the eastern seaboard or Gulf coast of the United States. Individuals banded in Alaska and many other points eastward in the Canadian north have shown strong tendencies to move to the east coast between southern New York and Virginia and then following a southwesterly route to the Gulf coast or perhaps departing the southern mainland and moving over water to the Caribbean Islands and beyond to South America. Other birds banded in Alaska and similar places in northern Canada appear to follow inland routes that take them more directly to the Texas Gulf coast and then southwards through central America to their ultimate destination. In addition to this southeasterly tendency, some *tundrius* and *anatum* birds from Alaska move directly south along the Alaska-British Columbia coast or inland across British Columbia converging in the Pacific Northwest region of Washington and southern British Columbia. Some may winter here or carry on coastally or inland to southern California. Some juvenile pealei birds follow a coastal route to southern California as well.

The spring migration of Peregrines is undoubtedly underway during March at southern latitudes with a heavy movement along the Gulf coast during April and May. Birds arrive in southern Canada as early as mid-April in some years with the heaviest movement in central Alberta being from May 4 to 23. In southern Ontario, the usual peak is April 15 to May 5. Arrival on the northern Alaskan breeding grounds is probably after mid-May but Yukon birds are somewhat earlier. A spring movement along the west coast through Washington State occurs from late March through early May. The peak is likely in April, coinciding with the major movement of shorebirds along the coast.

Spring migration routes are not as well known or defined as the fall routes. The Texas coast near Padre Island is a major spring staging area during April as birds are thought to be following the middle-American stem from South America. At Padre Island, the Gulf coast turns eastward which competes with the preferred direction for migrants. Routes to northern breeding grounds are felt to be fairly direct with the eastern seaboard not experiencing the concentrations of falcons that occurs during the fall. A significant portion of the northern breeding population of Peregrines is felt to utilize this relatively small area of south Texas and northeastern Mexico.

BEHAVIOR

The Peregrine has long been known for its fast flight during diving attacks, but it does exhibit other flight modes. Normal flapping flight speed is about 25 to 40 miles per hour (40 to 64 kilometers per hour) with a rate of about four wingbeats per second. The flap is quite

shallow and seems to undulate down the wing in pulses. Descriptors such as fluid, rhythmic, and elastic have also been used for this flight style. When conditions are optimal, birds will soar with the tail spread and take advantage of thermals. But it is perhaps the high speed stoop that stirs the imagination. Recorded speeds of 170 to 220 miles per hour (272 to 352 kilometers per hour) in an angled dive are cited by some researchers with theoretical maximums of 245 miles per hour (392 kilometers per hour) attainable but others suggest the maximum is closer to 110 to 130 miles per hour (176 to 208 kilometers per hour). More normal strike speeds are probably around these lower limits. Perching on elevated sites is used as a hunting tactic, but at other times, low perches such as fence posts, logs on mud flats, humps on open ground, trees, cliff faces or buildings may be used. General intolerance of human activities near nest sites seems to be the norm, but birds using buildings in cities indicate some adaptive capability.

The hunting tactics are grouped into 14 basic categories but combinations are usually used to effect a kill. Hunting is done during the day and may occur at dusk or in the early morning. Nocturnal hunting has been suggested but evidence is lacking. Some studies indicate that different races of the Peregrine Falcon will employ certain tactics over others, depending upon the preferred prey base, size of the falcon and other differences that influence hunting success.

Perch and Wait

- most hunting seems to be of this type where a high promontory, tree or other perch is used to survey the countryside and to launch an attack at the prey.

Soaring and Stooping

- from high elevation flight, the Peregrine Falcon will spot flying prey and stoop upon them at great speed. The resulting collision usually stuns and may kill the victim.

Straightaway Flight

- prey species are simply overtaken with fast flight and picked from the air by the falcon's talons with this particular technique. The victims are often small and may be killed and eaten while the falcon is still flying.

Low Level Hunting (contouring)

- birds will fly low over the ground, hiding behind bushes, hills or other objects in order to effect a surprise attack on unsuspecting prey. Falcons hunting over the ocean will use waves to hide behind as well.

Accipiter Method

- occasionally in forested regions, the Peregrine Falcon will remain concealed in or below the forest canopy and then rise closely to birds perched above.

Fishing

- the Peregrine Falcon has been observed to snatch Arctic Grayling from shallow water.

Piracy

- like the Gyrfalcon, the Peregrine Falcon has been known to follow dogs, human beings and Northern Harriers and then to attack prey flushed by these "beaters." This falcon has also been seen stealing fish from an Osprey and is known to rob other Peregrine Falcons.

Cooperative Hunting

- occasionally, mated pairs will hunt together and one will maneuver prey into position for the other to strike.

Bat Catching

- utilizing the stoop or straightaway pursuit, the Peregrine Falcon will capture bats much as they do other flying prey of similar size.

Cannibalism

- the Peregrine Falcon has been seen to eat its own eggs when accidentally broken, but it is not known whether this was an action to keep the nest clean, to benefit nutritionally, or both.

Nest Robbing

- there have been a few observations of pre-flight young being taken, particularly of colonial nesting species.

Insect Hawking

- the aerial pursuit and capture of large insects is seldom reported but juveniles appear to engage in this more frequently than do adults.

Carrion Eating

- rarely, the Peregrine Falcon has been seen feeding upon dead birds apparently killed by some other source.

Pursuit on Foot

- observations have been made of birds walking on the ground chasing insects and fiddler crabs have been taken by birds walking through a marshy area.

The high speed stoop of the Peregrine Falcon will often kill prey upon impact. High speed passes using the feet to strike a blow to the victim's head are also used. A bite to the neck is used to dispatch prey whether or not it has died from the initial contact. If they are not being taken back to the nest, small victims may be consumed in mid-flight and aerial feeding is not uncommon amongst Peregrine Falcons that hunt at sea. Larger animals may be taken to a plucking site during the breeding season or they may be consumed near the killing site. Before delivering prey to his mate or nestlings, the male often eats the head. Although it can go for several days without feeding, the Peregrine Falcon will consume up to one-quarter to one-third of a pound of food per day. In Alaska, it was estimated that parents and their brood require the equivalent of 100 ptarmigan or ducks or about 2,000 songbirds during the four month nesting period. Virtually all prey is dismantled before consumption.

The Peregrine Falcon will "flight bathe" by splashing into water and rising up immediately to keep on flying. Usually, birds walk into shallow water and splash and douse themselves until thoroughly wet. They will drink and then fly off to a perch to dry. Long grass wet with dew is also used to bathe and salt water is avoided. A common posture for drying is with the back to the sun and the wings and tail partially spread. Wing flapping and feather shaking is common during the drying process.

Nest defense is well-developed in the Peregrine Falcon but it does not seem to have developed the pugnacious reputation of the Prairie Falcon. Territorial defense includes a range of pursuit, attack and strike behavior along with vocal chitterings. Opponents may lock talons and tumble earthwards and rarely, death may occur during such encounters. The Peregrine Falcon will attack eagles with vigor and possibly all buteos are pursued, particularly the Rough-legged Hawk. Great Horned Owls will take Peregrine Falcon young and in return, the falcons will strike and occasionally kill Great Horned Owls when discovered. Ravens and Peregrines often scrap over the possession of nesting cliffs but the Raven can be a wily and formidable adversary, often inflicting injury to the attacker.

The Peregrine Falcon is a solitary nester but the presence of suitable habitat and an abundant food supply has resulted in densities of *F. p. pealei* as high as one nest per mile

(1.6 kilometers) of coastline. Three pairs within one-half mile (0.8 kilometer) in an inland location in southern British Columbia were recorded for *F. p. anatum* in 1906. Other locations in northern Canada have inter-nest distances ranging from two to 12 miles (3.2 to 19.2 kilometers) but in Britain, nests as close as 300 feet (93 meters) have been recorded. During the pre-pesticide era, population densities in the United States may have ranged from one pair for every 500 to 20,000 square miles (1,295 to 51,800 square kilometers) but home ranges are more likely in the range of 20 to 50 square miles (51.8 to 129.5 square kilometers) per pair. Territorial defense occurs generally within 300 to 1,500 feet (93 to 465 meters) of the nest, depending upon the identity of the approaching species.

Except in resident populations where the nesting territory may be occupied year round, the males arrive at the eyrie about one week prior to the females. He advertises his presence with noisy high circling flights and high perching displays. Arrival of the female initiates an elaborate, spectacular series of aerial performances that can last for two to four weeks and culminate in formation of the pair bond. In the early phase of courtship, activities include high-circling above the nest site, high-perching, the undulating sky dance consisting of steep dives and pullouts, aerial "kissing" where the beaks touch, slow flights with wings held high and feed out to land at the ledge, and a variety of postures, bowing, cooperative hunting and nest defense behaviors and vocalizations. Later, various displays occur on the nesting ledge by both sexes that include bowing, variations of walking, scraping, and vocalizations. The female selects the scrape to be used for the eggs. Food-related begging, aerial displays and vocalizations by the female indicates that she wants the male to feed her, which he may do for up to four weeks prior to egg-laying. The female indicates readiness for copulation by tipping forward and uttering "eechip" calls and watching the male. He has various displays and calls that he uses to induce copulation interest. Copulation occurs several times per day for several weeks prior to egg-laying. Lifelong monogamy has been suggested but this may only occur in some pairs and has been questioned as the norm for most populations. Lost mates are replaced.

The potential longevity in the wild and for captured birds has been suggested as 20 years. The average life expectancy for birds that survive to breeding age is five to six years. The first year mortality has been estimated as high as 60 percent or more in some populations, with much of this not taking place on the breeding grounds. Population mortality rates of 25 to 30 percent have been noted. Causes include shooting on the wintering grounds for taxidermy, random shooting by hunters, electrocution on power poles, predation, density-related territorial disputes, organochlorine pesticide effects, natural attrition, accidents, and so forth.

ADAPTATIONS

The diet of the Peregrine Falcon, although highly avian in composition, shows more variety than any other North American falcon. As well, it has shown a remarkable ability to adapt to a wide variety of habitats and climates worldwide. It has been suggested that one limitation has been the need to nest in a location which includes the combination of an abundant prey base in proximity to large areas of open air space for high speed aerial pursuits. The prey species must be willing to cross these open spaces in order to be vulnerable to capture by Peregrines.

HABITAT

In all seasons, the Peregrine Falcon is a bird of open spaces. Historically, it has bred in a wide variety of habitats ranging from desertlike conditions through temperate forest and arctic tundra. A common factor in all habitats is the presence of suitable nesting cliffs, often near rivers or bodies of water, but the mere presence of these physical conditions does not guarantee the presence of Peregrine Falcons. *F. p. anatum* occupies North America from the

treeline south to Mexico and its habitats include or historically included coniferous and deciduous woodlands with open spaces, open grassland and shrub-steppe country as well as a variety of other intermediate variations. Hunting tends to take place above the forest canopy as opposed to inside the forest as with accipiters. *F. p. tundrius* is a bird of the treeless open spaces above treeline in the Canadian and Alaskan arctic. It occupies areas far from the ocean in the harsher northern climates. On the west coast of North America, *F. p. pealei* is a bird of the cool, temperate rainforests at the interface with the sea. It hunts over the ocean and does not occur inland, preferring islands to even the mainland coast.

The breeding habitat of all races includes cliffs of rock or dirt but there are populations that will use trees as nest sites. The presence of water is also a common element and it may be in the form of rivers, large lakes or oceans. Rarely, Peregrine Falcons have become resident around large, metropolitan cities. Wintering habitats for migrant birds are also diverse and may only require a prey base with suitable perching sites. Migrating falcons can be found almost anywhere but show preferences for open places such as beaches, sand dunes, river deltas or other non-treed areas where prey species congregate and would find escape difficult.

VOICE

There is much variation in the descriptions of the Peregrine Falcon's voice but all might be thought of in terms of variations of several basic calls. The voice of the male is higher than that of the female. "Cacking" is the most commonly described call and is used in nest defense or as a rapid fire scream during an attack. When perched high during courtship or when the female is ready to copulate, either sex may give the "waik" call. "Eeechip" is used during mutual courtship and breeding displays as well as during some aggressive and fighting circumstances. When making the nest scrape, "chuckles" are uttered and when begging for food a "treble-whine" is given. "Eep-eep-eep" is used during aggressive chase, "upchip" when the female is ready to copulate and "chitter" for copulation readiness. When she is not ready for copulation, the female utters a "chup-chup" and when mounting for copulation, the male gives the "chutter" call. When being threatened with attack, the "treble-whine", and "chitter" are used. Most calls are used in various contexts and relate to advertising, display, copulation, feeding and territorial defense.

FOODS

The primary food of the Peregrine Falcon is birds, and more than 250 species worldwide have been recorded as prey. Other items include small mammals (bats, rodents), insects, fish, crabs, slugs and rarely carrion. *F. p. pealei* concentrates upon seabirds, and particularly alcids, such as auklets and murrelets, but will take ducks, storm-petrels, and shorebirds amongst others. *F. p. tundrius* concentrates on smaller birds such as passerines and shorebirds but is quite capable of dispatching ptarmigan or ducks. In times of high rodent numbers, this race will exploit the mammal component very successfully. *F. p. anatum*, on the breeding territory or in migration along with *tundrius*, utilizes many forest species that venture into open country or birds of the open spaces such as Rock Doves, jays, flickers, blackbirds, swallows, pheasants, and so forth. In North America, food studies have shown birds to occupy an average of 98 percent of the diet of all Peregrine Falcons studied. Species represented in large numbers were Rock Doves, Mourning Doves, Crested Auklets, Least Auklets, Ancient Murrelets, Common Snipes, Gray Jays, and Lapland Longspurs. Shorebirds have been a large component of diets in some locations.

PELLETS

The pellets are elongated and blunt-ended and range from 1.5 to 2 inches (38.1 Millimeters) long by 1 inch (25.4 millimeters) in diameter. They may contain feathers, fur,

chitin, claws or bits of vegetation but never bones. Digestive juices seem to eliminate all prey bones. Pellets are regurgitated once per day and may accumulate at nest sites, plucking posts or below perches.

NESTING

The preferred nest sites are on cliffs, steep banks or rocky islets and are often close to water. Ledges on tall buildings and trees have been used as well as quarries, church towers, bridges and assorted other sites such as hummocks, dirt slopes or dykes. The most common nest in North America is a scrape on a rocky ledge, often with a bit of an overhang and some dirt or debris on the ledge to scrape a laying site. The site is not necessarily on the highest cliff face in the area. If alternate sites are available, mated pairs may rotate amongst several over the course of years. Nest sites are traditional and some have been used for hundreds of years.

Tree-nesting has been infrequently documented in North America, such that a small population of pealei using old Bald Eagle nests and tree cavities along the coast of British Columbia is of interest. Six such nests within 15 miles (24 kilometers) of each other suggests the possibility of a genetically-related population that has adopted the strategy in the absence of suitable cliffs and the presence of large numbers of alcids nesting at the same sites.

The clutch size varies from three to four eggs. Rarely, clutches have reached seven eggs. The egg-laying interval is normally 48 hours but it may extend to 72 hours and can take place anytime during the day. The Peregrine Falcon is single-brooded, but replacement clutches may be initiated within two to three weeks and as many as four replacements have been noted in wild birds. By removing clutches, a female may be induced to lay up to 20 eggs. The egg ground color varies from creamy through browns and reddish, overlain by dots and blotches of warm browns with considerable variation. The shell is smooth and the eggs are subelliptical in shape. In the largest race, *F. P. pealei*, egg size ranged from 1.91 to 2.28 inches (48.5 to 58 millimeters) in length and 1.54 to 1.69 inches (39.1 to 43 millimeters) in width and averaged 2.10 inches (53.3 millimeters) long and 1.60 inches (40.6 millimeters) wide. Eggs for *F. p. anatum* ranged from 1.91 to 2.24 inches (48.5 to 57 millimeters) in length and 1.52 to 1.71 inches (38.5 to 43.5 millimeters) in width and averaged 2.09 inches (53.23 millimeters) long and 1.62 inches (41.26 millimeters) wide. Eggs of the race *F. p. tundrius* average slightly smaller.

The age at first breeding is generally two years. The males arrive at the nest site first and following the laying of the last egg, incubation is mainly by the female. Captive males have incubated for up to one-quarter of the daylight hours. The male hunts for the female and the young as most of the brooding of the nestlings is done by the female. He will cache food nearby and the female will retrieve it during her brief forays from the nest. The incubation period varies from 33 to 35 days. Nestlings are brooded continuously for 10 to 14 days after which the downy feathers are well-developed and brooding time decreases steadily. Activity outside of the nest by the young increases by about day 28 and fledging occurs from 40 to 49 days after hatching. Once the young are on the wing, there is close association for up to 60 days in some populations. Behavior during this period is varied and includes feeding, hunting, aerial acrobatics and practice flights. In some cases, the onset of migration may terminate the family bond, but it is not universally so. Young have been seen with parents as far south as the Gulf coast of Texas.

CONSERVATION

The abrupt decline of primarily the *anatum* and *tundrius* races of North American Peregrine Falcons between the 1940s and 1970 has been well-documented. Declines

elsewhere in the world were noted and the effects of various pesticides have been studied extensively and documented as a major cause of the declines. Recovery in parts of the former range was rapid where there was a healthy remnant population left such as in the arid southwestern United States. Reintroduction of captive bred birds has been undertaken in portions of the range in the continental United States and Canada but not without some controversy about the action. By 1985, recovery in many of the world populations was documented but some were still in trouble, including parts of the Yukon, the northern Rocky Mountains, the Northwest Territories, Colorado, and Texas. Despite some inadequately answered questions about the details of the pesticide impacts, the fate of released birds, and the state of our knowledge about the population dynamics of Peregrine Falcons, there is optimism that the future for this falcon is a positive one. Population estimates vary, but there was likely 2,800 to 3,800 breeding pairs in North America during the mid 1980s.

Conservation efforts will likely focus around a number of key initiatives such as:

- the provision of suitable nest sites in developed parts of North America where a suitable prey base exists
- a better understanding and possible manipulation of gene flow between small populations that are reproductively isolated from other groups due to the Peregrine Falcon's tendency to return to its natal area to breed
- techniques to successfully introduce birds into areas that are re-colonizing slowly due to the strong philopatric tendencies of Peregrine Falcons
- understanding the details of the new gene pool and racial characteristics of the falcons introduced to the range formerly occupied by *P. f. anatum* prior to the pesticide era declines. The new birds are from a different genetic background and will evolve differently from the original occupants.
- better understanding and efforts to conserve Peregrine Falcons in other continents where our knowledge is limited. Places like South America, Russia, India, China, and Japan are little-known at the present time.
- continued education in North America and the world to prevent the slaughter of raptors by hunters and collectors
- continued monitoring and careful management of the known populations so that other threats to their survival such as the loss of habitat for their prey base does not become an even greater problem than the pesticide impacts.

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Gyrfalcon

Falco rusticolus

GENERAL DESCRIPTION

The consummate falcon of the Arctic region - the Gyrfalcon - is a bird that stirred the imagination of Kublai Khan and was written about by Marco Polo. It is a large and powerful falcon with plumage that varies from nearly pure white through very dark sepia and tones of streaked gray in between. The Gyrfalcon lacks the large mustache of the Peregrine Falcon, and the two-toned underwing of both the gray-morph and dark-morph birds distinguish them from other larger falcons. The two-toned underwing is less pronounced on adult gray-morph Gyrfalcons. The white birds are unlike any other. The flight is fast and powerful.

Nesting is on cliffs in the northern latitudes, with most birds spending the entire year close to the breeding grounds. Post-breeding dispersal brings some birds as far south as the northern United States every year, providing excitement and anticipation amongst birdwatchers anxious to see the "big northern Gyrfalcon!"

SIZE

The Gyrfalcon is the largest of the North American falcons. The females vary from 20.5 to 25.5 inches (52.1 to 64.8 centimeters) with an average of 22 inches (55.9 centimeters) in length, and wingspreads from 47 to 53 inches (119.4 to 134.6 centimeters). Their weights vary from 2.5 to 4.4 pounds (1134 to 1996 grams). Males are slightly shorter at 19 to 22.5 inches (48.3 to 57.2 centimeters) with an average of 21 inches (53.3 centimeters), and wingspreads from 40 to 49 inches (101.6 to 124.5 centimeters). They weigh between 1.75 and 2.9 pounds (794 to 1,315 grams). Weight ranges of live birds captured in the wild can vary depending upon breeding condition, time of year, and whether prey has been recently captured and is still in the crop. In one study, live captured migrants in Greenland did not exhibit such a wide weight variation with females averaging 3.2 pounds (1,451 grams) and males 2.8 pounds (1,270 grams).

MORPHS AND MOLTS

The Gyrfalcon ranges in color from pure white birds with darker spots, through degrees of gray to an extreme of very dark brown. This has led many authors to describe three morphs, or color phases, as white, gray, and dark or black. Others disagree with such divisions and suggest that color variation is a continuum from white to dark with much variation between. The specific descriptions follow this latter philosophy, but for ease of organization it will arbitrarily deal with white, gray, and dark groupings of plumages. Sexes are generally alike but males can be lighter overall than females, especially in gray-morph birds. Often in males, the saturation of dark pigments is not as great as in females but this is not universally true.

Molting occurs annually, and following the juvenile plumage, birds reach adult plumage after the first molt (2nd calendar year of life). Appearance does not change with subsequent molts. Molt in the adults begins while the young are still in the nest but the ability to fly is never lost. Wings and tail begin to molt first, followed by body feathers, with the entire process lasting about five months (in captive birds). Molt from the juvenile into adult feathering starts with the body feathers during the first winter. The wings and tail feathers start at the same time as the adults, which is in the April to May period.

SPECIFIC DESCRIPTION

Adults Gray-morph - Perched

Note that this color-morph includes a spectrum of plumages ranging from gray through brown except for the darkest of birds.

