

= American kestrel =

The American kestrel (*Falco sparverius*) is the smallest and most common falcon in North America . It has about a two to one range in size over subspecies and sex , varying in size from about the weight of a blue jay to a mourning dove . It also ranges to South America , and is a well established species that has evolved seventeen subspecies adapted to different environments and habitats throughout the Americas . It exhibits sexual dimorphism in size (females being moderately larger) and plumage , although both sexes have a rufous back with noticeable barring . Its plumage is colorful and attractive , and juveniles are similar in plumage to adults .

The American kestrel usually hunts in energy conserving fashion by perching and scanning the ground for prey to ambush , though it also hunts from the air . It sometimes hovers in the air with rapid wing beats while homing in on prey . Its diet typically consists of grasshoppers and other insects , lizards , mice , and small birds (e.g. sparrows) . This broad diet has contributed to its wide success as a species . It nests in cavities in trees , cliffs , buildings , and other structures . The female lays three to seven eggs , which both sexes help to incubate .

Its breeding range extends from central and western Alaska across northern Canada to Nova Scotia , and south throughout North America , into central Mexico and the Caribbean . It is a local breeder in Central America and is widely distributed throughout South America . Most birds breeding in Canada and the northern United States migrate south in the winter . It is an occasional vagrant to western Europe .

Based on appearance and behavior it was for many years considered a member of the primarily European and African kestrel clade within the genus *Falco* , but recent DNA analysis shows the American kestrel to actually be genetically more closely related to the larger American falcons such as the Aplomado falcon , the Peregrine falcon , and Prairie falcon . Though the species has not been renamed as a result of these genetic analyses , it is not actually a kestrel in the phylogenetic sense . Instead , a process of convergent evolution to fit a similar small prey niche in the ecosystem as the true kestrels has left it with similar physical characteristics and hunting methods .

The American kestrel is a common bird used in falconry , especially by beginners . Though not as strong a flyer as many other larger falcons , proper training and weight control by the falconer allows many American kestrels to become effective hunters of birds in the size range of sparrows and starlings , with occasional success against birds up to approximately twice their own weight .

= = Description = =

Under traditional classification , the American kestrel is the smallest raptor in America . The American kestrel is sexually dimorphic , although there is some overlap in plumage coloration between the sexes . The bird ranges from 22 to 31 cm (8 @. 7 to 12 @. 2 in) in length with a wingspan of 51 ? 61 cm (20 ? 24 in) . The female kestrel is larger than the male , though less so than larger falcons , being typically about 10 % to 15 % larger within a subspecies . The more northern subspecies tend to larger sizes , with a large northern female being about twice the size of a small southern male . The male typically weighs 80 ? 143 g (2 @. 8 ? 5 @. 0 oz) , and the female 86 ? 165 g (3 @. 0 ? 5 @. 8 oz) . In standard measurements , the wing bone is 16 ? 21 cm (6 @. 3 ? 8 @. 3 in) long , the tail is 11 ? 15 cm (4 @. 3 ? 5 @. 9 in) and the tarsus is 3 @. 2 ? 4 cm (1 @. 3 ? 1 @. 6 in) .

Physically , American kestrels are leaner and less muscular than larger falcons . The pectoral flight muscles of the American kestrel make up only about 12 % of its body weight , as compared to about 20 % for the strongest flying falcons such as the peregrine . The wings are moderately long , fairly narrow , and taper to a point . Their less muscular body type is adapted to energy conserving ambush hunting , rather than spending large amounts of energy consuming time on the wing and getting into long tail @-@ chases of bird prey . For their size , they have strong talons and beaks , and can swiftly dispatch prey . Their lean build and energy conserving strategy allows a lower daily food intake than if they were more strongly muscled , yet with enough strength to commonly take bird prey as large as themselves , and occasionally larger . The success of this body style and

hunting strategy is reflected in the high success of the species in densely populating a large range throughout the Americas . The flight of the American kestrel is not so dramatic and swift as more muscular falcons such as Merlins and peregrines , but their efficient adaptation to a broader diet of more available smaller prey , and need for less food per day , has resulted in there being many more of them .

In contrast to many other raptor species , the sexes differ more in plumage than in size . Males have blue @-@ grey wings with black spots and white undersides with black barring . The back is rufous , with barring on the lower half . The belly and flanks are white with black spotting . The tail is also rufous , with a white or rufous tip and a black subterminal band . The back and wings of the female American kestrel are rufous with dark brown barring . The undersides of the females are creamy to buff with heavy brown streaking . The tail is noticeably different from the male 's , being rufous in color with numerous narrow dark black bars . Juveniles exhibit coloration patterns similar to the adults ' . In both sexes , the head is white with a bluish @-@ grey top . There are also two narrow , vertical black facial markings on each side of the head , while other falcons have one . Two black spots (ocelli) can be found on each side of the white or orangish nape . The function of these spots is debated , but the most commonly accepted theory is that they act as " false eyes " , and help to protect the bird from potential attackers .