HEAD

- variably gray on the crown, sides and nape with light whitish streaks
- usually white across the forehead, on the chin, and in superciliary area above the eye
- some birds may have a narrow dark mustache mark extending down from the eye
- there is often a dark area behind the eye and the cheek is pale with variable dark markings
- the beak is bluish basally with a dark tip
- the cere is yellow and eyelids pale flesh
- the eye is dark

BODY

- the underparts are white with dark spotting on the breast and belly and variable dark barring on the flanks (sides)
- the back varies from slate gray with or without a sepia tinge and these feathers have variably light margins and pale gray cross bars

WINGS

- as for the back with a slate gray color and pale gray cross bars on the primaries and scapulars
- the primaries have long, unbarred dark tip areas

TAIL

- banded with alternating light and dark gray bands on the dorsal surface, but usually white beneath

LEGS

- the legs and feet are yellow and the talons black

Immature Gray-morph - Perched

HEAD

- dark, gray-brown crown and nape with pale streaking
- usually white across the forehead, on the chin and in superciliary area above the eye
- some birds may have a narrow dark mustache mark extending down from the eye
- there is often a dark area behind the eye and the cheek is pale with variable dark markings
- beak bluish horn with a darker tip
- cere and eyelids bluish gray
- the eye is dark

BODY

- underparts are white with heavy dark-brown vertical streaking
- the back is grayish-brown and more brown than the adults
- usually a pale fringe on each feather which gives bird a "scalloped" appearance

WINGS

- upper wing coverts are colored similarly to the back
- the primaries are extensively dark tipped

TAIL

- dark brown with numerous narrow, light bands that vary in width between individuals

LEGS

- the legs and feet are bluish to greenish gray and the talons black

Adult Gray-morph - Flight

- a large grayish to gray-brown falcon on the dorsal surface with a variably whitish, gray-spotted and barred underside
- the back may have a scaled appearance with a gray, banded tail
- the head and chest contrast with the back and underparts
- the underwing appears two-toned as the lighter primaries contrast with the coverts in the inner part of the wing

Immature Gray-morph - Flight

- a large falcon with a two-toned underside on the wings as in the adults of the gray variant; flight feathers paler than underwing coverts
- the belly appears browner and more streaked than in adults and the back appears darker and browner

SIMILAR SPECIES

Evolutionarily, the Gyrfalcon is felt to be related to the Saker Falcon of Eurasia. Under certain conditions in the field, this bird is most likely to be confused with the Peregrine Falcon. The "Peale's" race of the Peregrine Falcon is dark and may be confused with darker Gyrfalcons, especially in immature plumage. The uniformly dark underwing of the Peregrine Falcon versus the two-toned underwing of the Gyrfalcon are important distinctions. The Gyrfalcon and Peregrine Falcon have different wing-to-tail ratios. When perched, the wings are much shorter than the tail on the Gyrfalcon while they are equal, or nearly so, on the Peregrine Falcon. Occasionally, the Northern Goshawk may be mistaken for the large falcon as its wingbeats and wing tips are very similar. The pale, barred underwing and heavily-banded tail of the Northern Goshawk distinguishes it. Partially albinistic Red-tailed Hawks may be confused with white-morph Gyrfalcons, but dark marks on the nape, usually some red in the tail, and lack of clear area at dark wing tips should easily separate this buteo from the falcon. In flight, wing shape and flight style will distinguish the Red-tailed Hawk immediately.

OTHER NAMES

The Gyrfalcon is also known as "Black" Gyrfalcon, "Gray" Gyrfalcon, "Gyr:", "Jerfalcon", "Partridge Hawk", and "White Gyrfalcon."

ETYMOLOGY

The genus *Falco* is of Latin origin and means "sickle." This is likely in reference to the shape of the talons. The species name *rusticolus* is also from Latin and appears to be a construct of two words - *rusticus*, "countryman" and *incola*, "inhabitant." Combined, the words therefore mean "an inhabitant of the countryside", referring to this falcon's habitat of wide open, wild spaces. *Gyr* is traceable to the Old High German language and the word "giri" meaning greedy. Thus, this is the greedy falcon.

MYTHOLOGY

The Gyrfalcon has long been a coveted species in the world of falconry and prized as one of the most glamorous and mystical of the birds of prey.

RANGE

The northern latitudes of the world is home during the breeding season for the Gyrfalcon. In North America, breeding is restricted to portions of northern, western, and southern Alaska, extreme northwestern British Columbia, the northern and central Yukon, northern Northwest Territories, the Arctic islands, and northern Quebec (Labrador).

Wintering occurs from the breeding range south, irregularly throughout Canada to the northern United States. Extremes of southern occurrence, infrequently, are to about the middle of California and the most northerly fringes of Arizona, New Mexico, and Oklahoma and then easterly to southern Kentucky and Virginia. Areas where at least some birds can be found year round include the southern parts of the Arctic archipelago, Alaska, and the northern continental parts of Canada.

Worldwide, the breeding range of the Gyrfalcon includes Greenland, Iceland, and the Eurasian mainland from Norway east throughout the former U.S.S.R.

MIGRATION

Southward movements do not include the whole population and are irregular from year to year and possibly geographically. Birds do not seem to go any farther south than necessary to find food, thus a pronounced regular pattern of migration does not occur. The exception is in juvenile birds that regularly move out of at least the higher latitudes. Migration patterns of ptarmigans within the northern latitudes affect responses by Gyrfalcons.

Movement from the Arctic archipelago occurs from late August onwards into early October, with birds moving into warmer regions of the Northwest Territories or Labrador for the winter. This movement precedes the major movement of ptarmigan by a few weeks so that the falcons are strategically positioned to intercept incoming prey. Regular fall movements are reported in northwestern Alaska. Birds reach southern Canada as early as mid-October, with similar arrival times in the northern United States. Big flight years south are presumably correlated with cyclical lows in the populations of northern ptarmigans. By the end of March or early April, birds are gone from the southern latitudes. Migration routes are not well-documented, but coastal movements in Alaska are well-known in the fall. Spring movements are not documented.

BEHAVIOR

In flight the Gyrfalcon is fast and powerful, often appearing slower than it really is due to the size of the bird. Wingbeats are at times slow, deep and powerful, but on other occasions, wing movement is limited to the outer portions or "hands." Soaring and gliding on level wings as well as hovering have been noted. The level flight speed is faster than that of a Peregrine Falcon.

Hunting occurs near the ground with flight usually within six feet (1.9 meters) of the surface and following the contours of the land. This "contouring" behavior is often used in conjunction with some of the following major categories:

Perch and Wait

- a temporary perch such as a rock or low tree is used to spot potential prey before dropping off into a contouring flight pattern for the final approach.

Soaring and Quartering

- upon leaving a perch, birds may rise up at a steep angle and then circle or soar at heights of several hundred feet or more before moving away in search of prey. They rarely stoop from the soar as do Peregrine Falcons.

Contouring

- searching while flying low over the ground following the contours is an alternative to the soaring search.

Piracy- although normally shy, Gyrfalcons have followed trappers and hunters and taken prey that were flushed or killed. This behavior may occur with other birds but has not been documented.

Strike, Kill, and Consumption

- preferably from above and behind, a disabling blow with the feet is struck as the falcon approaches its prey at high speed. Upon a quick return, the victim is grasped with the talons and bitten through the neck at the base of the skull to effect the kill. More prey is taken on the ground or water than from the air. The prey may be eaten on the spot, but more often, it is taken to a plucking site where it is eaten or plucked and taken to the nest site. The sternum of large birds is bitten through and long bones pulled from their sockets as part of the feeding process.

The Gyrfalcon will bathe in both water and snow. Normally, the Gyrfalcon is thought of as a solitary bird that is usually seen alone or with a mate during the nesting season. The exception seems to be during the fall migration, or at certain high latitude wintering sites, where primarily juvenile birds will gather together. This may be in response to localized food resources and foraging opportunities as opposed to a desire for sociability. Nesting densities with internest distances as close as every 6 miles (9.6 kilometers) have been recorded in productive habitat in the Northwest Territories, but normally, distances are greater. The hunted areas of pairs in one Alaskan study ranged from 75 to 375 square miles (195 to 971 square kilometers) but this relates to food supply rather than defended territory.

There does not appear to be a pugnacious reputation surrounding this species as with some other falcons, but they are not fearful of attacking larger birds. Eagles seem particularly prone to their furious attacks if they have entered the breeding territory of a pair of falcons. The female Gyrfalcon is more inclined to make the attacks on these large birds, making them easily-trained by falconers to hunt larger species. In defense of its nest and territory, this large falcon will also attack wolverines, foxes, ravens, and other raptors, but it usually slips away at the sight of human beings. Quarreling with ravens in its territory is a frequent occurrence.

"Play" has been described primarily as mock attacks on inanimate objects and sometimes other birds. Young, captive falcons have attacked bushes, grass clumps, pieces of dirt, and other items during these activities.

Home ranges in Alaska vary from 83 to 700 square miles (215 to 1,813 square kilometers) and probably average closer to 400 square miles per pair (1,036 square kilometers). In Iceland, ranges as small as 25 square miles (65 square kilometers) were noted and in Sweden in a peak lemming year, single pairs may have been surviving within 1 square mile (2.6 square kilometers) ranges.

At certain latitudes, males occupy the breeding territory year round, presumably allowing them to defend the nest site and to establish it early in the process. The courtship phase includes variations and combinations of

several basic activities that include advertising by lone males, courtship flights by paired birds, nest ledge displays, food transfer and copulation. Advertising by the male includes at least the following activities with much variation on the core themes:

Eyrie Flyby

- this consists of repeated figure 8 flights past the nest with the crossing point directly in front of the nest. Wailing calls accompany the flight.

Wail-Pluck

- while plucking prey, the male will utter wailing calls, pause to look about and finally eat the item.

Male Ledge Display

- at a prospective nest site, the male will stand in a horizontal posture with the beak pointing downward and utter a series of "chup" notes. If mated, he may scrape the nest site.

Undulating Roll

- beginning in level flight, the male will partially roll in one direction and then roll 180 degrees in the opposite direction. Partway through the second roll, the bird will enter a steep dive and return to level flight at the bottom, rise again to the original altitude and begin the display again.

Wail

- wailing is a two syllable call given in a sequence of up to ten notes and is given more often by unmated males than by mated birds.

There are various flight behaviors where the female will join the male and execute a series of tandem activities such as mutual floating descent, passing and leading or food transfer. As well, a variety of pre-copulatory activities can be initiated by either sex. Copulation never seems to occur right at the nest site and begins about one month before egg laying. The number of copulation's for the entire nesting period is not likely as high as in other falcons and ends when the third egg is laid. Forty-seven copulation's were documented in one Yukon study.

Captive birds have lived as long as 30 years, but the average is closer to eight or 10 years. There appears to be no information recorded for wild birds. A high mortality for first year birds has been suggested by many authors, but information is presumptive and data is sparse. Starvation can affect nestlings when prey availability is lowered. On average, it appears that each pair of birds is able to raise two young and in good food years, this may increase to three. Sources of mortality include shooting, disease and starvation, with the latter likely being the greatest cause of death in most populations. Reduced production due to pesticide impacts does not seem to be a problem for Gyrfalcons. Predation by other raptors or mammals has been alleged but poorly documented. The impacts of illegal falconry are not documented for North America but this has been a cause of serious declines in Finland during this century. Elsewhere, heavy exploitation appeared to cause no decline.

ADAPTATIONS

The halux, or rear toe, is not fixed as in other falcons and can be rotated forward alongside the other three toes. This allows the bird to lie prone on the breast with both feet flat on the ground under the breast. Birds sleep in this position and can enter states of deep sleep. These circumstances are valuable during severe weather conditions when a lowered energy output and maximum heat retention position would be important survival aids. The clutch size appears to be directly linked to the size of the major prey populations. This is particularly useful to a species that has a limited prey base, and would be unable to feed a

large clutch by simply increasing the variety of animals hunted to compensate for losses in other species.

HABITAT

The Gyrfalcon is one of the few quintessential birds of the high arctic. It prefers open tundra country and breeds south to the sparsely treed edge of the northern boreal forest. The presence of rocky cliffs for nesting is an essential component of the habitat. Alpine zones in the mountains of Alaska and northern British Columbia are also utilized, but extensive areas of boggy tundra are avoided, probably due to the absence of nesting sites. At southern latitudes, during the winter, birds occupy habitats similar in general characteristics to the northern breeding areas, but modification by humans is often more extensive. Wintering Gyrfalcons select open, rolling grasslands which may be sparsely treed, lake edges, large river deltas devoid of trees or open farmlands. Coastal lowlands as well as interior valleys and plateaus are visited but extensively forested areas are avoided. Natural areas on the fringes, or within large metropolitan areas, may also be used. Open, marshy areas suitable for dabbling ducks are hunted as well as upland areas.

VOICE

The voice is generally louder, gruffer and deeper than that of the Peregrine Falcon, but many features are similar. The male's voice is higher pitched than that of the female. A guttural "kak-kak-kak" is given by both sexes as a territorial threat and mobbing call. The male will also give this during some flight displays with his mate. The wailing call is a two syllable vocalization that is used in a variety of courtship and other heterosexual situations. It is given mainly by males but females will utter it during copulation and after receiving food. A number of variations are used. A single syllable "chup" call is given by both sexes during various courtship displays and at other times during the nesting period. A faster version of this call known as the "chattering" call is also given during ledge displays and food - passing ceremonies. A "chittering" call is given by both sexes and is featured during copulation activities. Other calls include loud trilling, screams and rattling as well as variants of some of the above calls. Food begging calls of the young are querulous mewings and juveniles have been heard giving deep raven-like calls.

FOOD

The diet varies geographically and by season, depending upon the availability of prey items. Unlike the Peregrine Falcon, the diet of the Gyrfalcon is much more limited and often very focused on one or two major prey species. Throughout its range, this large falcon prefers to hunt ptarmigan wherever they are available. Both Rock and Willow ptarmigan are taken, but food studies seldom differentiate between them. As the breeding season progresses, Arctic ground squirrels become a major secondary source of food, especially as the ground squirrel young become available. Generally, birds make up 60 to 90 percent of the biomass in Gyrfalcon diets. The range of other prey species includes a variety of dabbling and diving ducks, sandpipers and plovers, Short-eared Owl, Northern Harrier, Rough-legged Hawk, jaegers, terns and gulls, a variety of passerines (Snow Bunting, Horned Lark, sparrows), hares, mink, rats, and microtine rodents such as lemmings. On southern wintering grounds, Gyrfalcons have been observed to take Mallards and have been seen hovering over a flock of Gray Partridge. Rock Doves may also be taken. Carrion feeding has been observed and prey included codfish, Glaucous Gull, and mammals caught in snares set by trappers. Caching of partially-consumed prey is a regular occurrence.

PELLETS

Pellet shape and size vary with the contents. Fresh pellets are generally elongate and

cylindrical with rounded or conical ends. The length can vary from 1.25 to 3.0 inches (3.2 to 7.6 centimeters) in length and the diameter is about 1 inch (2.5 centimeters). Pellets containing mostly fur are more regular in shape than those containing bones. When the contents are primarily skin or visceral organs, the consistency is much harder than the loose, amorphous pellets that are mainly feathers and hair. Pellet color will vary with age and content but range from browns through shades of gray or greenish to yellowish gray. They contain fur, feathers and small bones and occasionally vegetation from the viscera of ptarmigan.

NESTING

The preferred nesting site, called an aerie, throughout the range is on a cliff ledge with an overhang for weather protection. The average overhang will cover about 80 percent of the nesting ledge. Occupied cliffs vary in height from 50 to 110 feet (15.5 to 34.1 meters) with nest heights ranging from 12 to 90 feet (3.7 to 27.9 meters) above the base. There appears to be no preference for extremely high cliffs. Unoccupied stick nests of the Common Raven or Golden Eagle are readily used. Westerly or southerly exposures are preferred in some areas, but elsewhere, no directional preferences are apparent. Nest sites are most often not accessible to mammalian predators or humans without climbing gear. In wooded areas, stick nests built in trees by other raptors such as the Rough-legged Hawk are used. The nest may also be a slight scrape on a ledge with no nesting structure at all. The Gyrfalcon has occupied old stick nests on man-made structures such as gold dredges, pile drivers, and even a sluice box. Often, piles of debris such as old bones litter the nest site and the area is usually heavily-stained with droppings.

Clutch size varies geographically from two to seven, but frequently three to four eggs. The clutch size appears to be linked to the current food supply. The eggs are broadly oval and average 2.4 inches (6.1 centimeters) long and 1.8 inches wide (4.6 centimeters). The ground color is creamy white with various degrees of fine cinnamon-reddish spotting often overlain with brownish blotching. Rarely, eggs are all whitish but may also look brownish overall. The shell is granular and not glossy. A replacement clutch will be laid if lost early in the season.

The interval between laying averages 56 hours with the incubation period averaging 35 days. Incubation usually starts when the third egg is laid such that hatching is partially asynchronous in case of a large clutch size. The total time from the start of laying until the last egg is hatched in a four egg clutch averages 43 days. Some authors report incubation starting with the first egg laid. Clutch replacement in the event of loss early in the nesting period has been reported within 14 days. Incubation is mainly by the female, but the male may sit on the eggs for as much as one-third of the daylight hours. As the incubation period progresses, the male may sit for longer periods of time. Brooding of the young is done by the female but the male may show some interest for the first few days after hatching. Throughout the entire incubation and first ten days of the nestling period, the female is entirely dependent upon the male for food. Ordinarily, he does not feed the brood, but rather he brings food to the female who rips it into pieces for the nestlings. At about ten days after hatching, the down of the young is sufficiently-well developed for them to thermo-regulate on their own. The female begins to hunt and bring food along with the male.

During the nestling period, the young start actively competing for food at 15 days although they are not aggressive. At 30 days, they are able to feed on carcasses independently. Fledging takes place at 46 to 49 days and complete independence is gained after a further 30 or more days. The young are fed by the parents for the four to five weeks after fledging with the time from egg laying to complete independence of the young being at least 110 days.

CONSERVATION

Population estimates for Gyrfalcons in North America vary and there appears to be no recent estimates. In the mid to late 1980s, it was suggested that there may have been in excess of 1,300 pairs in Alaska and the Yukon. No estimates were available for the Northwest Territories or northern Quebec which were felt to have populations that could exceed the Yukon at 700 to 800 pairs. Worldwide, the estimates varied from 7,000 to 17,000 pairs for the same period. The North American population appears to be stable and fluctuations tied to the natural cycles of food sources such as ptarmigan. Given that most Gyrfalcons rely upon food sources that are not in contact with pesticides or industrial pollutants, there is not the concern for population declines for this reason, as in other raptors. Contaminants have been found in low levels but not sufficient to cause egg shell thinning. The pollutants were presumed to have come from the consumption of migratory birds that became contaminated during periods spent in southern latitudes.

Since earlier studies were completed, evidence that pollutants can reach Arctic areas via air currents suggests that vigilance may be warranted for populations of Gyrfalcons that feed heavily on seabirds. Other threats include aircraft overflights in nesting areas as the north becomes explored more heavily by helicopter. Population declines in Finland, due to egg collection, remind us that the potential impacts of legal or illegal falconry must never be forgotten.

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Gyrfalcon - gray

Falco rusticolus

GENERAL DESCRIPTION

The consummate falcon of the Arctic region - the Gyrfalcon - is a bird that stirred the imagination of Kublai Khan and was written about by Marco Polo. It is a large and powerful falcon with plumage that varies from nearly pure white through very dark sepia and tones of streaked gray in between. The Gyrfalcon lacks the large mustache of the Peregrine Falcon, and the two-toned underwing of both the gray-morph and dark-morph birds distinguish them from other larger falcons. The two-toned underwing is less pronounced on adult gray-morph Gyrfalcons. The white birds are unlike any other. The flight is fast and powerful.

Nesting is on cliffs in the northern latitudes, with most birds spending the entire year close to the breeding grounds. Post-breeding dispersal brings some birds as far south as the northern United States every year, providing excitement and anticipation amongst birdwatchers anxious to see the "big northern Gyrfalcon!"

SIZE

The Gyrfalcon is the largest of the North American falcons. The females vary from 20.5 to 25.5 inches (52.1 to 64.8 centimeters) with an average of 22 inches (55.9 centimeters) in length, and wingspreads from 47 to 53 inches (119.4 to 134.6 centimeters). Their weights vary from 2.5 to 4.4 pounds (1134 to 1996 grams). Males are slightly shorter at 19 to 22.5 inches (48.3 to 57.2 centimeters) with an average of 21 inches (53.3 centimeters), and wingspreads from 40 to 49 inches (101.6 to 124.5 centimeters). They weigh between 1.75 and 2.9 pounds (794 to 1,315 grams). Weight ranges of live birds captured in the wild can vary depending upon breeding condition, time of year, and whether prey has been recently captured and is still in the crop. In one study, live captured migrants in Greenland did not exhibit such a wide weight variation with females averaging 3.2 pounds (1,451 grams) and males 2.8 pounds (1,270 grams).

MORPHS AND MOLTS

The Gyrfalcon ranges in color from pure white birds with darker spots, through degrees of gray to an extreme of very dark brown. This has led many authors to describe three morphs, or color phases, as white, gray, and dark or black. Others disagree with such divisions and suggest that color variation is a continuum from white to dark with much variation between. The specific descriptions follow this latter philosophy, but for ease of organization it will arbitrarily deal with white, gray, and dark groupings of plumages. Sexes are generally alike but males can be lighter overall than females, especially in gray-morph birds. Often in males, the saturation of dark pigments is not as great as in females but this is not universally true.

Molting occurs annually, and following the juvenile plumage, birds reach adult plumage after the first molt (2nd calendar year of life). Appearance does not change with subsequent molts. Molt in the adults begins while the young are still in the nest but the ability to fly is never lost. Wings and tail begin to molt first, followed by body feathers, with the entire process lasting about five months (in captive birds). Molt from the juvenile into adult feathering starts with the body feathers during the first winter. The wings and tail feathers start at the same time as the adults, which is in the April to May period.

SPECIFIC DESCRIPTION

Adults Gray-morph - Perched

Note that this color-morph includes a spectrum of plumages ranging from gray through brown except for the darkest of birds.

HEAD

- variably gray on the crown, sides and nape with light whitish streaks
- usually white across the forehead, on the chin, and in superciliary area above the eye
- some birds may have a narrow dark mustache mark extending down from the eye
- there is often a dark area behind the eye and the cheek is pale with variable dark markings
- the beak is bluish basally with a dark tip
- the cere is yellow and eyelids pale flesh
- the eye is dark

BODY

- the underparts are white with dark spotting on the breast and belly and variable dark barring on the flanks (sides)
- the back varies from slate gray with or without a sepia tinge and these feathers have variably light margins and pale gray cross bars

WINGS

- as for the back with a slate gray color and pale gray cross bars on the primaries and scapulars
- the primaries have long, unbarred dark tip areas

TAIL

- banded with alternating light and dark gray bands on the dorsal surface, but usually white beneath

LEGS

- the legs and feet are yellow and the talons black

Immature Gray-morph - Perched

HEAD

- dark, gray-brown crown and nape with pale streaking
- usually white across the forehead, on the chin and in superciliary area above the eye
- some birds may have a narrow dark mustache mark extending down from the eye
- there is often a dark area behind the eye and the cheek is pale with variable dark markings
- beak bluish horn with a darker tip
- cere and eyelids bluish gray
- the eye is dark

BODY

- underparts are white with heavy dark-brown vertical streaking
- the back is grayish-brown and more brown than the adults
- usually a pale fringe on each feather which gives bird a "scalloped" appearance

WINGS

- upper wing coverts are colored similarly to the back
- the primaries are extensively dark tipped

TAIL

- dark brown with numerous narrow, light bands that vary in width between individuals

LEGS

- the legs and feet are bluish to greenish gray and the talons black

Adult Gray-morph - Flight

- a large grayish to gray-brown falcon on the dorsal surface with a variably whitish, gray-spotted and barred underside
- the back may have a scaled appearance with a gray, banded tail
- the head and chest contrast with the back and underparts
- the underwing appears two-toned as the lighter primaries contrast with the coverts in the inner part of the wing

Immature Gray-morph - Flight

- a large falcon with a two-toned underside on the wings as in the adults of the gray variant; flight feathers paler than underwing coverts
- the belly appears browner and more streaked than in adults and the back appears darker and browner

SIMILAR SPECIES

Evolutionarily, the Gyrfalcon is felt to be related to the Saker Falcon of Eurasia. Under certain conditions in the field, this bird is most likely to be confused with the Peregrine Falcon. The "Peale's" race of the Peregrine Falcon is dark and may be confused with darker Gyrfalcons, especially in immature plumage. The uniformly dark underwing of the Peregrine Falcon versus the two-toned underwing of the Gyrfalcon are important distinctions. The Gyrfalcon and Peregrine Falcon have different wing-to-tail ratios. When perched, the wings are much shorter than the tail on the Gyrfalcon while they are equal, or nearly so, on the Peregrine Falcon. Occasionally, the Northern Goshawk may be mistaken for the large falcon as its wingbeats and wing tips are very similar. The pale, barred underwing and heavily-banded tail of the Northern Goshawk distinguishes it. Partially albinistic Red-tailed Hawks may be confused with white-morph Gyrfalcons, but dark marks on the nape, usually some red in the tail, and lack of clear area at dark wing tips should easily separate this buteo from the falcon. In flight, wing shape and flight style will distinguish the Red-tailed Hawk immediately.

OTHER NAMES

The Gyrfalcon is also known as "Black" Gyrfalcon, "Gray" Gyrfalcon, "Gyr:", "Jerfalcon", "Partridge Hawk", and "White Gyrfalcon."

ETYMOLOGY

The genus *Falco* is of Latin origin and means "sickle." This is likely in reference to the shape of the talons. The species name *rusticolus* is also from Latin and appears to be a construct of two words - *rusticus*, "countryman" and *incola*, "inhabitant." Combined, the words therefore mean "an inhabitant of the countryside", referring to this falcon's habitat of wide open, wild spaces. *Gyr* is traceable to the Old High German language and the word "giri" meaning greedy. Thus, this is the greedy falcon.

MYTHOLOGY

The Gyrfalcon has long been a coveted species in the world of falconry and prized as one of the most glamorous and mystical of the birds of prey.

RANGE

The northern latitudes of the world is home during the breeding season for the Gyrfalcon. In North America, breeding is restricted to portions of northern, western, and southern Alaska, extreme northwestern British Columbia, the northern and central Yukon, northern Northwest Territories, the Arctic islands, and northern Quebec (Labrador).

Wintering occurs from the breeding range south, irregularly throughout Canada to the northern United States. Extremes of southern occurrence, infrequently, are to about the middle of California and the most northerly fringes of Arizona, New Mexico, and Oklahoma and then easterly to southern Kentucky and Virginia. Areas where at least some birds can be found year round include the southern parts of the Arctic archipelago, Alaska, and the northern continental parts of Canada.

Worldwide, the breeding range of the Gyrfalcon includes Greenland, Iceland, and the Eurasian mainland from Norway east throughout the former U.S.S.R.

MIGRATION

Southward movements do not include the whole population and are irregular from year to year and possibly geographically. Birds do not seem to go any farther south than necessary to find food, thus a pronounced regular pattern of migration does not occur. The exception is in juvenile birds that regularly move out of at least the higher latitudes. Migration patterns of ptarmigans within the northern latitudes affect responses by Gyrfalcons.

Movement from the Arctic archipelago occurs from late August onwards into early October, with birds moving into warmer regions of the Northwest Territories or Labrador for the winter. This movement precedes the major movement of ptarmigan by a few weeks so that the falcons are strategically positioned to intercept incoming prey. Regular fall movements are reported in northwestern Alaska. Birds reach southern Canada as early as mid-October, with similar arrival times in the northern United States. Big flight years south are presumably correlated with cyclical lows in the populations of northern ptarmigans. By the end of March or early April, birds are gone from the southern latitudes. Migration routes are not well-documented, but coastal movements in Alaska are well-known in the fall. Spring movements are not documented.

BEHAVIOR

In flight the Gyrfalcon is fast and powerful, often appearing slower than it really is due to the size of the bird. Wingbeats are at times slow, deep and powerful, but on other occasions, wing movement is limited to the outer portions or "hands." Soaring and gliding on level wings as well as hovering have been noted. The level flight speed is faster than that of a Peregrine Falcon.

Hunting occurs near the ground with flight usually within six feet (1.9 meters) of the surface and following the contours of the land. This "contouring" behavior is often used in conjunction with some of the following major categories:

Perch and Wait

- a temporary perch such as a rock or low tree is used to spot potential prey before dropping off into a contouring flight pattern for the final approach.

Soaring and Quartering

- upon leaving a perch, birds may rise up at a steep angle and then circle or soar at heights of several hundred feet or more before moving away in search of prey. They rarely stoop from the soar as do Peregrine Falcons.

Contouring

- searching while flying low over the ground following the contours is an alternative to the soaring search.

Piracy- although normally shy, Gyrfalcons have followed trappers and hunters and taken prey that were flushed or killed. This behavior may occur with other birds but has not been documented.

Strike, Kill, and Consumption

- preferably from above and behind, a disabling blow with the feet is struck as the falcon approaches its prey at high speed. Upon a quick return, the victim is grasped with the talons and bitten through the neck at the base of the skull to effect the kill. More prey is taken on the ground or water than from the air. The prey may be eaten on the spot, but more often, it is taken to a plucking site where it is eaten or plucked and taken to the nest site. The sternum of large birds is bitten through and long bones pulled from their sockets as part of the feeding process.

The Gyrfalcon will bathe in both water and snow. Normally, the Gyrfalcon is thought of as a solitary bird that is usually seen alone or with a mate during the nesting season. The exception seems to be during the fall migration, or at certain high latitude wintering sites, where primarily juvenile birds will gather together. This may be in response to localized food resources and foraging opportunities as opposed to a desire for sociability. Nesting densities with internest distances as close as every 6 miles (9.6 kilometers) have been recorded in productive habitat in the Northwest Territories, but normally, distances are greater. The hunted areas of pairs in one Alaskan study ranged from 75 to 375 square miles (195 to 971 square kilometers) but this relates to food supply rather than defended territory.

There does not appear to be a pugnacious reputation surrounding this species as with some other falcons, but they are not fearful of attacking larger birds. Eagles seem particularly prone to their furious attacks if they have entered the breeding territory of a pair of falcons. The female Gyrfalcon is more inclined to make the attacks on these large birds, making them easily-trained by falconers to hunt larger species. In defense of its nest and territory, this large falcon will also attack wolverines, foxes, ravens, and other raptors, but it usually slips away at the sight of human beings. Quarreling with ravens in its territory is a frequent occurrence.

"Play" has been described primarily as mock attacks on inanimate objects and sometimes other birds. Young, captive falcons have attacked bushes, grass clumps, pieces of dirt, and other items during these activities.

Home ranges in Alaska vary from 83 to 700 square miles (215 to 1,813 square kilometers) and probably average closer to 400 square miles per pair (1,036 square kilometers). In Iceland, ranges as small as 25 square miles (65 square kilometers) were noted and in Sweden in a peak lemming year, single pairs may have been surviving within 1 square mile (2.6 square kilometers) ranges.

At certain latitudes, males occupy the breeding territory year round, presumably allowing them to defend the nest site and to establish it early in the process. The courtship phase includes variations and combinations of

several basic activities that include advertising by lone males, courtship flights by paired birds, nest ledge displays, food transfer and copulation. Advertising by the male includes at least the following activities with much variation on the core themes:

Eyrie Flyby

- this consists of repeated figure 8 flights past the nest with the crossing point directly in front of the nest. Wailing calls accompany the flight.

Wail-Pluck

- while plucking prey, the male will utter wailing calls, pause to look about and finally eat the item.

Male Ledge Display

- at a prospective nest site, the male will stand in a horizontal posture with the beak pointing downward and utter a series of "chup" notes. If mated, he may scrape the nest site.

Undulating Roll

- beginning in level flight, the male will partially roll in one direction and then roll 180 degrees in the opposite direction. Partway through the second roll, the bird will enter a steep dive and return to level flight at the bottom, rise again to the original altitude and begin the display again.

Wail

- wailing is a two syllable call given in a sequence of up to ten notes and is given more often by unmated males than by mated birds.

There are various flight behaviors where the female will join the male and execute a series of tandem activities such as mutual floating descent, passing and leading or food transfer. As well, a variety of pre-copulatory activities can be initiated by either sex. Copulation never seems to occur right at the nest site and begins about one month before egg laying. The number of copulation's for the entire nesting period is not likely as high as in other falcons and ends when the third egg is laid. Forty-seven copulation's were documented in one Yukon study.

Captive birds have lived as long as 30 years, but the average is closer to eight or 10 years. There appears to be no information recorded for wild birds. A high mortality for first year birds has been suggested by many authors, but information is presumptive and data is sparse. Starvation can affect nestlings when prey availability is lowered. On average, it appears that each pair of birds is able to raise two young and in good food years, this may increase to three. Sources of mortality include shooting, disease and starvation, with the latter likely being the greatest cause of death in most populations. Reduced production due to pesticide impacts does not seem to be a problem for Gyrfalcons. Predation by other raptors or mammals has been alleged but poorly documented. The impacts of illegal falconry are not documented for North America but this has been a cause of serious declines in Finland during this century. Elsewhere, heavy exploitation appeared to cause no decline.

ADAPTATIONS

The halux, or rear toe, is not fixed as in other falcons and can be rotated forward alongside the other three toes. This allows the bird to lie prone on the breast with both feet flat on the ground under the breast. Birds sleep in this position and can enter states of deep sleep. These circumstances are valuable during severe weather conditions when a lowered energy output and maximum heat retention position would be important survival aids. The clutch size appears to be directly linked to the size of the major prey populations. This is particularly useful to a species that has a limited prey base, and would be unable to feed a

large clutch by simply increasing the variety of animals hunted to compensate for losses in other species.

HABITAT

The Gyrfalcon is one of the few quintessential birds of the high arctic. It prefers open tundra country and breeds south to the sparsely treed edge of the northern boreal forest. The presence of rocky cliffs for nesting is an essential component of the habitat. Alpine zones in the mountains of Alaska and northern British Columbia are also utilized, but extensive areas of boggy tundra are avoided, probably due to the absence of nesting sites. At southern latitudes, during the winter, birds occupy habitats similar in general characteristics to the northern breeding areas, but modification by humans is often more extensive. Wintering Gyrfalcons select open, rolling grasslands which may be sparsely treed, lake edges, large river deltas devoid of trees or open farmlands. Coastal lowlands as well as interior valleys and plateaus are visited but extensively forested areas are avoided. Natural areas on the fringes, or within large metropolitan areas, may also be used. Open, marshy areas suitable for dabbling ducks are hunted as well as upland areas.

VOICE

The voice is generally louder, gruffer and deeper than that of the Peregrine Falcon, but many features are similar. The male's voice is higher pitched than that of the female. A guttural "kak-kak-kak" is given by both sexes as a territorial threat and mobbing call. The male will also give this during some flight displays with his mate. The wailing call is a two syllable vocalization that is used in a variety of courtship and other heterosexual situations. It is given mainly by males but females will utter it during copulation and after receiving food. A number of variations are used. A single syllable "chup" call is given by both sexes during various courtship displays and at other times during the nesting period. A faster version of this call known as the "chattering" call is also given during ledge displays and food - passing ceremonies. A "chittering" call is given by both sexes and is featured during copulation activities. Other calls include loud trilling, screams and rattling as well as variants of some of the above calls. Food begging calls of the young are querulous mewings and juveniles have been heard giving deep raven-like calls.

FOOD

The diet varies geographically and by season, depending upon the availability of prey items. Unlike the Peregrine Falcon, the diet of the Gyrfalcon is much more limited and often very focused on one or two major prey species. Throughout its range, this large falcon prefers to hunt ptarmigan wherever they are available. Both Rock and Willow ptarmigan are taken, but food studies seldom differentiate between them. As the breeding season progresses, Arctic ground squirrels become a major secondary source of food, especially as the ground squirrel young become available. Generally, birds make up 60 to 90 percent of the biomass in Gyrfalcon diets. The range of other prey species includes a variety of dabbling and diving ducks, sandpipers and plovers, Short-eared Owl, Northern Harrier, Rough-legged Hawk, jaegers, terns and gulls, a variety of passerines (Snow Bunting, Horned Lark, sparrows), hares, mink, rats, and microtine rodents such as lemmings. On southern wintering grounds, Gyrfalcons have been observed to take Mallards and have been seen hovering over a flock of Gray Partridge. Rock Doves may also be taken. Carrion feeding has been observed and prey included codfish, Glaucous Gull, and mammals caught in snares set by trappers. Caching of partially-consumed prey is a regular occurrence.

PELLETS

Pellet shape and size vary with the contents. Fresh pellets are generally elongate and

cylindrical with rounded or conical ends. The length can vary from 1.25 to 3.0 inches (3.2 to 7.6 centimeters) in length and the diameter is about 1 inch (2.5 centimeters). Pellets containing mostly fur are more regular in shape than those containing bones. When the contents are primarily skin or visceral organs, the consistency is much harder than the loose, amorphous pellets that are mainly feathers and hair. Pellet color will vary with age and content but range from browns through shades of gray or greenish to yellowish gray. They contain fur, feathers and small bones and occasionally vegetation from the viscera of ptarmigan.

NESTING

The preferred nesting site, called an aerie, throughout the range is on a cliff ledge with an overhang for weather protection. The average overhang will cover about 80 percent of the nesting ledge. Occupied cliffs vary in height from 50 to 110 feet (15.5 to 34.1 meters) with nest heights ranging from 12 to 90 feet (3.7 to 27.9 meters) above the base. There appears to be no preference for extremely high cliffs. Unoccupied stick nests of the Common Raven or Golden Eagle are readily used. Westerly or southerly exposures are preferred in some areas, but elsewhere, no directional preferences are apparent. Nest sites are most often not accessible to mammalian predators or humans without climbing gear. In wooded areas, stick nests built in trees by other raptors such as the Rough-legged Hawk are used. The nest may also be a slight scrape on a ledge with no nesting structure at all. The Gyrfalcon has occupied old stick nests on man-made structures such as gold dredges, pile drivers, and even a sluice box. Often, piles of debris such as old bones litter the nest site and the area is usually heavily-stained with droppings.

Clutch size varies geographically from two to seven, but frequently three to four eggs. The clutch size appears to be linked to the current food supply. The eggs are broadly oval and average 2.4 inches (6.1 centimeters) long and 1.8 inches wide (4.6 centimeters). The ground color is creamy white with various degrees of fine cinnamon-reddish spotting often overlain with brownish blotching. Rarely, eggs are all whitish but may also look brownish overall. The shell is granular and not glossy. A replacement clutch will be laid if lost early in the season.

The interval between laying averages 56 hours with the incubation period averaging 35 days. Incubation usually starts when the third egg is laid such that hatching is partially asynchronous in case of a large clutch size. The total time from the start of laying until the last egg is hatched in a four egg clutch averages 43 days. Some authors report incubation starting with the first egg laid. Clutch replacement in the event of loss early in the nesting period has been reported within 14 days. Incubation is mainly by the female, but the male may sit on the eggs for as much as one-third of the daylight hours. As the incubation period progresses, the male may sit for longer periods of time. Brooding of the young is done by the female but the male may show some interest for the first few days after hatching. Throughout the entire incubation and first ten days of the nestling period, the female is entirely dependent upon the male for food. Ordinarily, he does not feed the brood, but rather he brings food to the female who rips it into pieces for the nestlings. At about ten days after hatching, the down of the young is sufficiently-well developed for them to thermo-regulate on their own. The female begins to hunt and bring food along with the male.

During the nestling period, the young start actively competing for food at 15 days although they are not aggressive. At 30 days, they are able to feed on carcasses independently. Fledging takes place at 46 to 49 days and complete independence is gained after a further 30 or more days. The young are fed by the parents for the four to five weeks after fledging with the time from egg laying to complete independence of the young being at least 110 days.

CONSERVATION

Population estimates for Gyrfalcons in North America vary and there appears to be no recent estimates. In the mid to late 1980s, it was suggested that there may have been in excess of 1,300 pairs in Alaska and the Yukon. No estimates were available for the Northwest Territories or northern Quebec which were felt to have populations that could exceed the Yukon at 700 to 800 pairs. Worldwide, the estimates varied from 7,000 to 17,000 pairs for the same period. The North American population appears to be stable and fluctuations tied to the natural cycles of food sources such as ptarmigan. Given that most Gyrfalcons rely upon food sources that are not in contact with pesticides or industrial pollutants, there is not the concern for population declines for this reason, as in other raptors. Contaminants have been found in low levels but not sufficient to cause egg shell thinning. The pollutants were presumed to have come from the consumption of migratory birds that became contaminated during periods spent in southern latitudes.

Since earlier studies were completed, evidence that pollutants can reach Arctic areas via air currents suggests that vigilance may be warranted for populations of Gyrfalcons that feed heavily on seabirds. Other threats include aircraft overflights in nesting areas as the north becomes explored more heavily by helicopter. Population declines in Finland, due to egg collection, remind us that the potential impacts of legal or illegal falconry must never be forgotten.

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Gyrfalcon - dark

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Molting occurs annually, and following the juvenile plumage, birds reach adult plumage after the first molt (2nd calendar year of life). Appearance does not change with subsequent molts. Molt in the adults begins while the young are still in the nest but the ability to fly is never lost. Wings and tail begin to molt first, followed by body feathers, with the entire process lasting about five months (in captive birds). Molt from the juvenile into adult feathering starts with the body feathers during the first winter. The wings and tail feathers start at the same time as the adults, which is in the April to May period.

SPECIFIC DESCRIPTION

Adult Dark-morph - Perched

HEAD

- overall may be dark sepia and appear "hooded" with some light marks on the nape
- beak bluish basally with dark area at the tip
- cere yellow and eyelids flesh
- eye dark

BODY

- the underparts can be almost entirely dark, or can be "spotted" so heavily as to appear "streaked", with light areas on the breast and cross-banded with light areas on the lower belly and flanks
- the back is sooty-brown

WINGS

- sooty brown coverts and primaries

TAIL

- upper tail coverts and rump bluish-gray with barring; rest of tail sooty brown with many light transverse bands
- some individual tails may be all dark with dark barring and a pale brown tip
- undertail dark with light markings

LEGS

- the tarsi and feet are yellow and the talons are black

Immature Dark-morph - Perched

HEAD

- solid dark brown with occasional light marks on the hind neck and crown
- beak and cere as in adults
- eye dark

BODY

- underparts are dark brown with some white streaking but variable
- back is dark brown

WINGS

- the upperwing coverts and primaries are dark brown

TAIL

- the tail is solid dark brown; upper tail coverts and rump are solid brown, or lack distinct grayish-blue cast found on adults
- the undertail coverts are dark brown with paler streaks

LEGS

- the tarsi and feet are bluish gray and the talons dark brown-black

Adult Dark-morph - Flight

- large, dark-bodied falcons with a very two-toned effect on the underwing linings
- the underwing coverts are dark with some white markings and the flight feathers are grayish

Immature Dark-morph - Flight

- a large dark falcon with two-toned underwing; dark coverts and paler flight feathers as in adults
- somewhat less white markings overall

SIMILAR SPECIES

Evolutionarily, the Gyrfalcon is felt to be related to the Saker Falcon of Eurasia. Under certain conditions in the field, this bird is most likely to be confused with the Peregrine Falcon. The "Peale's" race of the Peregrine Falcon is dark and may be confused with darker Gyrfalcons, especially in immature plumage. The uniformly dark underwing of the Peregrine Falcon versus the two-toned underwing of the Gyrfalcon are important distinctions. The Gyrfalcon and Peregrine Falcon have different wing-to-tail ratios. When perched, the wings are much shorter than the tail on the Gyrfalcon while they are equal, or nearly so, on the Peregrine Falcon. Occasionally, the Northern Goshawk may be mistaken for the large falcon as its wingbeats and wing tips are very similar. The pale, barred underwing and heavily-banded tail of the Northern Goshawk distinguishes it. Partially albinistic Red-tailed Hawks may be confused with white-morph Gyrfalcons, but dark marks on the nape, usually some red in the tail, and lack of clear area at dark wing tips should easily separate this *buteo* from the falcon. In flight, wing shape and flight style will distinguish the Red-tailed Hawk immediately.

OTHER NAMES

The Gyrfalcon is also known as "Black" Gyrfalcon, "Gray" Gyrfalcon, "Gyr:", "Jerfalcon", "Partridge Hawk", and "White Gyrfalcon."

ETYMOLOGY

The genus *Falco* is of Latin origin and means "sickle." This is likely in reference to the shape of the talons. The species name *rusticolus* is also from Latin and appears to be a construct of two words - *rusticus*, "countryman" and *incola*, "inhabitant." Combined, the words therefore mean "an inhabitant of the countryside", referring to this falcon's habitat of wide open, wild spaces. *Gyr* is traceable to the Old High German language and the word "giri" meaning greedy. Thus, this is the greedy falcon.

MYTHOLOGY

The Gyrfalcon has long been a coveted species in the world of falconry and prized as one of the most glamorous and mystical of the birds of prey.

RANGE

The northern latitudes of the world is home during the breeding season for the Gyrfalcon. In North America, breeding is restricted to portions of northern, western, and southern Alaska, extreme northwestern British Columbia, the northern and central Yukon, northern Northwest Territories, the Arctic islands, and northern Quebec (Labrador).

Wintering occurs from the breeding range south, irregularly throughout Canada to the northern United States. Extremes of southern occurrence, infrequently, are to about the middle of California and the most northerly fringes of Arizona, New Mexico, and Oklahoma and then easterly to southern Kentucky and Virginia. Areas where at least some birds can be found year round include the southern parts of the Arctic archipelago, Alaska, and the northern continental parts of Canada.