= = = Vocalizations = = =

The American kestrel has three basic vocalizations ? the " klee " or " killy " , the " whine " , and the " chitter " . " The " klee " is usually delivered as a rapid series ? klee , klee , klee , klee when the kestrel is upset or excited . This call is used in a wide variety of situations and is heard from both sexes , but the larger females typically have lower @-@ pitched voices than the males . The " whine " call is primarily associated with feeding , but is also uttered during copulation . The " chitter " is used in activities that involve interaction between male and female birds , including courtship feeding , copulation , and the feeding of nestlings . Nestlings can produce calls similar to those of adults at 16 days old .

= = Taxonomy = =

Until the sixth edition of the AOU Checklist of North American Birds was published by the American Ornithologists ' Union in 1983 , the most commonly used name for the American kestrel was the sparrow hawk or sparrowhawk . This was due to a mistaken connection with the Eurasian sparrowhawk in the genus *Accipiter* . The sixth edition of the AOU Checklist corrected this , officially renaming the bird American kestrel . Several other colloquial names for the kestrel are also in use , including grasshopper hawk , due to its diet , and killy hawk , due to its distinct call .

As noted in the introduction , DNA analysis shows the American kestrel to actually be genetically more closely related to the larger American falcons than to the true kestrels . However , based on its physical similarity to the kestrels and the established nature of the name American kestrel , there has been little impetus to change its name . This could change in the future if continued genetic research more precisely determines the evolutionary history of the American kestrel within the genus *Falco* . The entire genus is actually a set of species so closely related that most or all can be hybridized by artificial insemination . Significant natural hybridization of species has occurred in the past during the evolution of this closely related set of species , such that precise evolutionary genetic analysis as to which species are more basal to other species or to the genus as a whole is difficult to render .

The American kestrel 's scientific name , *Falco sparverius* , was given by Carl Linnaeus in his 18th century work *Systema Naturae* . The genus refers to the falcate , or hooked , shape of the beak , and the specific name means " pertaining to a sparrow " , referring to the bird 's small size and hunting of sparrows as a typical prey .

Seventeen subspecies of the American kestrel are recognized , generally based upon plumage , size , and vocalizations :

F. s. sparverius , described by Linnaeus in 1758 , is the nominate subspecies . It is found in most of the United States , Canada , and Mexico .

F. s. paulus , described by Howe and King in 1902 , is found in the Southeast United States , from Louisiana to Florida .

F. s. peninsularis , described by Mearns in 1892 , is found in southern Baja California .

F. s. tropicalis , described by Griscom in 1930 , is found from southern Mexico to northern Honduras .

F. s. nicaraguensis , described by Howell in 1965 , is found in Honduras and Nicaragua .

F. s. sparveroides , described by Vigors in 1827 , is found in Cuba and the Isle of Youth , and southern to central Bahamas .

F. s. dominicensis , described by Gmelin in 1788 , is found in Hispaniola and Jamaica .

F. s. caribaeorum , described by Gmelin in 1788 , is found in Puerto Rico through the Lesser Antilles to Grenada .

F. s. brevipennis , described by Berlepsch in 1892 , is found in the Netherlands Antilles .

F. s. isabellinus , described by Swainson in 1837 , is found from Venezuela to northern Brazil .

F. s. ochraceus , described by Cory in 1915 , is found in eastern Colombia and northwest Venezuela .

F. s. caucae , described by Chapman in 1915 , is found in western Colombia .

F. s. aequatorialis , described by Mearns in 1892 , is found in northern Ecuador .

F. s. peruvianus , described by Cory in 1915 , is found in southwest Ecuador , Peru , and northern Chile .

F. s. fernandensis , described by Chapman in 1915 , is found on the Juan Fernández Islands off Chile .

F. s. cinnamominu , described by Swainson in 1837 , is found in Peru , Chile , and Argentina .

F. s. cearae , described by Cory in 1915 , is found from northeast Brazil south to eastern Bolivia .

= = Ecology and behavior = =

American kestrels are found in a wide variety of habitats , including grasslands , meadows , deserts , and other open to semiopen regions . They can also be found in both urban and suburban areas . A kestrel 's habitat must include perches , open space for hunting , and cavities for nesting (whether natural or man @-@ made) . The American kestrel is able to live in very diverse conditions , ranging from above the Arctic Circle , to the tropics of Central America , to elevations of over 4 @,@ 500 m (14 @,@ 800 ft) in the Andes Mountains . The bird is distributed from northern Canada and Alaska to the southernmost tip of South America , Tierra del Fuego . It is the only kestrel found in the Americas , though as mentioned above this classification is genetically inaccurate . It has occurred as a vagrant in the UK , Denmark , Malta and the Azores .