Worldwide, the breeding range of the Gyrfalcon includes Greenland, Iceland, and the Eurasian mainland from Norway east throughout the former U.S.S.R.

MIGRATION

Southward movements do not include the whole population and are irregular from year to year and possibly geographically. Birds do not seem to go any farther south than necessary to find food, thus a pronounced regular pattern of migration does not occur. The exception is in juvenile birds that regularly move out of at least the higher latitudes. Migration patterns of ptarmigans within the northern latitudes affect responses by Gyrfalcons.

Movement from the Arctic archipelago occurs from late August onwards into early October, with birds moving into warmer regions of the Northwest Territories or Labrador for the winter. This movement precedes the major movement of ptarmigan by a few weeks so that the falcons are strategically positioned to intercept incoming prey. Regular fall movements are reported in northwestern Alaska. Birds reach southern Canada as early as mid-October, with similar arrival times in the northern United States. Big flight years south are presumably correlated with cyclical lows in the populations of northern ptarmigans. By the end of March or early April, birds are gone from the southern latitudes. Migration routes are not well-documented, but coastal movements in Alaska are well-known in the fall. Spring movements are not documented.

BEHAVIOR

In flight the Gyrfalcon is fast and powerful, often appearing slower than it really is due to the size of the bird. Wingbeats are at times slow, deep and powerful, but on other occasions, wing movement is limited to the outer portions or "hands." Soaring and gliding on level wings as well as hovering have been noted. The level flight speed is faster than that of a Peregrine Falcon.

Hunting occurs near the ground with flight usually within six feet (1.9 meters) of the surface and following the contours of the land. This "contouring" behavior is often used in conjunction with some of the following major categories:

Perch and Wait

- a temporary perch such as a rock or low tree is used to spot potential prey before dropping off into a contouring flight pattern for the final approach.

Soaring and Quartering

- upon leaving a perch, birds may rise up at a steep angle and then circle or soar at heights of several hundred feet or more before moving away in search of prey. They rarely stoop from the soar as do Peregrine Falcons.

Contouring

- searching while flying low over the ground following the contours is an alternative to the soaring search.

Piracy- although normally shy, Gyrfalcons have followed trappers and hunters and taken prey that were flushed or killed. This behavior may occur with other birds but has not been documented.

Strike, Kill, and Consumption

- preferably from above and behind, a disabling blow with the feet is struck as the falcon

approaches its prey at high speed. Upon a quick return, the victim is grasped with the talons and bitten through the neck at the base of the skull to effect the kill. More prey is taken on the ground or water than from the air. The prey may be eaten on the spot, but more often, it is taken to a plucking site where it is eaten or plucked and taken to the nest site. The sternum of large birds is bitten through and long bones pulled from their sockets as part of the feeding process.

The Gyrfalcon will bathe in both water and snow. Normally, the Gyrfalcon is thought of as a solitary bird that is usually seen alone or with a mate during the nesting season. The exception seems to be during the fall migration, or at certain high latitude wintering sites, where primarily juvenile birds will gather together. This may be in response to localized food resources and foraging opportunities as opposed to a desire for sociability. Nesting densities with internest distances as close as every 6 miles (9.6 kilometers) have been recorded in productive habitat in the Northwest Territories, but normally, distances are greater. The hunted areas of pairs in one Alaskan study ranged from 75 to 375 square miles (195 to 971 square kilometers) but this relates to food supply rather than defended territory.

There does not appear to be a pugnacious reputation surrounding this species as with some other falcons, but they are not fearful of attacking larger birds. Eagles seem particularly prone to their furious attacks if they have entered the breeding territory of a pair of falcons. The female Gyrfalcon is more inclined to make the attacks on these large birds, making them easily-trained by falconers to hunt larger species. In defense of its nest and territory, this large falcon will also attack wolverines, foxes, ravens, and other raptors, but it usually slips away at the sight of human beings. Quarreling with ravens in its territory is a frequent occurrence.

"Play" has been described primarily as mock attacks on inanimate objects and sometimes other birds. Young, captive falcons have attacked bushes, grass clumps, pieces of dirt, and other items during these activities.

Home ranges in Alaska vary from 83 to 700 square miles (215 to 1,813 square kilometers) and probably average closer to 400 square miles per pair (1,036 square kilometers). In Iceland, ranges as small as 25 square miles (65 square kilometers) were noted and in Sweden in a peak lemming year, single pairs may have been surviving within 1 square mile (2.6 square kilometers) ranges.

At certain latitudes, males occupy the breeding territory year round, presumably allowing them to defend the nest site and to establish it early in the process. The courtship phase includes variations and combinations of several basic activities that include advertising by lone males, courtship flights by paired birds, nest ledge displays, food transfer and copulation. Advertising by the male includes at least the following activities with much variation on the core themes:

Eyrie Flyby

- this consists of repeated figure 8 flights past the nest with the crossing point directly in front of the nest. Wailing calls accompany the flight.

Wail-Pluck

- while plucking prey, the male will utter wailing calls, pause to look about and finally eat the item.

Male Ledge Display

- at a prospective nest site, the male will stand in a horizontal posture with the beak pointing downward and utter a series of "chup" notes. If mated, he may scrape the nest site.

Undulating Roll

- beginning in level flight, the male will partially roll in one direction and then roll 180 degrees in the opposite direction. Partway through the second roll, the bird will enter a steep dive and return to level flight at the bottom, rise again to the original altitude and begin the display again.

Wail

- wailing is a two syllable call given in a sequence of up to ten notes and is given more often by unmated males than by mated birds.

There are various flight behaviors where the female will join the male and execute a series of tandem activities such as mutual floating descent, passing and leading or food transfer. As well, a variety of pre-copulatory activities can be initiated by either sex. Copulation never seems to occur right at the nest site and begins about one month before egg laying. The number of copulation's for the entire nesting period is not likely as high as in other falcons and ends when the third egg is laid. Forty-seven copulation's were documented in one Yukon study.

Captive birds have lived as long as 30 years, but the average is closer to eight or 10 years. There appears to be no information recorded for wild birds. A high mortality for first year birds has been suggested by many authors, but information is presumptive and data is sparse. Starvation can affect nestlings when prey availability is lowered. On average, it appears that each pair of birds is able to raise two young and in good food years, this may increase to three. Sources of mortality include shooting, disease and starvation, with the latter likely being the greatest cause of death in most populations. Reduced production due to pesticide impacts does not seem to be a problem for Gyrfalcons. Predation by other raptors or mammals has been alleged but poorly documented. The impacts of illegal falconry are not documented for North America but this has been a cause of serious declines in Finland during this century. Elsewhere, heavy exploitation appeared to cause no decline.

ADAPTATIONS

The halux, or rear toe, is not fixed as in other falcons and can be rotated forward alongside the other three toes. This allows the bird to lie prone on the breast with both feet flat on the ground under the breast. Birds sleep in this position and can enter states of deep sleep. These circumstances are valuable during severe weather conditions when a lowered energy output and maximum heat retention position would be important survival aids. The clutch size appears to be directly linked to the size of the major prey populations. This is particularly useful to a species that has a limited prey base, and would be unable to feed a large clutch by simply increasing the variety of animals hunted to compensate for losses in other species.

HABITAT

The Gyrfalcon is one of the few quintessential birds of the high arctic. It prefers open tundra country and breeds south to the sparsely treed edge of the northern boreal forest. The presence of rocky cliffs for nesting is an essential component of the habitat. Alpine zones in the mountains of Alaska and northern British Columbia are also utilized, but extensive areas of boggy tundra are avoided, probably due to the absence of nesting sites. At southern latitudes, during the winter, birds occupy habitats similar in general characteristics to the northern breeding areas, but modification by humans is often more extensive. Wintering Gyrfalcons select open, rolling grasslands which may be sparsely treed, lake edges, large river deltas devoid of trees or open farmlands. Coastal lowlands as well as interior valleys and plateaus are visited but extensively forested areas are avoided. Natural areas on the fringes, or within large metropolitan areas, may also be used. Open, marshy

areas suitable for dabbling ducks are hunted as well as upland areas.

VOICE

The voice is generally louder, gruffer and deeper than that of the Peregrine Falcon, but many features are similar. The male's voice is higher pitched than that of the female. A guttural "kak-kak-kak" is given by both sexes as a territorial threat and mobbing call. The male will also give this during some flight displays with his mate. The wailing call is a two syllable vocalization that is used in a variety of courtship and other heterosexual situations. It is given mainly by males but females will utter it during copulation and after receiving food. A number of variations are used. A single syllable "chup" call is given by both sexes during various courtship displays and at other times during the nesting period. A faster version of this call known as the "chattering" call is also given during ledge displays and food - passing ceremonies. A "chittering" call is given by both sexes and is featured during copulation activities. Other calls include loud trilling, screams and rattling as well as variants of some of the above calls. Food begging calls of the young are querulous mewings and juveniles have been heard giving deep raven-like calls.

FOOD

The diet varies geographically and by season, depending upon the availability of prey items. Unlike the Peregrine Falcon, the diet of the Gyrfalcon is much more limited and often very focused on one or two major prey species. Throughout its range, this large falcon prefers to hunt ptarmigan wherever they are available. Both Rock and Willow ptarmigan are taken, but food studies seldom differentiate between them. As the breeding season progresses, Arctic ground squirrels become a major secondary source of food, especially as the ground squirrel young become available. Generally, birds make up 60 to 90 percent of the biomass in Gyrfalcon diets. The range of other prey species includes a variety of dabbling and diving ducks, sandpipers and plovers, Short-eared Owl, Northern Harrier, Rough-legged Hawk, jaegers, terns and gulls, a variety of passerines (Snow Bunting, Horned Lark, sparrows), hares, mink, rats, and microtine rodents such as lemmings. On southern wintering grounds, Gyrfalcons have been observed to take Mallards and have been seen hovering over a flock of Gray Partridge. Rock Doves may also be taken. Carrion feeding has been observed and prey included codfish, Glaucous Gull, and mammals caught in snares set by trappers. Caching of partially-consumed prey is a regular occurrence.

PELLETS

Pellet shape and size vary with the contents. Fresh pellets are generally elongate and cylindrical with rounded or conical ends. The length can vary from 1.25 to 3.0 inches (3.2 to 7.6 centimeters) in length and the diameter is about 1 inch (2.5 centimeters). Pellets containing mostly fur are more regular in shape than those containing bones. When the contents are primarily skin or visceral organs, the consistency is much harder than the loose, amorphous pellets that are mainly feathers and hair. Pellet color will vary with age and content but range from browns through shades of gray or greenish to yellowish gray. They contain fur, feathers and small bones and occasionally vegetation from the viscera of ptarmigan.

NESTING

The preferred nesting site, called an aerie, throughout the range is on a cliff ledge with an overhang for weather protection. The average overhang will cover about 80 percent of the nesting ledge. Occupied cliffs vary in height from 50 to 110 feet (15.5 to 34.1 meters) with nest heights ranging from 12 to 90 feet (3.7 to 27.9 meters) above the base. There appears to be no preference for extremely high cliffs. Unoccupied stick nests of the Common

Raven or Golden Eagle are readily used. Westerly or southerly exposures are preferred in some areas, but elsewhere, no directional preferences are apparent. Nest sites are most often not accessible to mammalian predators or humans without climbing gear. In wooded areas, stick nests built in trees by other raptors such as the Rough-legged Hawk are used. The nest may also be a slight scrape on a ledge with no nesting structure at all. The Gyrfalcon has occupied old stick nests on man-made structures such as gold dredges, pile drivers, and even a sluice box. Often, piles of debris such as old bones litter the nest site and the area is usually heavily-stained with droppings.

Clutch size varies geographically from two to seven, but frequently three to four eggs. The clutch size appears to be linked to the current food supply. The eggs are broadly oval and average 2.4 inches (6.1 centimeters) long and 1.8 inches wide (4.6 centimeters). The ground color is creamy white with various degrees of fine cinnamon-reddish spotting often overlain with brownish blotching. Rarely, eggs are all whitish but may also look brownish overall. The shell is granular and not glossy. A replacement clutch will be laid if lost early in the season.

The interval between laying averages 56 hours with the incubation period averaging 35 days. Incubation usually starts when the third egg is laid such that hatching is partially asynchronous in case of a large clutch size. The total time from the start of laying until the last egg is hatched in a four egg clutch averages 43 days. Some authors report incubation starting with the first egg laid. Clutch replacement in the event of loss early in the nesting period has been reported within 14 days. Incubation is mainly by the female, but the male may sit on the eggs for as much as one-third of the daylight hours. As the incubation period progresses, the male may sit for longer periods of time. Brooding of the young is done by the female but the male may show some interest for the first few days after hatching. Throughout the entire incubation and first ten days of the nestling period, the female is entirely dependent upon the male for food. Ordinarily, he does not feed the brood, but rather he brings food to the female who rips it into pieces for the nestlings. At about ten days after hatching, the down of the young is sufficiently-well developed for them to thermo-regulate on their own. The female begins to hunt and bring food along with the male.

During the nestling period, the young start actively competing for food at 15 days although they are not aggressive. At 30 days, they are able to feed on carcasses independently. Fledging takes place at 46 to 49 days and complete independence is gained after a further 30 or more days. The young are fed by the parents for the four to five weeks after fledging with the time from egg laying to complete independence of the young being at least 110 days.

CONSERVATION

Population estimates for Gyrfalcons in North America vary and there appears to be no recent estimates. In the mid to late 1980s, it was suggested that there may have been in excess of 1,300 pairs in Alaska and the Yukon. No estimates were available for the Northwest Territories or northern Quebec which were felt to have populations that could exceed the Yukon at 700 to 800 pairs. Worldwide, the estimates varied from 7,000 to 17,000 pairs for the same period. The North American population appears to be stable and fluctuations tied to the natural cycles of food sources such as ptarmigan. Given that most Gyrfalcons rely upon food sources that are not in contact with pesticides or industrial pollutants, there is not the concern for population declines for this reason, as in other raptors. Contaminants have been found in low levels but not sufficient to cause egg shell thinning. The pollutants were presumed to have come from the consumption of migratory birds that became contaminated during periods spent in southern latitudes.

Since earlier studies were completed, evidence that pollutants can reach Arctic areas via

air currents suggests that vigilance may be warranted for populations of Gyrfalcons that feed heavily on seabirds. Other threats include aircraft overflights in nesting areas as the north becomes explored more heavily by helicopter. Population declines in Finland, due to egg collection, remind us that the potential impacts of legal or illegal falconry must never be forgotten.

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Gyrfalcon - white

Falco rusticolus

GENERAL DESCRIPTION

The consummate falcon of the Arctic region - the Gyrfalcon - is a bird that stirred the imagination of Kublai Khan and was written about by Marco Polo. It is a large and powerful falcon with plumage that varies from nearly pure white through very dark sepia and tones of streaked gray in between. The Gyrfalcon lacks the large mustache of the Peregrine Falcon, and the two-toned underwing of both the gray-morph and dark-morph birds distinguish them from other larger falcons. The two-toned underwing is less pronounced on adult gray-morph Gyrfalcons. The white birds are unlike any other. The flight is fast and powerful.

Nesting is on cliffs in the northern latitudes, with most birds spending the entire year close to the breeding grounds. Post-breeding dispersal brings some birds as far south as the northern United States every year, providing excitement and anticipation amongst birdwatchers anxious to see the "big northern Gyrfalcon!"

SIZE

The Gyrfalcon is the largest of the North American falcons. The females vary from 20.5 to 25.5 inches (52.1 to 64.8 centimeters) with an average of 22 inches (55.9 centimeters) in length, and wingspreads from 47 to 53 inches (119.4 to 134.6 centimeters). Their weights vary from 2.5 to 4.4 pounds (1134 to 1996 grams). Males are slightly shorter at 19 to 22.5 inches (48.3 to 57.2 centimeters) with an average of 21 inches (53.3 centimeters), and wingspreads from 40 to 49 inches (101.6 to 124.5 centimeters). They weigh between 1.75 and 2.9 pounds (794 to 1,315 grams). Weight ranges of live birds captured in the wild can vary depending upon breeding condition, time of year, and whether prey has been recently captured and is still in the crop. In one study, live captured migrants in Greenland did not exhibit such a wide weight variation with females averaging 3.2 pounds (1,451 grams) and males 2.8 pounds (1,270 grams).

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Molting occurs annually, and following the juvenile plumage, birds reach adult plumage after the first molt (2nd calendar year of life). Appearance does not change with subsequent molts. Molt in the adults begins while the young are still in the nest but the ability to fly is never lost. Wings and tail begin to molt first, followed by body feathers, with the entire process lasting about five months (in captive birds). Molt from the juvenile into adult feathering starts with the body feathers during the first winter. The wings and tail feathers start at the same time as the adults, which is in the April to May period.

SPECIFIC DESCRIPTION

Adult White-morph - Perched

HEAD

- virtually entirely white in the lightest birds
- variable amounts of dark brown/black streaking on the crown extending into spots on the nape.
- throat white
- beak variously described as yellowish -brown to yellowish-gray basally and dusky at the tip
- the cere is light yellow and the eyelids flesh to pale flesh
- the eye is dark brown

BODY

- the entire body is white with the breast and abdomen immaculate, except for a few dark spots
- the flanks have dark spotting as well
- the back is usually barred with dark, sepia markings that vary in extent and intensity

WINGS

- the wings are basically white with dark tips and varying degrees of barring as for the back
- the wing tips reach one-half or two-thirds of the way down the tail in perched birds

TAIL

- the upper surface of the tail may be cleanly white or variably streaked or barred, but more narrowly in the rump area
- the undertail coverts are usually unstreaked white

LEGS

- the legs and feet are yellow and talons black

Immature White-morph - Perched

Note that immatures are overall very similar to the adults but are browner dorsally

HEAD

- finely streaked with dark brown
- the beak bluish horn with darker tip
- cere and eyelids are bluish
- the eye is very dark

BODY

- underparts white with short, dark brown streaking
- back is mostly dark brown but feathers can have broad white edgings
- whiter individuals can lack streaking on the underparts and the dark areas on the dorsal feathering can be much reduced

WINGS

- as for adults

TAIL

- as for adults

LEGS

- the legs and feet are bluish and the talons dark brown to black

Adult White-morph - Flight

- a large, robust white falcon that looks all white underneath except for the black wing tips
- at any distance, the dorsal surface will appear essentially white with black wing tips, but degrees of darker barring may be visible
- the wings are long and broad with less taper than those of a Peregrine and more blunt-tipped
- the tail is long and very broad in proportion to other falcons

Immature White-morph - Flight

- similar to adults except for brownish tones on the back
- underparts usually with light streaking or dash markings

SIMILAR SPECIES

Evolutionarily, the Gyrfalcon is felt to be related to the Saker Falcon of Eurasia. Under certain conditions in the field, this bird is most likely to be confused with the Peregrine Falcon. The "Peale's" race of the Peregrine Falcon is dark and may be confused with darker Gyrfalcons, especially in immature plumage. The uniformly dark underwing of the Peregrine Falcon versus the two-toned underwing of the Gyrfalcon are important distinctions. The Gyrfalcon and Peregrine Falcon have different wing-to-tail ratios. When perched, the wings are much shorter than the tail on the Gyrfalcon while they are equal, or nearly so, on the Peregrine Falcon. Occasionally, the Northern Goshawk may be mistaken for the large falcon as its wingbeats and wing tips are very similar. The pale, barred underwing and heavily-banded tail of the Northern Goshawk distinguishes it. Partially albinistic Red-tailed Hawks may be confused with white-morph Gyrfalcons, but dark marks on the nape, usually some red in the tail, and lack of clear area at dark wing tips should easily separate this buteo from the falcon. In flight, wing shape and flight style will distinguish the Red-tailed Hawk immediately.

OTHER NAMES

The Gyrfalcon is also known as "Black" Gyrfalcon, "Gray" Gyrfalcon, "Gyr:", "Jerfalcon", "Partridge Hawk", and "White Gyrfalcon."

ETYMOLOGY

The genus *Falco* is of Latin origin and means "sickle." This is likely in reference to the shape of the talons. The species name *rusticolus* is also from Latin and appears to be a construct of two words - *rusticus*, "countryman" and *incola*, "inhabitant." Combined, the words therefore mean "an inhabitant of the countryside", referring to this falcon's habitat of wide open, wild spaces. *Gyr* is traceable to the Old High German language and the word "giri" meaning greedy. Thus, this is the greedy falcon.

MYTHOLOGY

The Gyrfalcon has long been a coveted species in the world of falconry and prized as one of the most glamorous and mystical of the birds of prey.

RANGE

The northern latitudes of the world is home during the breeding season for the

Gyr Falcon. In North America, breeding is restricted to portions of northern, western, and southern Alaska, extreme northwestern British Columbia, the northern and central Yukon, northern Northwest Territories, the Arctic islands, and northern Quebec (Labrador).

Wintering occurs from the breeding range south, irregularly throughout Canada to the northern United States. Extremes of southern occurrence, infrequently, are to about the middle of California and the most northerly fringes of Arizona, New Mexico, and Oklahoma and then easterly to southern Kentucky and Virginia. Areas where at least some birds can be found year round include the southern parts of the Arctic archipelago, Alaska, and the northern continental parts of Canada.

Worldwide, the breeding range of the Gyr Falcon includes Greenland, Iceland, and the Eurasian mainland from Norway east throughout the former U.S.S.R.

MIGRATION

Southward movements do not include the whole population and are irregular from year to year and possibly geographically. Birds do not seem to go any farther south than necessary to find food, thus a pronounced regular pattern of migration does not occur. The exception is in juvenile birds that regularly move out of at least the higher latitudes. Migration patterns of ptarmigans within the northern latitudes affect responses by Gyr Falcons.

Movement from the Arctic archipelago occurs from late August onwards into early October, with birds moving into warmer regions of the Northwest Territories or Labrador for the winter. This movement precedes the major movement of ptarmigan by a few weeks so that the falcons are strategically positioned to intercept incoming prey. Regular fall movements are reported in northwestern Alaska. Birds reach southern Canada as early as mid-October, with similar arrival times in the northern United States. Big flight years south are presumably correlated with cyclical lows in the populations of northern ptarmigans. By the end of March or early April, birds are gone from the southern latitudes. Migration routes are not well-documented, but coastal movements in Alaska are well-known in the fall. Spring movements are not documented.

BEHAVIOR

In flight the Gyr Falcon is fast and powerful, often appearing slower than it really is due to the size of the bird. Wingbeats are at times slow, deep and powerful, but on other occasions, wing movement is limited to the outer portions or "hands." Soaring and gliding on level wings as well as hovering have been noted. The level flight speed is faster than that of a Peregrine Falcon.

Hunting occurs near the ground with flight usually within six feet (1.9 meters) of the surface and following the contours of the land. This "contouring" behavior is often used in conjunction with some of the following major categories:

Perch and Wait

- a temporary perch such as a rock or low tree is used to spot potential prey before dropping off into a contouring flight pattern for the final approach.

Soaring and Quartering

- upon leaving a perch, birds may rise up at a steep angle and then circle or soar at heights of several hundred feet or more before moving away in search of prey. They rarely stoop from the soar as do Peregrine Falcons.

Contouring

- searching while flying low over the ground following the contours is an alternative to the soaring search.

Piracy- although normally shy, Gyrfalcons have followed trappers and hunters and taken prey that were flushed or killed. This behavior may occur with other birds but has not been documented.

Strike, Kill, and Consumption

- preferably from above and behind, a disabling blow with the feet is struck as the falcon approaches its prey at high speed. Upon a quick return, the victim is grasped with the talons and bitten through the neck at the base of the skull to effect the kill. More prey is taken on the ground or water than from the air. The prey may be eaten on the spot, but more often, it is taken to a plucking site where it is eaten or plucked and taken to the nest site. The sternum of large birds is bitten through and long bones pulled from their sockets as part of the feeding process.

The Gyrfalcon will bathe in both water and snow. Normally, the Gyrfalcon is thought of as a solitary bird that is usually seen alone or with a mate during the nesting season. The exception seems to be during the fall migration, or at certain high latitude wintering sites, where primarily juvenile birds will gather together. This may be in response to localized food resources and foraging opportunities as opposed to a desire for sociability. Nesting densities with internest distances as close as every 6 miles (9.6 kilometers) have been recorded in productive habitat in the Northwest Territories, but normally, distances are greater. The hunted areas of pairs in one Alaskan study ranged from 75 to 375 square miles (195 to 971 square kilometers) but this relates to food supply rather than defended territory.

There does not appear to be a pugnacious reputation surrounding this species as with some other falcons, but they are not fearful of attacking larger birds. Eagles seem particularly prone to their furious attacks if they have entered the breeding territory of a pair of falcons. The female Gyrfalcon is more inclined to make the attacks on these large birds, making them easily-trained by falconers to hunt larger species. In defense of its nest and territory, this large falcon will also attack wolverines, foxes, ravens, and other raptors, but it usually slips away at the sight of human beings. Quarreling with ravens in its territory is a frequent occurrence.

"Play" has been described primarily as mock attacks on inanimate objects and sometimes other birds. Young, captive falcons have attacked bushes, grass clumps, pieces of dirt, and other items during these activities.

Home ranges in Alaska vary from 83 to 700 square miles (215 to 1,813 square kilometers) and probably average closer to 400 square miles per pair (1,036 square kilometers). In Iceland, ranges as small as 25 square miles (65 square kilometers) were noted and in Sweden in a peak lemming year, single pairs may have been surviving within 1 square mile (2.6 square kilometers) ranges.

At certain latitudes, males occupy the breeding territory year round, presumably allowing them to defend the nest site and to establish it early in the process. The courtship phase includes variations and combinations of several basic activities that include advertising by lone males, courtship flights by paired birds, nest ledge displays, food transfer and copulation. Advertising by the male includes at least the following activities with much variation on the core themes:

Eyrie Flyby

- this consists of repeated figure 8 flights past the nest with the crossing point directly in

front of the nest. Wailing calls accompany the flight.

Wail-Pluck

- while plucking prey, the male will utter wailing calls, pause to look about and finally eat the item.

Male Ledge Display

- at a prospective nest site, the male will stand in a horizontal posture with the beak pointing downward and utter a series of "chup" notes. If mated, he may scrape the nest site.

Undulating Roll

- beginning in level flight, the male will partially roll in one direction and then roll 180 degrees in the opposite direction. Partway through the second roll, the bird will enter a steep dive and return to level flight at the bottom, rise again to the original altitude and begin the display again.

Wail

- wailing is a two syllable call given in a sequence of up to ten notes and is given more often by unmated males than by mated birds.

There are various flight behaviors where the female will join the male and execute a series of tandem activities such as mutual floating descent, passing and leading or food transfer. As well, a variety of pre-copulatory activities can be initiated by either sex. Copulation never seems to occur right at the nest site and begins about one month before egg laying. The number of copulation's for the entire nesting period is not likely as high as in other falcons and ends when the third egg is laid. Forty-seven copulation's were documented in one Yukon study.

Captive birds have lived as long as 30 years, but the average is closer to eight or 10 years. There appears to be no information recorded for wild birds. A high mortality for first year birds has been suggested by many authors, but information is presumptive and data is sparse. Starvation can affect nestlings when prey availability is lowered. On average, it appears that each pair of birds is able to raise two young and in good food years, this may increase to three. Sources of mortality include shooting, disease and starvation, with the latter likely being the greatest cause of death in most populations. Reduced production due to pesticide impacts does not seem to be a problem for Gyrfalcons. Predation by other raptors or mammals has been alleged but poorly documented. The impacts of illegal falconry are not documented for North America but this has been a cause of serious declines in Finland during this century. Elsewhere, heavy exploitation appeared to cause no decline.

ADAPTATIONS

The halux, or rear toe, is not fixed as in other falcons and can be rotated forward alongside the other three toes. This allows the bird to lie prone on the breast with both feet flat on the ground under the breast. Birds sleep in this position and can enter states of deep sleep. These circumstances are valuable during severe weather conditions when a lowered energy output and maximum heat retention position would be important survival aids. The clutch size appears to be directly linked to the size of the major prey populations. This is particularly useful to a species that has a limited prey base, and would be unable to feed a large clutch by simply increasing the variety of animals hunted to compensate for losses in other species.

HABITAT

The Gyrfalcon is one of the few quintessential birds of the high arctic. It prefers open

tundra country and breeds south to the sparsely treed edge of the northern boreal forest. The presence of rocky cliffs for nesting is an essential component of the habitat. Alpine zones in the mountains of Alaska and northern British Columbia are also utilized, but extensive areas of boggy tundra are avoided, probably due to the absence of nesting sites. At southern latitudes, during the winter, birds occupy habitats similar in general characteristics to the northern breeding areas, but modification by humans is often more extensive. Wintering Gyrfalcons select open, rolling grasslands which may be sparsely treed, lake edges, large river deltas devoid of trees or open farmlands. Coastal lowlands as well as interior valleys and plateaus are visited but extensively forested areas are avoided. Natural areas on the fringes, or within large metropolitan areas, may also be used. Open, marshy areas suitable for dabbling ducks are hunted as well as upland areas.

VOICE

The voice is generally louder, gruffer and deeper than that of the Peregrine Falcon, but many features are similar. The male's voice is higher pitched than that of the female. A guttural "kak-kak-kak" is given by both sexes as a territorial threat and mobbing call. The male will also give this during some flight displays with his mate. The wailing call is a two syllable vocalization that is used in a variety of courtship and other heterosexual situations. It is given mainly by males but females will utter it during copulation and after receiving food. A number of variations are used. A single syllable "chup" call is given by both sexes during various courtship displays and at other times during the nesting period. A faster version of this call known as the "chattering" call is also given during ledge displays and food - passing ceremonies. A "chittering" call is given by both sexes and is featured during copulation activities. Other calls include loud trilling, screams and rattling as well as variants of some of the above calls. Food begging calls of the young are querulous mewings and juveniles have been heard giving deep raven-like calls.

FOOD

The diet varies geographically and by season, depending upon the availability of prey items. Unlike the Peregrine Falcon, the diet of the Gyrfalcon is much more limited and often very focused on one or two major prey species. Throughout its range, this large falcon prefers to hunt ptarmigan wherever they are available. Both Rock and Willow ptarmigan are taken, but food studies seldom differentiate between them. As the breeding season progresses, Arctic ground squirrels become a major secondary source of food, especially as the ground squirrel young become available. Generally, birds make up 60 to 90 percent of the biomass in Gyrfalcon diets. The range of other prey species includes a variety of dabbling and diving ducks, sandpipers and plovers, Short-eared Owl, Northern Harrier, Rough-legged Hawk, jaegers, terns and gulls, a variety of passerines (Snow Bunting, Horned Lark, sparrows), hares, mink, rats, and microtine rodents such as lemmings. On southern wintering grounds, Gyrfalcons have been observed to take Mallards and have been seen hovering over a flock of Gray Partridge. Rock Doves may also be taken. Carrion feeding has been observed and prey included codfish, Glaucous Gull, and mammals caught in snares set by trappers. Caching of partially-consumed prey is a regular occurrence.

PELLETS

Pellet shape and size vary with the contents. Fresh pellets are generally elongate and cylindrical with rounded or conical ends. The length can vary from 1.25 to 3.0 inches (3.2 to 7.6 centimeters) in length and the diameter is about 1 inch (2.5 centimeters). Pellets containing mostly fur are more regular in shape than those containing bones. When the contents are primarily skin or visceral organs, the consistency is much harder than the loose, amorphous pellets that are mainly feathers and hair. Pellet color will vary with age and content but range from browns through shades of gray or greenish to yellowish gray. They

contain fur, feathers and small bones and occasionally vegetation from the viscera of ptarmigan.

NESTING

The preferred nesting site, called an aerie, throughout the range is on a cliff ledge with an overhang for weather protection. The average overhang will cover about 80 percent of the nesting ledge. Occupied cliffs vary in height from 50 to 110 feet (15.5 to 34.1 meters) with nest heights ranging from 12 to 90 feet (3.7 to 27.9 meters) above the base. There appears to be no preference for extremely high cliffs. Unoccupied stick nests of the Common Raven or Golden Eagle are readily used. Westerly or southerly exposures are preferred in some areas, but elsewhere, no directional preferences are apparent. Nest sites are most often not accessible to mammalian predators or humans without climbing gear. In wooded areas, stick nests built in trees by other raptors such as the Rough-legged Hawk are used. The nest may also be a slight scrape on a ledge with no nesting structure at all. The Gyrfalcon has occupied old stick nests on man-made structures such as gold dredges, pile drivers, and even a sluice box. Often, piles of debris such as old bones litter the nest site and the area is usually heavily-stained with droppings.

Clutch size varies geographically from two to seven, but frequently three to four eggs. The clutch size appears to be linked to the current food supply. The eggs are broadly oval and average 2.4 inches (6.1 centimeters) long and 1.8 inches wide (4.6 centimeters). The ground color is creamy white with various degrees of fine cinnamon-reddish spotting often overlain with brownish blotching. Rarely, eggs are all whitish but may also look brownish overall. The shell is granular and not glossy. A replacement clutch will be laid if lost early in the season.

The interval between laying averages 56 hours with the incubation period averaging 35 days. Incubation usually starts when the third egg is laid such that hatching is partially asynchronous in case of a large clutch size. The total time from the start of laying until the last egg is hatched in a four egg clutch averages 43 days. Some authors report incubation starting with the first egg laid. Clutch replacement in the event of loss early in the nesting period has been reported within 14 days. Incubation is mainly by the female, but the male may sit on the eggs for as much as one-third of the daylight hours. As the incubation period progresses, the male may sit for longer periods of time. Brooding of the young is done by the female but the male may show some interest for the first few days after hatching. Throughout the entire incubation and first ten days of the nestling period, the female is entirely dependent upon the male for food. Ordinarily, he does not feed the brood, but rather he brings food to the female who rips it into pieces for the nestlings. At about ten days after hatching, the down of the young is sufficiently-well developed for them to thermo-regulate on their own. The female begins to hunt and bring food along with the male.

During the nestling period, the young start actively competing for food at 15 days although they are not aggressive. At 30 days, they are able to feed on carcasses independently. Fledging takes place at 46 to 49 days and complete independence is gained after a further 30 or more days. The young are fed by the parents for the four to five weeks after fledging with the time from egg laying to complete independence of the young being at least 110 days.

CONSERVATION

Population estimates for Gyrfalcons in North America vary and there appears to be no recent estimates. In the mid to late 1980s, it was suggested that there may have been in excess of 1,300 pairs in Alaska and the Yukon. No estimates were available for the Northwest Territories or northern Quebec which were felt to have populations that could exceed the

Yukon at 700 to 800 pairs. Worldwide, the estimates varied from 7,000 to 17,000 pairs for the same period. The North American population appears to be stable and fluctuations tied to the natural cycles of food sources such as ptarmigan. Given that most Gyrfalcons rely upon food sources that are not in contact with pesticides or industrial pollutants, there is not the concern for population declines for this reason, as in other raptors. Contaminants have been found in low levels but not sufficient to cause egg shell thinning. The pollutants were presumed to have come from the consumption of migratory birds that became contaminated during periods spent in southern latitudes.

Since earlier studies were completed, evidence that pollutants can reach Arctic areas via air currents suggests that vigilance may be warranted for populations of Gyrfalcons that feed heavily on seabirds. Other threats include aircraft overflights in nesting areas as the north becomes explored more heavily by helicopter. Population declines in Finland, due to egg collection, remind us that the potential impacts of legal or illegal falconry must never be forgotten.

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Prairie Falcon

Falco mexicanus

GENERAL DESCRIPTION

The Prairie Falcon is a medium-sized falcon of the open, arid country of the west. It's lighter, brown-buff colors match well with tones of the landscapes over which it nests and hunts. This is a fast-flying bird that nests on cliffs and engages in hot pursuit of its prey over open country. Large blackish patches on the white underwings distinguishes this from all other falcons. A narrow, black mustache mark, blockish head shape and large eyes are typical. The back and upperwing are medium brown with pale bars and fringes on most feathers and the tail shows light barring underneath. The pale feathering of the underbody is spotted on the belly and barred on the flanks of adults and with streaks on immatures.

SIZE

This is a medium-sized hawk, second-largest in length of the six North American falcons. The Peregrine Falcon is the same length but is slightly heavier while the Gyrfalcon is the largest overall. There is no overlap in size or weight ranges between the smaller male Prairie Falcon and the larger females.

Females average 17 inches (43.2 centimeters) in length while males average 15 inches (38.1 centimeters). Wingspan in females averages 43 inches (109.2 centimeters) and males average 37 inches (94 centimeters). The average weight for females is 1.9 pounds (862 grams) and for males it is 1.2 pounds (544 grams).

MORPHS AND MOLTS

There are no color morphs in Prairie Falcon plumage and the males and females look the same. The back color of individual birds may vary somewhat but not in any way that suggests predictable color morphs. Darker backed birds are always juveniles in their first fall plumage. They appear darker all the time because they lack pale cross barring on their back. Partial albinism has been reported for this falcon.

Molting occurs annually and following the juvenile plumage, it is the second molt before birds reach the definitive (adult) plumage. This does not change in appearance during subsequent molts. Molting begins with the wing feathers, followed by the body feathers and finally the tail feathers. In Wyoming and Colorado, molt begins in late May and is complete by early October.

SPECIFIC DESCRIPTION

It should be noted that sexes are similar in adult plumages. However, females show a slaty cast on the back that may not develop to the same extent as in males. As well, females have noticeably darker underwing patches (on axillars and median coverts) than males.

Adult - Perched

HEAD

- top of head variably gray-brown with dusky streaks
- whitish cheek area between eye and brownish "ear patch" on side of head
- throat and the line above the eye are white

- a narrow black mustache extends from below the eye in a downward direction along the chin
- the beak is bluish with a dark tip
- the cere and eyelid are yellow
- the eye is dark brown

BODY

- the underparts are pure white with dark spots on the breast and belly and barred feathers on the flanks
- many feathers of the back and upper wing coverts are light tan in color with dark brown or sooty patches in the center
- the effect is a darkish back with many light tan cross bars
- slatey-bluish cast develops by second year which is difficult to detect in the field

WINGS

- the upper sides of flight feathers are very dark with light tan to orange-rusty bars
- the wingtips do not reach the tip of the tail in perched birds

TAIL

- upper side has a brownish cast but can vary from gray to rusty colored
- about 10 transverse dusky bars occur on the upper side and they increase in extent with age - the tip is white
- the underside is whitish with incomplete pale banding

LEGS

- the legs and feet are yellow and the talons are black
- whitish leg feathers have dark spots

Immature - Perched

HEAD

- pattern much the same as in adult but softer overall
- the top of the head is somewhat darker than adult
- pale eye stripe may be more prominent
- the beak is bluish with a dusky tip
- the cere and eye ring are pale bluish
- the eye is very dark

BODY

- the chin and throat are white while the breast and other underparts are creamy in fresh plumage which quickly fades to white
- short, narrow streaks on the breast and belly, wide, long streaks on the flanks
- there are more dark markings than in adults and they tend to merge into blackish areas on the sides
- the flanks are more heavily streaked
- the back is somewhat darker than in adults with the light brown barring lacking

WINGS

- similar to adult plumage

TAIL- the upper surface is darker with more complete barring and the tip is white

- the underside is whitish as in adults

LEGS

- the legs and feet are pale bluish with black talons but they start developing the yellow

color

Adult - Flight

- a large falcon with whitish undersides and dark patches in the center of the underwings, or "armpits" , and median coverts; heaviest on females of both ages
- the back often appears to have a "tan" look or at least much lighter than the dark back of a Peregrine Falcon
- the upper side of the tail is somewhat lighter than the back and wings and thus contrasts markedly
- overall slim body, longish tail, back-swept wings

Immature - Flight

- in general, resembles adults but usually more streaked below and darker above; females darker under the wing than males

SIMILAR SPECIES

In overall size and proportions, the adult Prairie Falcon most closely resembles the adult Peregrine Falcon, but the latter is much darker-backed, has a significantly broader mustache stripe and lacks the dark patches in the axillars and median coverts of the wing underside. Many immature Peregrine Falcons have an identical narrow mustache but the light area on the face, behind the eye on the Prairie Falcon is distinctive. Light colored Swainson's Hawks may have a superficially-similar face pattern but they lack the white area between the eye and the ear patch as seen in Prairie Falcon.

OTHER NAMES

The Prairie Falcon has also been called the "Bullet Hawk."

ETYMOLOGY

Falco is of Latin origin and means "sickle." Many authors believed it to be in reference to the shape of the beak but it has been suggested that the name more properly refers to the shape of the talons. the species name mexicanus refers to Mexico - the country from which the Prairie Falcon was first described. Prairie describes the type of countryside preferred by this species, which is essentially open, hot and dry places.

MYTHOLOGY

There is no known mythology for this species in North America

RANGE

In North America, the Prairie Falcon breeds from south-central British Columbia, southern Alberta and southwestern Saskatchewan south through the west and mid-western states to northern Mexico. Breeding has been recorded east as far as western North and South Dakota, western Nebraska, most of Colorado, and New Mexico.

Most wintering birds occur south of southern Washington, Idaho, and Oregon with some movement eastward into Nebraska, Kansas, Oklahoma and central Texas. The winter range extends well down into Mexico including Baja California. Winter dispersal takes some birds into the eastern states such as Minnesota, Missouri, and Illinois with records along the

eastern seaboard into the Carolinas and Gulf coast. Birds occur annually in the northern parts of the breeding range during winter but numbers are low. This falcon can be regularly found year-round in those parts of the breeding range south of about 42 degrees latitude and north of Mexico.

The Prairie Falcon occurs nowhere else in the world. It is thought to be related to the Laggar Falcon of southern Asia and perhaps to the Saker Falcon of eastern Asia and northern Africa but has never been recorded in these regions.

MIGRATION

The Prairie Falcon is a bird of the western and mid-western prairie lands and in general, it tends to stay there. Indeed, on the basis of birds present on northern breeding grounds during the winter, it has caused some authors to suggest that this species does not migrate at all. However, dispersal from the breeding range occurs as early as late July in some areas as adults and fledged young seek new food sources. By late August or September, in most places, movement is evident with arrival on the wintering grounds in Utah during late October for example. Arrival in favorite wintering areas in Colorado and Wyoming occurred during November in one study. The widespread wanderings of birds in search of food following the breeding season plus the eastward dispersal of juveniles from nesting areas confounds the ability to describe a discreet migration period.

In general, the young of the year, and at least some of the adult population, make a distinct movement into southern and eastern regions not occupied during the nesting season. Other adults remain within the general breeding range but cluster on favored wintering grounds in response to aggregations of prey species such as Horned Larks.

Return to the breeding grounds generally occurs from February to April but birds have been seen at aeries in Idaho during late January. In Colorado and Wyoming, activity in the vicinity of nest sites has been noted in late February. In British Columbia, eggs are laid during April, suggesting spring migration at least during March and April if not earlier.

Migration corridors are not known or well-documented. In one study, dispersal from nesting areas in Wyoming and Colorado showed a strong east-southeast orientation with some birds moving as far as the eastern states.

BEHAVIOR

The Prairie Falcon has been described as having a dashing flight with a wing beat consisting of rapid strokes and short glides. Other observers describe the wing beat as "stiff and mechanical" as opposed to fluid and undulating as in the Peregrine Falcon. The wing beats are mostly below a horizontal plane. When soaring, the wings are held flat and when gliding, the wrists may be held below the body with the wing tips cocked upward. Birds have been seen to hover when hunting. Approach to a perch is often from below as the birds swing upwards to alight.

The hunting tactics are grouped into eleven basic categories, as follows:

Perch and Wait

- where high perches are available, birds prefer to spend time "on lookout," an energy-efficient way of finding prey.

Low-level Hunting

- over open country free of obstructions like trees, falcons will fly low over the ground and flush prey just ahead of them, accelerating at the end to make the strike. Cruising

speeds of 45 miles per hour (72 kilometers per hour) have been estimated during this hunting method.

Hovering

- with quick wing beats that hold the bird nearly motionless in the air, the bird will spot its potential victim and then plunge nearly straight down for the strike.

Stooping

- this is a dramatic attack as a hunting bird swoops down from elevations reported as high as 3,000 feet (930 meters) above the ground, leveling off just above its prey and flushing the quarry ahead. A similar descent is often made from elevations in the 30 to 200 foot (9.3 to 62 meters) range as well.

Accipiter Method

- occasionally, falcons will act like accipiters and drop in behind bushes or trees and use them as screens as they dart out to capture a surprised prey.

Merlin Method

- this tactic involves approaching prey rapidly from the downwind side.

Buteo Method

- in search of grasshoppers or other small prey, the Prairie Falcon has been observed hopping around on the ground or up onto small bushes in the fashion of some Swainson's Hawk techniques.

Piracy (Using Beaters)

- in the analogy from some human styles of hunting, falcons will follow other raptors that are flushing or capturing birds and then engage the other raptor, often causing it to drop its hard-won prey. The falcon will then pick up the freshly-killed meal or simply out fly the other raptor and capture the flushed prey. This technique is also called kleptoparasitism.

Insect Hawking

- falcons will fly after large insects such as dragonflies and turn their bodies, using their feet to effect the capture.

Nest Robbing

- the Prairie Falcon has been seen clinging to cliff swallow nests and pulling birds from the cavity with their beak.

Cannibalism

- adults have been known to eat their own young when the nestlings have died apparently from other causes.

The Prairie Falcon also has a "strike, kill, and consumption" approach to prey. As it approaches small prey, it uses its feet to mete out a sharp blow which stuns the victim. With a quick turn and approach, the quarry is snatched with the feet and a killing bite to the neck vertebrae is made. Larger birds may be struck in mid-flight in the style of the Peregrine Falcon. Although the victim usually dies from the force of the strike, extra insurance is provided by breaking the neck with the beak. Repeated strikes at larger prey such as jackrabbits will break or dislocate the neck, blind the animal or stun it sufficiently that killing with the beak can be accomplished. With small prey, the head and neck are crushed and eaten, including the beak and some feathers. The breast and entrails of larger prey are eaten but the bones are not picked clean. Some flesh always remains for the scavengers. Small quarry are taken to a perch to be eaten. Larger prey are eaten on the ground and to avoid detection, the falcon may spread its wings and "mantle" over the carcass.

Bathing in water has been noted infrequently but captive birds have shown a preference for water baths over dust baths when both were provided. Dust-bathing in the wild is a regular occurrence and nesting females may bath more frequently than males. This likely serves to remove insect nest parasites that accumulate on her during the incubation period.

"Play" has been described in the Prairie Falcon based upon a series of actions whereby a bird would drop a piece of cow dung in mid-air or from a perch and then fly after it attempting to capture it. These in-flight retrievals were not always successful. This playful behavior contrasts with some descriptions of this falcon's temperament as vile and unpredictable, moody and whimsical. Some falconers find them to be "fractious and irascible" and veterinarians caring for injured birds at Kamloops, British Columbia, note the Prairie Falcon as being more aggressive than most other raptors. Nest defense can be quite vigorous but other studies have shown falcons to be potentially quite tolerant of human activities in the vicinity of the aerie, including traffic and construction noise. Behavior towards other raptors tends to be aggressive and birds as large as Great Horned Owls have been killed during encounters. Larger birds can rob prey or scare Prairies away from a kill. Prairie Falcons are solitary nesters but densities as high as 20 pairs in a 16 mile (25.6 kilometers) stretch of suitable habitat have been reported and rarely nests as close as 600 feet (186 meters) apart have both been occupied when they were out of sight of each other. Home range estimates vary from 10 to 50 square miles (25.9 to 129.5 square kilometers) but the core foraging area is likely 10 to 15 square miles (25.9 to 38.9 square kilometers) for many pairs.

Nesting sites are traditional and are used for many years, at times being the sites first occupied by Peregrine Falcons for decades prior. Breeding does not generally occur before age two but immatures paired with adults can be successful. Males arrive at the aeries seven to 10 days before the females and establishment of the pair bond occurs at the nest site. Vocalizations and spectacular aerial displays characterize the two to four week period prior to breeding but the behavior has not been well-described. The number of copulations can be as high as 215 for the entire period prior to egg laying with the number of copulations during incubation and brood rearing dropping dramatically to about 30 for the period. Northern Goshawks and American Kestrels have been known to engage in 500 and 700 copulations per clutch respectively. Male Prairie Falcons do not guard their mates from copulations with other males, therefore it is theorized that frequent copulations will dilute the sperm of competitive males that may have been able to copulate occasionally with a mated female. This will help to ensure that the original male will be the parent of any surviving young. Other theories suggest that frequent copulation strengthens the pair bond or it may be a way for the female to evaluate the worthiness of her potential mate.

The potential maximum longevity for Prairie Falcon has been estimated at 20 years with banded birds 13 years old being recorded in the wild. Mortality amongst nestlings can be as high as 65 percent due to tick infestations. Nest predators include owls, Common Raven and Golden Eagle, bobcat, and coyote. Winter mortality of juveniles can be as high as 80 percent. Shooting of birds was a major source of mortality long after protective laws were passed and this may continue today. Lack of a winter food supply and inexperienced juveniles may account for some mortality. Aggressive interactions with other falcons has caused the death of some birds but such extremes must be considered rare.

ADAPTATIONS

The beak of all falcons has a notch in the cutting edge which allows it to hook more easily into the neck vertebrae of the quarry when biting to dispatch it. Prairie Falcon nestlings are unable to thermoregulate well for the first two weeks of life, so the female broods them closely to provide shade or warmth as required.

HABITAT

The Prairie Falcon is a bird of the open, dry countryside. Grasslands, canyonlands, cultivated prairies, alpine tundra, deserts, foothills, and dry mountain valleys are all utilized for breeding and/or foraging. Sparsely-treed areas are used but extensive forests are avoided. The breeding habitat is essentially the same as the general habitat but nest-sites are invariably on a rocky cliff or a ledge or hole in eroded banks along river courses. The rare exceptions include trees, abandoned quarries, and buildings. There are breeding records for alpine areas but in some parts of the range, it is speculated that alpine zones may only be used for mid-late summer hunting. Winter habitat is the lower elevation, lower snow zones of the prairies, grasslands and valley bottoms. Winter stubble fields and other grassy areas that are attractive to Horned larks will attract Prairie Falcons. One might say that as go the Horned Larks, so goes the Prairie Falcon. Useful attributes of all habitats include perch sites such as snags, rock faces, utility poles and wires, hay bales.

VOICE

Vocalizations are very similar to those of the Peregrine Falcon but slightly higher pitched. The alarm call is a series of "kik" notes given by both sexes. Literature references describe various sounds such as screaming, whistling, whining, yelping and cackling as being part of the repertoire. Voices of all of the larger falcons are felt to be similar in basic structure and function.

FOODS

The primary prey items are birds and mammals with the latter more available during the summer months and making up a greater part of the diet than. Falcons seem to key on certain species while they are available and then shift consumption to another species that is abundant. Opportunistic feeding on a variety of animals occurs anytime. While individual birds may have a relatively restricted diet, the range of prey items consumed by the species as a whole is quite large.

The major prey species during the breeding season include various species of ground squirrels, chipmunks, cottontails, jackrabbits, pika, Mallard, Sharp-tailed Grouse, Ring-necked Pheasant, White-tailed Ptarmigan, Rock Dove, Horned Lark, American Pipit, Black-billed Magpie, Mountain Bluebird, swallows, swifts, sparrows, and various species of lizards such as chuckwalla and horned lizard. Winter food items shift away from mammals and include open country birds such as the Horned Lark, Eastern and Western meadowlark, European Starling, longspurs, and Mourning Dove.

Secondary prey species include pocket gophers, wood rats, various lizards, insects such as scorpions, grasshoppers, locusts, crickets and dragonflies, domestic fowl, other less common bird species and falcon nestlings.

NESTING

The nest site, known as an aerie, is generally recessed in a cliff face and is basically a scrape in the rubble of the bedrock. No nest is built from sticks or other material but existing rubble may be rearranged. Cliff heights may vary from 25 or more (7.8 meters) feet and the nest location may be anywhere on the face but is often less than 50 feet (15.5 meters) from the bottom of the cliff so long that it is safe from mammalian predators. The scrape is usually under some type of overhang that shelters it from the weather.

Clutch size varies geographically from two to six eggs with an average close to four in

most places. The laying interval between each egg is one to two days. The eggs are pinkish-white with fine, regular spots over half of the surface and larger, more irregular spots over the other half. The dots are in the brown, reddish-brown and purplish shades but often, an overlying wash of similar tones may obscure the spots at one end. While slightly paler than other falcons, the Prairie Falcon's eggs give the impression of an overall buff or brownish splotched egg as opposed to white. The eggs are subelliptical and average 2 inches long (5.1 centimeters) by 1.6 inches wide (4.1 centimeters).

The male arrives at the aeries first and will do a some cleaning up of the scrape. It feeds the female from the time egg-laying starts throughout incubation and the close brooding of the downy young. Occasionally, the male will incubate the eggs while the female hunts or feeds on prey he has brought to her. Once the young are hatched, the male continues to feed them. Over the entire nesting period, the male brings about 75 percent of all the prey items to the nest. From the onset of egg-laying, the females spend most of their time incubating or brooding until the young are about two weeks old. Small periods are spent off of the nest for hunting and feeding. Once the young are 12 to 14 days old, the adult female begins to hunt and bring food back to the nest along with the male. Both sexes will defend the nest. Prey items are often cached before being brought to the nest and both sexes engage in this behavior although each uses different cache sites.

The incubation period is 31 days, occasionally longer and begins with the laying of the first egg. As more eggs are laid, the time spent incubating increases so that the first egg does not hatch far ahead of the last egg as in some raptors. The clutch hatches over a period of several days. Around day 30, the young will move toward the edge of the nest in anticipation of flight. Fledging occurs between 36 and 41 days. There is a short post-fledging period of family association before dispersal away from the aerie and family separation. The Prairie Falcon is single-brooded but will replace clutches lost early in the nesting period. This will occur within 15 to 20 days at the same nest or occasionally at a nearby site.

CONSERVATION

Since the decrease in the use of organochlorine pesticides in North America, the number of Prairie Falcons has been at least stable or increasing continent-wide. The fact that they do not migrate to countries where hazardous pesticides are still used is a bonus for this species. There are likely more than 5,000 pairs in North America and some ideal areas may have saturated breeding densities.

Threats locally include expanding urbanization that destroys nesting or foraging areas, illegal killing, excessive human disturbance around nests, and removal of prey species as part of agricultural pest control operations. Environmental contaminants always remain as a potential threat to birds at the top of the food chain and a constant vigil is required in this and other raptor species. This is particularly true where birds are foraging in areas with extensive agricultural operations. Illegal taking of eggs for falconry and museums may also be a local problem.

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Vultures and eagles

These groups of raptors are very large, usually dark, and heavy-looking birds that often soar for long periods without flapping their wings.

The VULTURES have short, featherless heads, long broad wings, and black bodies. The bill is long and hooked and the feet are without talons. Of all raptors, vultures and condors are the greatest gliders. They are often seen perched, with wings spread, to catch sun rays. During the nonbreeding season they are social often gathering in large flocks to feed, roost, or soar. Some species, like the Turkey Vulture, soars with its wings positioned in a dihedral or "V"-shape. Three species are found in North America, namely the Black Vulture, Turkey Vulture, and California Condor, which now may be extirpated from the wild.

The EAGLES are actually very large hawks that are mostly all-dark brown with relatively long wings in proportion to their body. The head appears "long" and it is feathered. The curved bills are sharply-pointed, and hooked, and the feet are very strong with sharp talons. They soar and glide on flat wings and often spend considerable time in the air on this activity. Two species, the Bald Eagle and Golden Eagle, are common in North America while two others, the White-tailed Eagle and Steller's Sea-Eagle, visit the continent only rarely.

Kites

These are medium-sized raptors with slender bodies that may have pointed wings like a falcon or paddle-shaped wings. Their flight is "bouncy", or buoyant, and usually slow and graceful. One species has a deeply forked tail. The beak may be small, or very long and strongly hooked. Three species, the Hook-billed Kite, White-tailed Kite, and Snail Kite are present year-round while the other two species, the American Swallow-tailed Kite and Mississippi Kite only spend the summer in North America.

Hawks

These are small to large-sized raptors that can be conveniently separated into four sub-groups, namely Osprey, Harrier, Accipiters, and Buteos. This is the largest group accounting for 18 species of North American birds of prey.

The Osprey is not often found far from water. It appears nearly as large as an eagle but the long crooked wings are distinctive. For this reason, it often resembles a gull in flight. The Osprey's tail is longer than its head and its legs are long. It is most often seen hovering over water, on rapidly beating wings, then plunging directly into the water after fish. Its outer toes are reversible and rough pads on its feet allow it to hold onto slippery fish. Only one species of Osprey occurs throughout the world!

The HARRIER is a medium-sized raptor that is very slim with a very long tail. It holds its long, round-tipped wings in a dihedral or "V" profile and often rocks back and forth in flight. The head appears small and it always shows a white rump when it flies. Only the Northern Harrier occurs in North America.

The ACCIPITERS are woodlands hawks that have short, rounded wings and long tails. Their bodies are slim and stream-lined and their heads are small. In flight, they often flap quickly with three or four rapid wingbeats then glide. Three species, the Sharp-shinned Hawk, Cooper's Hawk, and Northern Goshawk reside in North America.

The BUTEOS are essentially medium to large-sized soaring hawks that inhabit woodland or open country. They appear bulky, or heavy-set, and can soar for long periods without beating their wings. The wings are usually long and broad and the tail appears broad and rounded whether the bird is perched or flying. When perched, the wingtips usually reach the tip of the tail. About one-third of all raptors (13 species) in North America belong to this group. These include the Common Black-Hawk, Harris' Hawk, Gray Hawk, Roadside Hawk, Red-shouldered Hawk, Broad-winged Hawk, Short-tailed Hawk, Swainson's Hawk, White-tailed Hawk, Zone-tailed Hawk, Red-tailed Hawk, Ferruginous Hawk, and Rough-legged Hawk.

Caracara and falcons

These two groups of raptors both belong to the falcon family. They all have hooked beaks, sharp, pointed talons, excellent eyesight and either pursue prey directly and act as scavengers and pirates.

The CARACARAS are quite unlike what we consider a falcon to be looking like a mixture between a vulture and a falcon. They have large heads that appear crested and large, heavy beaks. Their legs are long and the wings are wide and rounded unlike the narrow, pointed wings of the true falcons. They also prefer to rob or scavenge food. Only one species occurs in North America, the Crested Caracara.

The FALCONS are small to medium-sized hawks with streamlined bodies and long pointed wings and long tails. The head appears large and sometimes rather squarish. Although they soar frequently, they are most often seen flying on nearly continuous wingbeats. When viewed closely all members of this group have a tooth-like projection on the cutting edge of the upper mandible. When perched the wingtips reach more than half way down the length of the tail. Six species breed in North America although the Aplomado Falcon is now very rare. The other falcons are the American Kestrel, Merlin, Peregrine Falcon, Gyrfalcon, and Prairie Falcon.

Arctic tundra

The arctic Tundra includes an area of about three million square kilometers that extends beyond the tree line in the far northern regions of North America. It is characterized by low temperatures, low precipitation, and a short growing season. Plant growth form here is low, and growth is slow. Typical vegetation is cotton grass, sedges, dwarf heaths, and small willows.

Summer - In June, July, and August, the arctic tundra sees a burst of biological activity. Water bodies lose most of their ice cover, lowland land surfaces become bare having lost their snow cover, and new plant growth begins. Most soils are water-saturated. Temperatures are relatively mild, for the arctic region, and fairly constant. Along the coast temperature range between 3 and 6 degrees Celsius and inland between 8 and 11 degrees Celsius.

The vegetative structure of the arctic tundra is fairly simple. Trees are absent, or in southern areas, stunted and small and plant life is short and usually grows close to the ground to avoid exposure to chilling winds.

Most animals in the arctic tundra gear their life to short summers and long winters. Most migrate from the area each autumn, but those that stay either hibernate until spring, or have adapted to winter life. For example, ptarmigan and Snowy Owls have feathers on their legs to protect them from the cold while caribou and muskox have winter coats of heavy underfur. Color is important too. White is the dominant color. For example, the Gyrfalcon is pure white in the high arctic, gray in the low arctic, and dark in the subarctic.

Winter - Throughout most of the year the arctic is a frozen ocean encircled by land. It is characterized as a harsh world of ice, rock, and permanently frozen ground. Darkness lasts for months and it is very cold. During the coldest months, temperatures range between -27 and -33 degrees Celsius, and rarely rises above freezing from October to May. Snowfall is usually light because the cold air is too dry to form snow-producing clouds. Only birds adapted to these deserts of ice and snow can be found in the arctic tundra during the winter.

Alpine tundra

This habitat is characteristic of the high mountains ranges at lower latitudes south of the arctic tundra. The alpine tundra is similar to the arctic tundra in having low temperatures, low precipitation, a short growing season, and plants that essentially have a low growth form. Rarely is the ground permanently frozen in the alpine tundra and plants reproduce there by seedlings, not vegetatively like in the arctic tundra. Also, the alpine tundra is a more severe habitat than the arctic tundra because of its strong winds, snow load, and fluctuating temperatures. The atmosphere is thinner in the high mountains and ultraviolet radiation is high. This habitat may extend up to 18,000 feet (5580 meters).

Summer - the land is characterized by rock-strewn slopes, lush meadows, shrub thickets, cushion and mat-forming plants (not lichens and heaths), areas of stunted trees known as "krumholtz", and boggy areas in protected spots. Some alpine tundra areas vary in weather and climate across North America. For instance, the climate in the high Appalachian Mountains is not nearly as cold and windswept as similar areas in the Rocky Mountains. Temperatures can vary near the soil from zero to 40 degrees Celsius in summer.

Common animals include the pika and marmot which hibernate during the winter months, and the mountain goat which is present year-round. Voles and pocket gophers may remain active all year under the snow. Because birds are able to live at high altitude levels where oxygen pressure is low many breed in this habitat. The Golden Eagle is often associated with alpine tundra areas. In late summer, alpine tundra, with its hoards of migrating passerines, is an important migrating and foraging area for many birds of prey.

Winter - most alpine tundra areas are covered with deep snow in winter and many large mammals descend into the lower reaches. Some high ridges are wind-swept and provide access to food for some mammals locally as well as ptarmigan, Snow Buntings, and a few other small birds. At these locations, Gyrfalcons, Golden Eagles, Merlins, and even Northern Goshawks may forage in this habitat.

Mountains and canyons

Mountains are almost like islands in the sky. They exert a tremendous influence on climate which results in many different habitats. They provide water for most of our rivers and create most of our deserts. The temperature and rainfall changes considerably with increasing altitudes. And the vegetation gives way from luxuriant lowland forests to bare peaks. The variety of plants and animals also decreases with altitude. In parts of the world, some birds have become so specialized for mountain life that they can live nowhere else. Food, protection, and shelter is available to mountain inhabitants only during the spring, summer, and fall months. Few birds remain in most mountains throughout the winter, ptarmigan being the exception.

Today, some mountain habitats are threatened by the grazing of domestic stock, urbanization, and recreational activities like skiing. Avalanches and soil erosion are of concern.

Canyons are steep-sided valleys, often with a river running through them. The slopes are usually bare of plant life, with cliffs, that provide ledges for nesting raptors like the California Condor, Red-tailed Hawk, American Kestrel, Prairie Falcon, and Golden Eagle. In most cases canyon habitats only provide shelter and nesting sites for raptors. They must search elsewhere for food.

Summer - a variety of insects, birds, and mammals occur, and breed, at different altitudes in mountains depending on the vegetation. The top usually has permanent snow and only the Rock Ptarmigan and mountain goat are present. With decreasing altitude, the vegetation passes through alpine meadows to dense forests and the diversity of animals increases. This provides a prey base for many nesting, migrating, and foraging birds of prey. In autumn, thermals and updrafts created by the north to south arrangement of mountains, assist birds of prey with their long migrations.

Canyons usually only provide nest sites for raptors that offer shelter and protection from predators. Hunting usually takes place elsewhere.

Winter - only the hardiest of raptors are able to survive in northern mountains during the winter, especially at high altitudes. Occasionally Golden Eagles and Gyrfalcons are found here feeding on mammal carcasses or ptarmigan respectively. The lower reaches of forested mountains provide suitable hunting areas for accipiters where squirrels and small forest birds are numerous. Farther south, the Red-tailed Hawk is frequently seen soaring over mountains.

Few raptors are found in canyons during winter months.

Deserts

Deserts in North America cover about 500,000 square miles (1,295,000 square kilometers) and rank fifth in size among the world's deserts. Each desert is distinctive but all are harsh environments and arid with high temperatures. In North America, there are four well defined deserts, the Great Basin, the Mojave, the Chihuahuan, and the Sonoran. The hottest and driest deserts occur in the southern deserts.

Shrubs and cacti dominate desert plant life. Two kinds of desert occur in North America. In the cool deserts of the Great Basin, sagebrush, saltbush, shadscale, hop sage, and greasewood dominates the land, while in the hot southwest, creosote bush, bur sage, burro bush, and cacti dominate the landscape. Southern deserts have tall saguaro cacti that provide nesting sites for desert-inhabiting raptors.

Not long ago, deserts were thought of as one of the few habitats on the planet that was in no danger of disappearing. Today, even these barren landscapes are slowly being invaded by man's activities.

Summer - the length of this season varies with latitude. In northern latitudes, the summer may last two or three months while in southern areas it lasts seven or eight months. Eastern and southern deserts receive most of their precipitation during the summer months. In some deserts, like the Chihuahuan Desert, annual plant growth is more numerous in summer.

Summer daytime temperatures often range between 104 and 113 degrees Fahrenheit and may reach 158 degrees Fahrenheit at the soil surface. Under extreme conditions, some small mammals and reptiles may actually estivate for short spells while others carry on daily activities at night. Some, like the antelope ground squirrel, are active by day even in hot temperatures. Many animals, especially insects and amphibians, carry out their reproductive cycles with the summer rains.

Winter - northern and western deserts receive most of their precipitation during the winter season. Following winter rains, in the early spring, plant growth is more numerous in far western deserts.

Many animals hibernate for the winter months, but some small rodents, depending upon the temperature, may be partially active during the winter months, especially in southern areas. Since reptiles are dependent on outside temperatures to be active, most endure the winter months in underground burrows and crevices. Other animals, like jackrabbits, doves, quail, and rats remain active in the desert year- round and provide food for raptors.

Grasslands

Grasslands, which once covered large areas of the mid-continent of North America, have shrunk greatly due to man's needs for agricultural and grazing lands. In the United States they occupy about four million acres. Many of the large grazing herbivores, like bison, have been replaced in part by cattle and horses. In some areas, forests have been replaced by grasslands and on these overgrazing and plowing have affected the small mammal and bird life.

Grasslands grow usually where there is too little rain or soil for trees to grow. However, if left undisturbed many grasslands would return to forest habitats. They grow mainly in the heartland of North America and consist mainly of bunch grasses, such as orchardgrass, broomsedge, crested wheatgrass, and little bluestem, and sod formers, such as blue grama, big bluestem, and buffalgrass. In turn they provide nesting sites for many birds like Grasshopper Sparrows, Dickcissels, Bobolinks, meadowlarks, and Horned Larks. Insects and small mammals, such as prairie deer mice and rabbits, occur in great abundance. The prairie dog is one of the common burrowing mammals and the kit fox and prairie chicken are considered an indicator grassland species. Raptors feed on most grassland wildlife.

Raptors that inhabit grasslands are adapted to hunt from the air, like the Ferruginous Hawk and Prairie Falcon. In some instances, where power posts have been erected, raptors like the Golden Eagle may use them as hunting perches. In some areas artificial nest platforms are being erected for birds of prey.

Summer - in late spring and early summer haying and mowing activities exposes the ground to wind and rain and may contribute to erosion. Loss of protective grass cover also affects small birds and mammals. Many are killed or maimed in farming activities, which in turn attracts opportunistic raptors. Heavy grazing can also affect nesting populations of ground-nesting birds.

Insects are abundant in grasslands. Their numbers peak in summer with another smaller peak in the fall. Insects provide food for a variety of ground-feeding small birds, such as the Horned Lark, which in turn are eaten by birds of prey. Mammals common at this time include jumping mice, prairie dogs, and pocket gophers. Larger animals include pronghorn antelope, coyotes, badgers, bobcats, Sage Grouse, Sharp-tailed Grouse, and rabbits.

Winter - all northern grasslands are covered with snow in winter while in some of the more southern areas snow cover is not as deep. Many of the small burrowing rodents, like pocket gophers, hibernate, however, many small mammals, like voles, remain active and live just under the snow. The Rough-legged Hawk, for example, feeds mainly on voles during the winter and has learned to catch them under the snow. Cottontail rabbits and jackrabbits are also active and provide food for many open country-living raptors. Depending on the amount of cover, many smaller birds such as meadowlarks, buntings, larks, and sparrows eat seeds and available insects which in turn are preyed upon by aerial attackers like the Merlin or Prairie Falcon.

Shrublands

Shrublands are a stage in the land's progress back to a forest environment. They occur in forested regions in eastern North America, forested mountains in the West, and around the edges of deserts in the South. Many are associated with wetlands. Most shrubs (e.g. chaparral environments) are not usually over eight feet (2.5 meters) in height. They rarely cover the land entirely but appear as scattered plants or clumps of brush situated in grasslands, on the sides of hills, along streams, around lakes, and in wet areas. In some places, like Florida, they form dense thickets. Typical shrubs include hazelnut, sumac, sweetbriar, some dogwoods, willows, chokecherry, alder, hawthorn, blackberry, red-osier dogwood, and hawthorne.

Animals living in this habitat include quail, grouse, cottontail rabbits, sparrows, blackbirds, and flycatchers.

Summer - new growth provides cover for many nesting species of birds including some vultures, kites, Northern Harrier, hawks, and falcons. Some of these raptors nest on the ground in dense thickets while others, like the Swainson's Hawk, build its nest in the crown of shrubs.

Winter - many shrubs lose their leaves in winter although some keep them year-round. Dense thickets provide cover for many birds, such as quail, and mammals, such as rabbits. The seeds and fruits of blackberry, hawthorne, wild rose, and dogwood provide food for many small mammals and birds which in turn are preyed upon by wintering birds of prey.

Deciduous forests

North America is rich in deciduous or hardwood forests. Most are found in regions with moderate rainfall and mild temperatures which are requirements for the spring growing season. In the eastern United States, these forests are the most extensive of all natural habitats. They extend from the borders of Canada, where they compete with coniferous forests, south to the Gulf coast states and inland to the prairie regions of the continent. Deciduous forests in the West are not as extensive, and more locally distributed.

These woodlands may be dominated by a single tree species like sugar maple, alder, trembling aspen, magnolia, yellow poplar, black cottonwood, or an oak. Often, there are several species of deciduous trees that are found together as mixed deciduous forests. These forests occur mainly on glaciated land which has deep, rich layers of soil. Usually two or more kinds of deciduous trees dominate the area. These might include associations of beech-sugar maple, or sugar maple-basswood typical in the East, or black cottonwood-red alder and birch-poplar-cottonwood in the West.

The greatest diversity of animal life is found on, or just below, the ground level where temperature and humidity are relatively constant. Soil invertebrates, shrews, ground squirrels, foxes, and grouse are common animals. Other species occupy the upper parts of the forest, including the canopy, depending upon season. Flying squirrels, tree mice, hawks, woodpeckers, nuthatches, warblers, and tanagers live here seasonally or year-round.

The Red-tailed, Red-shouldered, and Broad-winged hawks are the three species of buteos that are commonest residents of hardwood forests.

Summer - with spring comes the season of flowers, leaves, song, reproduction, and a bit later, in summer, growth. In March and April, the forest floor receives its maximum amount of light, just before the leaves appear. A second peak, somewhat less intense, occurs in the fall. The darkest period is mid-summer when the trees are in full foliage and not much sunlight reaches the forest floor. The highest temperatures are in the upper canopy where many hawks nest. It is also a safe nesting site because trees may reduce wind velocities by as much as 90 percent.

Winter - the deciduous forests in winter are places of quiet and leafless environments, often covered in snow or leaf litter. All but the hardiest animals hibernate. Still, some mammals like shrews, rabbits, foxes, squirrels, mice, and weasels remain active. Familiar birds include chickadees, woodpeckers, grouse, grosbeaks, finches, siskins, and nuthatches.

Accipiters hunt these bleak landscapes as do Red-tailed Hawks.

Coniferous forests

This type of forest occurs across the continent as a wide belt extending from New England and southern Canada northward to the arctic tundra, westward to the Pacific coast, and southward through the Rocky and Sierra mountains. In some areas a single conifer, such as ponderosa pine, dominates the vegetation. Coniferous forests may be composed of pines in the east, black spruce in the north, redwoods in the southwest, or Sitka spruce in the west.

Within the coniferous forest belt occurs large stands of mixed conifers. On the Pacific coast these may include associations of Douglas-fir, western redcedar, and western hemlock while in the East assorted combinations of several species of pines, white cedars, and hemlocks may be found together. As a rule these kinds of forests support a greater variety of birds than do coniferous forests. At higher elevations, alpine forests consist of mountain hemlock, red fir, lodgepole pine, and alpine fir.

Summer - some coniferous forests in summer have high moisture, high humidity, and warm temperatures, like those along the Pacific coast. The brightest and warmest part of a coniferous forest is the upper canopy although this changes slightly with forest type. For example, some pine forests are so dense that often very little light reaches the forest floor resulting in little understory growth. In some coniferous forests, such as those containing spruce-like trees, the temperature is coolest in the upper canopy and increase towards the ground.

Summer birds include creepers, flycatchers, crossbills, siskins, grouse, kinglets, nuthatches, thrushes, jays, and woodpeckers. Various squirrels, voles, marten, and weasels are common mammals.

Winter - unlike deciduous forests, evergreens keep their leaves year-round. In winter, during periods of heavy snow, the branches may provide areas of protection for many animals. In some years cone-bearing evergreens provide important food for crossbills, nutcrackers, nuthatches, grosbeaks, and siskins which in turn are fed upon by hawks, especially accipiters. Blue and Spruce grouse, and squirrels, are favorite foods for the Northern Goshawk at this time of year.

Mixed forests

Other important forest types include a mixture of both deciduous and coniferous trees. These forests are the most diverse in animal life because they provide the greatest range of food, cover, and protection. For example, trembling aspen, which is the most widespread tree in North America, when interspersed in coniferous forests, provides home for such animals as deer, grouse, bear, snowshoe hare, and beaver. Some northern forests contain mixtures of pine, hemlock, and an assortment of hardwoods.

Summer - raptors in this habitat often breed in deciduous trees and either roost in nearby coniferous trees or use them as "plucking posts" for prey. The prey base of birds and mammals is usually greater in mixed woodlands.

Winter - the openness of deciduous forests in winter allows easier prey capture for the accipiters and some buteos like the Red-tailed Hawk. Prey is often eaten, however, in the protection of conifers. During very cold winters, or severe snow storms, Bald Eagles will move from evening roost sites in cottonwoods to the protection of fir, cedar, or spruce trees for the evening.

Wetlands (marshes and swamps)

As a general habitat wetlands are in between an area that is permanently wet and one that is generally dry. They cannot really be considered as either entirely terrestrial or aquatic. They have important biological functions which include flood control, shoreline stabilization, nutrient recycling, toxicant control and support for an entire food chain.

All wetlands are characterized by having a certain amount of water for a significant part of the year. The water can be flowing, fresh, brackish, or salty in nature. Wetlands include marshes which are all dominated by reeds, rushes, grasses, and sedges. These may be freshwater marshes, tidal salt marshes, and tidal freshwater marshes. Other wetlands include swamps, peatlands, fens, bogs, mangroves, floodplains, estuaries, lagoons, and artificial ponds and sloughs.

In North America, Canada has about 314 million acres (127 million hectares) of wetlands or nearly one-quarter of the world's total. The United States (including Alaska), has about 420 million acres (170 million hectares). Wetlands in North America are found in the arctic, boreal regions, among prairie grasslands, in the upper Mississippi region, along the Atlantic and Gulf coast, in the Great Lakes and St. Lawrence Basin, scattered among the West Coast mountain ranges, North Pacific and South Pacific coasts, and the Everglades.

Many animals make important use of wetlands, often year-round, for food and shelter. Loons, grebes, waterfowl, moose, otters, beavers, muskrats, minks, hawks, kites, blackbirds, wrens, bitterns, rails, cranes, coots, terns, sparrows, gulls, herons, egrets, amphibians, reptiles, and fishes are common groups of animals associated with wetlands.

Some raptors, like the Snail Kite, are specialists and feed only on certain kinds of snails while other birds of prey, like the Northern Harrier, take a variety of prey.

Summer - this is the season of an abundance of plant and animal life and when many birds of prey, like kites, ospreys, and harriers, visit wetlands to breed. Other raptors forage in wetlands but nest in other habitats.

Winter - in northern areas of the continent many wetlands are frozen solid and the grasses and sedges wither and cattails and reeds stand bare. Plants, along with smaller invertebrate life such as snails, fishes, amphibians, and mammals such as muskrats, must live on a diminishing oxygen supply. And there is the constant threat of total freeze-out.

In coastal areas, and areas free of ice in the interior, wetlands are important wintering and staging areas for many waterbirds and waterfowl. It is during this period, when prey is abundant that many raptors take advantage of a localized food source.

Riparian (lakes and rivers)

Less than two percent of all ecosystems on land are classified as riparian in nature, yet they are one of the most important features in natural landscapes. They are highly productive biologically, help maintain water quality by acting as nutrient and sediment sinks, moderate flood intensity, and store water.

Riparian habitats occur along the banks of streams, rivers, and lakes. What separates them from other habitats is that they always have the presence of large quantities of water nearby. As a result, plant growth is much greater than in upland environments. Usually this means dense shrub areas and high trees. As well, bird densities are nearly twice as great as they are in upland areas.

Human use of riparian habitats for agriculture, timber and livestock production, recreation, and housing is seriously threatening the imminent health and future of this important habitat. Presently, governments and conservation agencies are developing programs to protect and restore riparian areas.

Summer - more birds of prey nest in riparian situations than in any other habitat. Tall, sturdy trees with large branches support the heavy nests of birds like eagles and ospreys while tall shrubs, with dense crown cover, are used by kites. Many raptors associated with this habitat in summer are fish, amphibian, or snail eaters. For some hawks, like the Osprey, this type of habitat is critical.

Winter - rivers, lakes, and streams with tall trees are used by many birds of prey in winter. This is most evident on salmon-spawning streams where tall trees provide perch, eating, and roost sites for Bald Eagles. The treed and shrubby edges of lakes and rivers provide good hunting areas for accipiters and small falcons. Wherever waterbirds congregate, falcons and eagles can be found. Several buteo hawks use tall trees in riparian environments as perch sites to locate prey, often mammals.

Seacoasts

This habitat includes the area where the land meets the sea. It is fed by rich nutrients from the sea as well as off the land by rivers. Flat areas of seacoasts are exposed daily by the ebb and flow tides. Steep rocky cliffs provide safe sites for millions of seabirds to nest while beaches, dunes, and estuaries are used as staging areas for millions of shorebirds during migration and in winter.

Specific habitats found along seashores include rocky shores, cliffs, sandy or rocky beaches, sand dunes, estuaries, bays, coves, harbors, inlets, mudflats, tidal shallows, and intertidal zones.

Summer - raptors that live in this habitat in summer prey on fish, seabirds, or sea ducks. Some, like the Steller's Sea- Eagle, "Peale's" Peregrine Falcon, and White-tailed Eagle are restricted to this environment while others, like the Bald Eagle, Osprey, and Gyrfalcon also nest in inland situations. In protected areas, the Turkey Vulture can often be seen feeding on carrion along the seashore.

Many raptors nest on cliff ledges, or on the ground on rocky pinnacles on remote islets. Others build their stick nests in tall trees near plentiful food supplies.

Winter - many of the same raptors that are found along seacoasts in summer also occur there in winter. At this time they are found near concentrations of diving ducks away from the open ocean, shorebirds along the beaches, puddle ducks around estuaries, and fishes in protected waters. Only the Merlin and Northern Harrier are not found along seacoasts in summer.

Agricultural lands

These are man-made habitats that occupy about one-tenth of the land area of the planet. Usually these lands are far more unproductive than natural habitats, mainly because much of the land supports but a single crop and it is well known that monoculture environments are poor in animal diversity.

Farmland, that is already inadequate for human needs, is being destroyed very quickly. In the United States, because of poor land-use, about 4,633 square miles (12,000 square kilometers) are degraded by soil erosion each year. This land does not include rangeland which raptors also utilize.

Clearing of forests, and planting crops in managed land, is a habitat that some birds of prey have recently been forced to adapt to. Short-grass hayfields and croplands provide food and cover for many small mammals such as voles and mice. These in turn are utilized by many hawks and some kites. Dead farm animals attract vultures and Crested Caracaras. Large trees in hedgerows, or along fences and windrows, are used by some buteo hawks as nest sites.

Summer - this is the primary growing season and a time of high activity by humans and their farm equipment. Ground- nesting raptors, like the Northern Harrier, are sometimes successful on shrubby and isolated farmlands. Two species, the Red-tailed and Swainson's hawk, seem to have adapted well to nesting in isolated tall trees, or groves of trees, on farmlands. Others, like the Ferruginous Hawk and Osprey, readily nest on man-made structures. Haying and mowing operations attract some vultures and kites and the Crested Caracara to dead and maimed small mammals.

Winter - although human activity is greatly reduced on farmlands in the winter there is an abundance of prey for raptors. Small voles and mice remain active, even under the snow. Large flocks of starlings, blackbirds, ground-foraging birds like pipits, buntings, and larks, and concentrations of puddle ducks in wet fields attract many hawks, falcons, and eagles.

Urban and residential

Another name for this habitat could be "towns and cities." It is a human-created area that is densely populated by people and in which the size of land unit is small. Most people associate these areas with concrete, pigeons, cars, starlings, asphalt, House Sparrows, tall buildings, rats, manicured yards, and raccoons. But urban and residential habitats can support an astonishing variety of wildlife.

Buildings, parks, ornamental gardens, backyards, boulevards, vegetable gardens, golf courses, bridges, garbage dumps, cemeteries, airports, woodlots, schoolyards, sewage lagoons, and canals and other waterways all provide specific habitats for animals.

When one compares some of the differences between birds in urban and residential habitats with natural habitats we find that the abundance of exotic species, the density, and "total weight" or biomass is highest in urban and residential habitats, while the abundance of native species and the total number of species is highest in natural habitats. Bird-feeding activities may be partly responsible for these results because most urban birds are seed-eaters while birds in natural habitats eat mainly insects.

Urbanization is probably more detrimental to hawks than to most other birds because they are at the top of food chains and their home ranges are larger than for most other birds. However, many are adapting to urban environments.

Summer - the Merlin is becoming established in some of the Canadian prairies including Calgary, Edmonton, Moose Jaw, Regina, and Saskatoon. In fact, in Saskatoon, the highest density has been recorded for the species anywhere and the breeding success is higher than most places. Perhaps availability of old crow and magpie nests along with a population of feeders birds and small passerines along rivers has helped this bird colonize these areas.

The Mississippi Kite is also expanding its range into urban areas in the southern United States each summer. Peregrine Falcons are breeding on some city skyscrapers and feeding on European Starlings and Rock Doves. In wooded urban habitats Sharp-shinned, Cooper's, Red-shouldered, and Red-tailed hawks can be found breeding. In more open habitats around cities the American Kestrel has recently been found nesting in cavities in tall building and telephone poles.

Winter - the growing interest in feeding backyard birds has attracted a host of raptors to city environments. Merlins, Sharp-shinned and Cooper's hawks are the commonest winter visitors. In more rural areas the Northern Goshawk takes medium-sized birds like thrushes and quail. In some areas Peregrine Falcons are present year- round. In southern areas, vultures roost on buildings and man-made structures, and forage along streets and highways, in and around urban and residential areas.

Ground

These nests may be mere scrapes or depressions in the ground with few, if any, nesting materials such as those of the vultures, or they may be shallow platforms built of sticks or cattails on wet or dry ground characteristic of the Northern Harrier. Some species, like the Rough-legged and Ferruginous hawk may also nest on the ground but usually in tall, well-built stick nests. Occasionally the Bald Eagle and Peregrine Falcon also nest on the ground.

Tree - stick nests

These nests range from shallow platforms of twigs and sticks that may be 15 inches (38 centimeters) in diameter and 6 inches (15 centimeters) deep to huge structures of large branches and sticks that are 11.6 feet (3.6 meters) across and 19.4 feet (6 meters) deep. The nests may be built on the top of trees as in the Osprey, in crotches next to the trunk as in the Bald Eagle, or flat on sturdy branches, away from the trunk, as in the Red-tailed Hawk.

Some species, like the Merlin, may lay its eggs in unused, or abandoned nests, of other species like jays and crows.

Cactus - stick nests

The arms of giant cacti, mainly saguaro, provide suitable support for the stick nests of raptors like the Harris', Swainson's, and Red-tailed hawks. Few other birds of prey use cacti as nesting sites. Nests here average about 30 inches (76 centimeters) across and are deeper than tree nests averaging 13 inches (33 centimeters).

Tree and cactus cavities

These nest sites are usually abandoned cavities excavated by woodpeckers such as the Pileated Woodpecker, Northern Flicker, Gila Woodpecker, Acorn Woodpecker, sapsuckers, and the Northern Three-toed Woodpecker. They may be found in dead and living trees, both coniferous and deciduous, as well as in saguaro and organ pipe cacti. Cavities may also be formed naturally as a result of wind, lightning, and ice storms, or from natural ageing of limbs and trunks.

Usually no nesting material is used to line the nest cavity.

Cliffs and ledges

These sites are usually isolated nest sites that are free from mammalian predators and provide the occupant with a general view of its foraging territory as well as thermals and uplift for easy flight. Some raptors, like vultures and some of the falcons, nest in caves or on ledges laying their eggs right on the ground. Others build odd-shaped stick nests that are crammed into available crevices, holes, and ledges.

Some raptors that lay their eggs on the ground, such as on cliff ledges, may be short of nest sites. Artificial ledges and small caves in natural situations can be created by blasting and digging.

Human-made structures

Some raptors build their nests on man-made structures that were not specifically erected for that purpose. For example, the Turkey and Black vulture, Peregrine Falcon, and American Kestrel have all used new buildings as nest sites. Old or abandoned buildings have been used by Ospreys, Red-tailed Hawks, and Ferruginous Hawks.

The cross beams and other supports on telephone and power poles have been used as support for many nesting hawks.

Nest boxes and platforms

Lack of nest sites for raptors may occur directly through natural causes such as erosion, ice storms, and wind as well as through loss of sites due to human activities. This is especially true for secondary cavity-nesting species like the American Kestrel. If food is plentiful, artificial nest sites can help increase or maintain numbers of breeding raptors. In other situations, additional nest sites can encourage young adult birds to breed a bit earlier than is normal. It is important that nest structures are built properly, placed where a food supply is available, not exposed directly to the weather, and are well concealed.

Artificial nest structures can include nest boxes, artificial tree cavities, towers, platforms, and baskets. Nest boxes are used primarily by the American Kestrel with success and locally have increased breeding densities. Artificially creating "natural" tree cavities by chainsaws and chisels, or injection of a heart-rot fungus, may be other methods of producing nesting cavities.

Raptors that breed in open country situations may be limited by lack of nest sites. All of these build large stick nests and therefore require sturdy support. Raptors have responded well to platforms, boxes, and baskets being set on towers, power and telephone poles, pilings, and other artificially erected nest poles. Such structures may attract raptors to areas where they have not previously nested. Sometimes more young are raised in artificial sites than in natural ones.

Snails

Snails are members of the phylum Mollusca, a large group of invertebrates that include such familiar animals as clams, oysters, squid, and octopods. Snails are the largest group of molluscs and have been very successful in establishing themselves in salt and fresh-water environments as well as on land. They are characterized by a soft body that is usually covered by a protective limy shell.

Only three raptors utilize snails as an important part of their diet. In Florida, the Snail Kite is totally dependent on trees snails, mainly the apple snail (*Pomacea paludosa*), that it plucks from trees during the day. Two other snails, (*Rhabdotus* and *Marisa*), are also eaten. The Hook-billed Kite also feeds primarily on snails but is also eats amphibians and insects.

Locally, the abalone, which is a large intertidal snail and a well known delicacy in restaurants, is eaten by Bald Eagles. One site of the Queen Charlotte Islands, in British Columbia, had over 300 shells scattered on the ground below a nest.

Insects

Insects occur almost everywhere in the world and make up more than one-half of all living animals. There are several hundred thousand kinds of insects and they can be found in almost every habitat, except the ocean. Most are small and of little value to birds of prey as food. However, large flying insects can form a significant part of a bird's diet.

Seven species of raptors have insects as part of their diet but only two, the American Swallow-tailed Kite and Mississippi Kite, use insects as a primary food source. These include large flying insects such as grasshoppers (Orthoptera), dragonflies (Odonata), cicadas (Homoptera), beetles (Coleoptera), and some ants (Hymenoptera).

Fishes

Fishes have always been an important food source for humans and today they have become a major source of protein for a rapidly increasing population. Fishes are basically cold-blooded vertebrates that live in water. They breathe with gills and have fins rather than legs. There are about 2,200 species in North America. Most of them are classified as "bony fishes" and they live in fresh, brackish, and marine waters.

Four species of raptors live principally on fish. Two of these are thought of as "sea eagles" and are rare in North America. The other two, the Osprey and Bald Eagle, are more widely distributed. Fishes can be captured alive, either seasonally during spawning or when present in immense schools, or throughout the year. Many are fed upon as carrion.

At least 65 species of fishes have been identified as prey for raptors. Some of the more common kinds include cutthroat, rainbow, and lake trout, alewife, surfperch, salmon (four species), suckers, Menhaden, carp, pollock, cod, shad, herring, rockfish, lingcod, bullhead, catfish, flounders, perch, and smelt.

Amphibians

Amphibians spend part of their lives in water and part on land. Even when on land they cluster around permanent bodies of water. Largest populations of amphibians, and the greatest diversity in numbers, occur in southern areas along the gulf coast. For example, there are over 60 species of amphibians in Georgia, while in Florida, in the rainy season, they may be millions of frogs, toads, and salamanders per square mile. Farther north, in Alaska, there are only six species of amphibians and perhaps a few hundred individuals per square mile. There are about 178 species of frogs, toads, and salamanders in North America.

No single bird of prey depends solely on amphibians for its food although seven species use them as parts of their diet. Not surprising, most of these raptors occur in the southern United States or spend a good part of their life near riparian and wetland habitats. In times of local food scarcity amphibians may become more important in some raptor diets.

Amphibians eaten include frogs and toads. Of these, tree frogs (hylids) are the group most preyed upon.

Reptiles

Like amphibians, reptiles breathe air and do not have the ability to control their own body temperature. They either lay eggs or give birth to live young and all have protective scales that allows them to be less dependent on water for survival. So temperatures dictate where they live and when they can be active. Like raptors, nearly all reptiles are flesh eaters of some kind. There are about 278 species of turtles, lizards, snakes, and crocodilians in North America with the greatest diversity in southern parts of the United States.

Some lizards and turtles, and most snakes are mainly active at night or in the early evening or morning. Most lizards and turtles, however, are active during the day when temperatures are warm and food is available.

Three species of hawks feed primarily on reptiles and all are found where reptiles are numerous, in the southern United States. Another nine species of raptors eat various kinds of reptiles as a significant part of their diet.

Lizards and snakes are the main reptiles eaten by birds of prey although some turtles are captured alive. The lizards can be arboreal-living (tree), or ground-living species and include a wide variety of groups including *Ameiva*, *Sceloporus*, *Cnemidophorus*, *Urosaurus*, *Holbrookia*, and *Phrynosoma*. Groups of snakes include *Masticophis*, *Thamnophis*, *Coluber*, *Pituophis*, *Opheodrys*, and *Crotalus*. Some of these genera live in trees.

Birds - open country

This habitat includes natural and man-altered grasslands, prairies, cultivated areas, arctic and alpine tundra, pastures, meadows, airports, golf courses, and deserts. Bird diversity and abundance in open country habitats is low when compared to say forests, mainly because the vegetation complexity is so simple.

Birds found in open country range in size from a sparrow to a Sage Grouse. Open country birds are mainly omnivorous but during the breeding season they feed mostly on grasshoppers, ants, beetles, and bugs. Typical groups include ptarmigan, larks, buntings, longspurs, pipits, and meadowlarks.

Nine species of raptors regularly feed on open country birds, four of which use them as primary prey. All of these predators are falcons which are streamlined hawks with long pointed wings that are pursuit predators.

Birds - urban and residential

Human residential yards and dwellings, as well as other structures and landscapes such as golf courses and airports, provide habitat for some species of wildlife that are utilized by birds of prey for food. With the phenomenal increase in feeding birds, and providing nest boxes and other situation for songbirds (and raptors), several birds of prey have adapted to nesting in urbanized areas as well as taking advantage of wildlife attracted to feeders, especially during the winter. Some raptors become resident in an area on a seasonal basis.

Four species of raptors have become associated with urban and residential areas. The Peregrine Falcon nests on tall buildings in some cities and regularly preys on Rock Doves and European Starlings, while the Merlin nests in some city boundaries and preys on small woodland birds. In the winter, the Sharp-shinned and Cooper' hawk, and frequently the Merlin, have adapted to regularly visit feeders in search of prey. Together, these raptors have captured at least 63 differently prey species of prey ranging in size from an Anna's Hummingbird to a Band-tailed Pigeon. The most common prey taken by the Sharp-shinned Hawk in northern regions, in winter, is the Dark-eyed Junco.

Other raptors occasionally visit feeders and urban and residential habitats for food. These include the Black Vulture (carrion), Turkey Vulture (carrion), White-tailed Kite (voles and rats), Bald Eagle (waterfowl), Northern Goshawk (pigeons, doves, chickens, (birds in nest boxes, grasshoppers), and Gyrfalcon (waterfowl, shorebirds).

Birds - forests and shrublands

This habitat includes pure and mixed deciduous and coniferous forests and shrublands. Prey diversity is high because of the variety of plants, climate, protection, and food available at various foraging levels, from beneath the ground to the top of the trees. The variety of birds is lowest in pure coniferous forests, such as a boreal forest, and highest in mixed coniferous\deciduous forests.

Forest birds include a wide variety of ground feeders, branch and trunk gleaners, berry and cone seed eaters, leaf eaters, insect chasers, and leaf litter specialists. Some groups include grouse, warblers, nuthatches, woodpeckers, vireos, thrushes, jays, towhees, sparrows, wrens, kinglets, chickadees, grosbeaks, finches, crossbills, tanagers, doves, and owls.

Shrubland birds use the dense cover to carry on much of their life activities. Some may forage in more open areas but frequently return to the safety of brushlands for cover. Typical prey groups here include quail, cuckoos, partridges, bobwhites, kingbirds, sparrows, warblers, magpies, owls, waxwings, and doves.

Ten species of raptors prey regularly upon forest and shrubland birds but only two, the Sharp-shinned and Cooper's hawk, have them as the primary part of their diet. These short-winged and long-tailed hawks are ideally adapted for capturing their prey in the confines of dense woods and shrubs. Other raptors often catch these birds as they move to or from these habitats.

Birds - seashores and oceans

This habitat includes the open ocean and nearshore environments. The true seabirds live here, birds that only come to land to breed each summer. At other times of the year they are far at sea. The nearshore areas include the seacoasts along with their rocky headlands, islands, cliffs, and beaches. It is in these habitats where most birds of prey find their food.

In summer, millions of murrelets, auklets, guillemots, dovekies, murrelets, and puffins nest on cliffs and offshore islands. Several species of raptors breed among these colonies because of the readily available food source. Falcons and eagles will also hunt over the open ocean at this time of year and prey upon shearwaters, fulmars, storm-petrels as well as diving seabirds.

In fall, migrating shorebirds provide food for falcons, both along the shore and at sea. In winter, waterfowl and other waterbirds like loons and grebes that seek the safety of protected inland seas and estuaries are preyed upon by both falcons and eagles.

Five species of raptors feed regularly on birds in the marine habitat. Only one, the "Peale's" Peregrine Falcon is dependent on seabirds for the principal part of its diet.

Mammals - squirrels and chipmunks

This group of medium to large-sized rodents all belong to the Family Sciuridae which includes 53 different species in North America. It includes the chipmunks (*Eutamias*, *Tamias*), woodchucks (*Marmota*), marmots (*Marmota*), ground squirrels (*Citellus*, *Spermophilus*), prairie dogs (*Cynomys*), tree squirrels (*Sciurus*, *Tamiasciurus*), antelope squirrels (*Ammospermophilus*), and flying squirrels (*Glaucomys*).

All but one group, the flying squirrels, are active during the day. Marmots, ground squirrels, prairie dogs, and chipmunks all carry on their breeding activities underground in a burrow. Tree squirrels and flying squirrels use trees as their nest sites. Some hibernate, others estivate, while some species are active year-round. They range in size from the Least Chipmunk, which has a body length of 3.6 to 4.5 inches (93 to 114 millimeters) and weighs between 1 and 2 ounces (28 and 57 grams), to the Hoary Marmot, which has a body length of 18 to 21 inches (46 to 53 centimeters), and weighs between eight and 20 pounds (3.6 to 9 kilograms).

Sciurids are found from sea level to the alpine tundra and inhabit a wide variety of habitats which may include open woods, rocky ravines, talus slopes, alpine meadows, dry prairies, thickets, pastures, grainfields, deciduous and coniferous forests, rocky canyons, grasslands, sagebrush flats, deserts, and tundra.

At least 12 species of raptors depend heavily on this group of rodents for food.

Mammals - small rodents

Rodents are gnawing mammals that comprise the largest group of mammals in the world. Collectively they are very successful and nearly cosmopolitan in distribution. They range in size from a pygmy mouse, that may be 4 inches (10 centimeters) long, including tail and weigh about one-third ounce (8.5 grams), to the beaver, which may be four feet (1.2 meters) long, including tail, and weigh more than 100 pounds (45 kilograms).

Rodents include many familiar mammals such as beavers, squirrels, mice, voles, marmots, chipmunks, rats, porcupines, woodchucks, lemmings, gophers, and muskrats. Some live underground, some on the ground, and others are arboreal and part of their lives in trees. Some hibernate, others estivate, and some are active year round. All have two upper and two lower incisor teeth, which never stop growing. Rodents are found in every conceivable habitat, from deserts to alpine meadows.

Although opinions vary between humans, rodents are a vital link in the food chain of so many other animals, including birds of prey.

At least 20 species of raptors feed to some extent on rodents while 14 of these have these small rodents as their primary prey. At least 121 different species can be considered as small rodents. Important groups include voles (*Microtus*, *Clethrionomys*, *Lagurus*, *Pitymys*), mice (*Peromyscus*), rats (*Rattus*, *Neotoma*, *Oryzomys* and *Sigmodon*), ground squirrels (*Citellus*), pocket gophers (*Thomomys*, *Geomys*), pocket mice (*Liomys*, *Perognathus*), prairie dogs (*Cynomys*), kangaroo mice (*Microdipodops*), jumping mice (*Zapus*), kangaroo rats (*Dipodomys*), squirrels (*Sciurus*, *Tamiasciurus*), chipmunks (*Tamias*, *Eutamias*), lemmings (*Dicrostonyx*, *Synaptomys*, *Lemmus*), marmots (*Marmota*) and antelope squirrels (*Ammospermophilus*).

Small rodents are found from sea level to alpine tundra. They inhabit a very diverse range of habitats such as deserts, wetlands, cultivated fields, coniferous and deciduous forests, thickets, human settlements, grasslands, river banks, islands, tundra, canyons, mountains, talus slopes, alpine meadows, and seashores.

Mammals - rabbits and hares

Some time ago this group of medium-sized mammals was actually classified along with the rodents. The main difference, besides ancestry, is that rabbits, hares, and lesser known pikas, all have two sets of upper incisor teeth. And rabbits and hares are quite different. Hares are generally larger overall with longer legs and ears. As well, the summer brown coat of hares in northern regions, turns white in winter.

Rabbits and hares are known to be able to produce three or more litters a year, each with two to seven young, depending on location. These, in turn, are fed upon by a wide variety of mammalian and avian predators, These mammals are usually most active at night than during the day.

Although eight species of raptors prey on rabbits and hares, none use the group as a primary source of food. This may change seasonally, and locally, depending on populations of other prey. For example, during years when hare numbers are very high, the Northern Goshawk may feed mainly on this prey for a short time. This group includes hares (*Lepus*), jackrabbits (*Lepus*), cottontails (*Sylvilagus*), and swamp, marsh, and brush rabbits (*Sylvilagus*).

Mammals - carnivores

This group of mammals is often referred to as the "flesh eating" animals. They range in size from the tiny Least Weasel to the Grizzly Bear. They include the dog-like mammals, marine mammals, bears, large cats, raccoons, and the mustelids, that include the martens, weasels, mink, skunks, and otters. It is the latter groups that are mainly preyed upon by raptors.

Only two species of birds of prey include the smaller carnivores as a significant part of their diet, the Crested Caracara and Red-tailed Hawk. Specific prey animals included raccoon, skunk, marten, weasel, and mink. Occasionally eagles have been seen taking young sea otter pups in Alaska. While carnivores may not be as important in the overall diet of most raptors they can become significant during periods when normal foods are not available.

Carrion

Animals that die naturally, or by accident, and those killed by traffic along highways or hunting and fishing activities, as well as other causes, provide a source of food utilized by a well- adapted group of raptors. In most cases both smell and sight is used to locate carcasses. These can include mice and voles chopped up in agricultural mowing operations, snakes run over by cars, still born domestic stock, as well as to whales and other sea mammals washed ashore on beaches.

Seven species of raptors regularly use carrion as part of their diet but only the vultures, condor, and Crested Caracara use it as the main source of food.

Alaska

Alaska is a large region, about one-fifth the size of the continental United States, and covers an area of about 587,000 square miles (1.5 million square kilometers). Due to its shape, and hundreds of islands, including the Aleutian and Pribilof islands, it has a coastline of almost 34,000 miles (54,400 kilometers). Major cities include Fairbanks, Juneau, and Anchorage.

This region includes all of Alaska except the Arctic tundra along the north coast. Much of the interior of the region is covered with boreal forests of spruce and birch where temperatures can range from -54 to 21 degrees Centigrade. Here broad valleys and high mountains predominate. Along coastal areas there are mixed forests of Sitka spruce, western hemlock, western red cedar, and lodgepole pine which are inundated with broad estuaries and flood plains. Rocky intertidal areas, full of life, provide direct and indirect food for eagles.

Stretching for hundreds of miles off the southwestern portion of Alaska are a group of treeless islands that are covered mainly with dwarf willow, crowberry, bearberry, grasses, and sedges reminiscent of sub-arctic vegetation. This is the country for sea eagles and Peregrine Falcons.

Thirteen species (and seven races breed) of birds of prey occur regularly in this region. Two more, the White-tailed Eagle and Steller's Sea-Eagle, are rare visitors and the only place in North America where birders get a good chance to see them. Seabird colonies attract high densities of breeding Peregrine Falcons, and in winter, salmon spawning streams support thousands of Bald Eagles.

Northwest Pacific

The Northwest Pacific region includes the northwestern portion of North America, except Alaska. The Yukon (except tundra areas), British Columbia (including offshore islands), and the states of Washington, Oregon, Idaho, and western Montana comprise this region. Major cities include Whitehorse, Vancouver, Seattle, and Portland.

It is primarily an area of extensive coniferous forests and north-south running mountain ranges. Both the boreal (northern interior) and temperate (coastal) forest types occur here. In the interior, temperatures can range from -48 to 27 degrees Celsius while along the milder coastal areas temperatures can range from -4 to 21 degrees Celsius. Summers can be dry seasons and deep snow is evident in some areas in winter.

In some areas of the interior cool deserts prevail. Rocky fjords, beaches, and estuaries are common. The Rocky Mountains borders much of the eastern boundary of this region. Large lakes and rivers are a dominant this region.

Nineteen species (and eight races breed) of birds of prey occur regularly, and breed, in this region. Another species, the California Condor, has been extirpated from the area. High densities of nesting Peregrine Falcons occur on the Queen Charlotte Islands, off the northern British Columbia coast, while Bald Eagles are attracted to salmon spawning streams in late summer and winter throughout the region. The north-south running mountain ranges serve as migration corridors each spring and fall for many raptors. And the millions of shorebirds that stop to rest and feed on estuaries along the coast attract falcons.

Southwest Pacific

The southwest Pacific region includes the four states of California, Nevada, Utah, and Arizona. Major cities include San Francisco, Los Angeles, Las Vegas, Reno, Salt Lake City, Tucson, and Phoenix.

It is a very diversified region with coastal temperate and interior coniferous forests, chaparral habitats, cool desert with sagebrush, hot deserts where there may be a long dry season and temperatures may reach 57 degrees Celsius, riparian thickets, and productive wetlands. Deep river canyons and mountains give additional variety to the landscape. Sandy beaches add to variety.

Twenty-seven (and four races breed) birds of prey regularly visit, and breed, in this region. The mountainous country of central California is the last stronghold for the endangered California Condor which now may be extirpated from the area. The deserts of southern Arizona are home to some rare North American hawks including the Common Black-Hawk, Gray Hawk, and Zone-tailed Hawk. Vultures are common and some kites are moving into, and becoming settled, in the region. It is also one of several areas on the continent where Crested Caracaras can be found.

North-Central

The North Central region includes the area between the Arctic tundra in the north and the grasslands in the south. Most of the Northwest Territories, northeastern British Columbia, and much of the Canadian prairie provinces of northern Alberta, Saskatchewan, and Manitoba are found in this region. Major human settlements include Yellowknife, Fort MacKay, Prince Albert, and Churchill. Some of the largest lakes on the continent occur here such as Great Bear and Great Slave lake and Lake Winnipeg.

This region is characterized by dense coniferous forests, patches of northern hardwoods, numerous small and large lakes, swamps and bogs, and many rivers.

Thirteen species (and four races breed) of birds of prey breed in this region. The forests attract accipiters, especially the resident Northern Goshawk. Bald Eagles and Ospreys build their large stick nests along lakeshores where fish are plentiful. The western limit of the Broad-winged Hawk's range occurs here where stands of aspen provide nest sites and a prey base. Due to harsh weather few raptors are found here in winter.

Mid-Central

The Mid Central region includes the southern Canadian provinces of Alberta, Saskatchewan, and Manitoba, most of Montana, Wyoming, eastern Colorado, northern New Mexico, North Dakota, South Dakota, most of Nebraska, western Minnesota, and northern Iowa. Major cities include Edmonton, Calgary, Regina, Winnipeg, Missoula, Fort Collins, Bismarck, Jamestown, and Omaha.

The mid-continent region of North America is covered with temperate grasslands, generally an open country environment where rainfall is too low to support extensive forests. It covers an area of about 3.5 million square miles (9 million square kilometers). Most of the native grasslands today are used for crop and grazing lands. Summers here can be hot, and winters cold. Seasonal thunderstorms are common.

Eighteen species (and five races breed) of birds of prey occur in this region. Open country raptors, like the Swainson's and Ferruginous hawk, are common here in summer while the Rough-legged Hawk is present in winter. The "Kridler's" Red-tailed Hawk is restricted to this region.

South-Central

The South Central region includes most of New Mexico, Texas, Oklahoma, southern Iowa, and the western portion of Missouri, Arkansas, and Louisiana. Major cities include Albuquerque, Santa Fe, San Antonio, Houston, Dallas, Oklahoma City, Wichita, and Little Rock.

This region is a land of relatively open country that has desert and semi-desert environments, mountain cliffs, dry, short grasslands, gorges, mesas, groves, riparian thickets, coastal sand dunes, and bare rocky slopes.

Twenty-nine species (and seven races breed) of birds of prey breed, winter, and visit this region, the most in North America. Some are rare and have restricted ranges like the Hook-billed Kite, Gray Hawk, Common Black-Hawk, Gray Hawk, White-tailed Hawk, and Roadside Hawk. Others, like the more widely distributed Harris' Hawk, has most of its range in this region.

Northeast Atlantic

The Northeast Atlantic region includes all of Ontario, Quebec, and Labrador (except tundra) and the Maritime provinces south along the Atlantic seaboard to Pennsylvania and west through Wisconsin to western Minnesota. All of the Great Lakes are also in this region. Major cities include Toronto, Ottawa, Montreal, St. Johns, Halifax, Boston, New York, Minneapolis, and St. Paul.

Northern portions of the region are covered by boreal coniferous forests of spruce, fir, and pine interspersed with numerous lakes, swamps, bogs, streams, and rivers. To the south, temperate broad-leaved hardwood forests of maples, beech, birch, oak, hickory, basswood, chestnut, elm, sycamore, and ash predominate. These trees lose their leaves in winter.

Sand dunes and beaches and intertidal areas provide foraging areas for hawks. Two groups of mountains, mainly the Notre Dame and Adirondack mountains run in a northeast to southwest direction east of the Great Lakes.

Sixteen species (and four races breed) of birds of prey occur in this region. It is well known as a major migration route for hundreds of thousands of raptors each year. Some raptors, like the Turkey Vulture, are extending its range northward into this region while others, like the Red-shouldered and Broad-winged hawk, only breed in the area.

Southeast Atlantic

The Southeast Atlantic region includes the area east of the Mississippi River to the Atlantic Ocean and from southern Minnesota, Wisconsin, Michigan, and Pennsylvania south to the Gulf Coast and Florida. Major cities include Milwaukee, Detroit, Philadelphia, Washington, Baltimore, St. Louis, Indianapolis, Cincinnati, Memphis, New Orleans, Charleston, Atlanta, Augusta, and Miami.

Much of the habitat of the coastal plain includes pine forests and pine barrens which stretch from Delaware southward to the coastal plains of Florida. When burned these coniferous forests are replaced with hardwoods such as magnolia, oak, and hickory. Hardwood forests, mainly in the interior, are dominated by yellow poplar, oak, chestnut, and hickory. Most of the Appalachian Mountain ranges occur in this region where red spruce and fir dominate.

Wooded cypress swamps, and hardwood swamps along rivers and lake shores, as well as the mangrove swamps of coastal Florida, are unique features of this region. Only two large lakes occur in the region, Lake Marion in South Carolina and Okeechobee Lake in Florida. Dense thickets of shrubs and small trees provide protection for ground-nesting raptors such as vultures.

Twenty-four species (and six races breed) of birds of prey are either resident, breed, or winter in this region. It is the only area in North America where the American Swallow-tailed Kite (summer), Snail Kite and Short-tailed Hawk (year-round) are found. Fish-eating Ospreys are common locally. Large numbers, and a wide variety of raptors, spend the winter in the area, especially in Florida. Many are tame and approachable. Some are considered pests.

Arctic

The Arctic Tundra region occurs at high latitudes in North America and encircles the top of the world north of the coniferous forest belt. It includes the northern coastal plain of Alaska and Yukon Territory, much of the Northwest Territories including the high arctic islands, parts of extreme northern Manitoba and Ontario bordering Hudson Bay, and far northern Quebec and Labrador. Major settlements include Inuvik, Bathurst Inlet, Resolute, Cambridge Bay, Chesterfield Inlet, and Nutak.

The region is a treeless plain. The vegetation starts at the tree line and consists of a blanket of sedges, cotton grasses, heaths, and dwarf willows. The ground is permanently frozen and alternate thawing and freezing helps mould the landscape. It has a cold climate with short summers and long winters. Numerous islands, with steep slopes and nesting seabirds are found throughout the region. These colonial birds provide food for the Gyrfalcon. Large rivers are few although streams are numerous during spring breakup.

Only three birds of prey occur regularly in this region. The Rough-legged Hawk and "Tundra" Peregrine Falcon only breed while the Gyrfalcon may be present year-round.

For Help on Help, Press F1