American kestrels in Canada and the northern United States typically migrate south in the winter , sometimes going as far as Central America and the Caribbean . Birds that breed south of about 35 ° north latitude are usually year @-@ round residents . Migration also depends on local weather conditions . Wintering kestrels ' choice of habitat varies by sex . Females are found in open areas more often than males during the non @-@ breeding season . A common explanation for this behavior is that the larger females arrive at the preferred habitat first and exclude males from their territory .

The American kestrel is not long @-@ lived , with a lifespan of < 5 years for wild birds . The oldest banded wild bird was 11 years and 7 months , while captive kestrels can live up to 14 ? 17 years . In a study , humans accounted for 43 @.@ 2 % of 1 @,@ 355 reported deaths , which included direct killing and roadkills , while predation (including by larger birds of prey) accounted for 2 @.@ 8 % . This statistic is likely biased , however , as reported deaths are usually found near or in areas populated by humans .

= = = Feeding = = =

American kestrels feed largely on small animals such as grasshoppers , dragonflies , lizards , mice , voles , and small birds . The kestrel has also been reported to have killed snakes , bats , and squirrels . The kestrel is able to maintain high population densities , at least in part because of the broad scope of its diet . The American kestrel 's primary mode of hunting is by perching and waiting for prey to come near . The bird is characteristically seen along roadsides or fields perched on objects such as trees , overhead power lines , or fence posts . It also hunts by kiting , hovering in the air with rapid wing beats and scanning the ground for prey . Other hunting techniques include low flight over fields , or chasing insects and birds in the air .

Prey is most often caught on the ground , though occasionally they take birds in flight . Before striking , the kestrel characteristically bobs its head and tail , then makes a direct flight toward the prey to grab it in its talons . Much like the red @-@ tailed hawk , American kestrels conserve energy in a hunt and pick their attacks with care as to position and odds of success . During the breeding season , the bird will carry large prey back to its mate or young . One study found that an American kestrel pair " foraged in ways that minimized the costs of energy acquisition in its particular situation " . For example , if the success rate for catching prey decreases significantly in a particular area , the bird will move to a different area .

= = = Reproduction = = =

American kestrels are sexually mature by their first spring . In migratory populations , the males arrive at the breeding ground before females , then the female selects a mate . Pair bonds are strong , often permanent . Pairs usually use previous nesting sites in consecutive years . This gives birds an advantage over younger or invading individuals , as they would already be familiar with the hunting grounds , neighbors , predators , and other features of the site . Males perform elaborate dive displays to advertise their territory and attract a mate . These displays consist of several climbs and dives , with three or four " klee " calls at their peaks . Females are promiscuous for about one to two weeks after their arrival at the nesting site . This is thought to stimulate ovulation . Food transfers from the male to the female occur from about four to five weeks prior to egg laying to one to two weeks after .

American kestrels are cavity nesters , but they are able to adapt to a wide variety of nesting situations . They generally prefer natural cavities (such as in trees) with closed tops and tight fitting entrances , as to provide for maximum protection of the eggs and young . Kestrels occasionally nest in holes created by large woodpeckers , or use the abandoned nests of other birds , such as red @-@ tailed hawks , merlins , and crows . They have been recorded nesting on cliff ledges and building tops , as well as in abandoned cavities in cactuses . American kestrels also commonly utilize nesting boxes .

Three to seven eggs (typically four or five) are laid approximately 24 ? 72 hours apart . The average egg size is 32 mm x 29 mm (1 @. @ 3 in x 1 @. @ 1 in) , 10 % larger than average for birds of its body size . The eggs are white to cream in color with brown or grey splotching . Incubation usually lasts 30 days and is mainly the responsibility of the female , although the male incubates 15 ? 20 % of the time . Eggs that are lost are typically replaced in 11 ? 12 days . Hatching takes place over three to four days . Hatchlings are altricial , and are only able to sit up after five days . They grow very quickly , reaching an adult weight after 16 ? 17 days . After 28 ? 31 days , their wings develop and they are able to leave the nest . The young adult kestrels may breed from a year old , and the species has approximately a three to five year life expectancy in the wild .

In ecological terms the reproductive pattern of the American kestrel leans towards a small bird " r @-@ selection " strategy . In r / K selection theory , selective pressures are hypothesised to drive evolution in one of two generalized directions : r- or K @-@ selection . R @-@ selected species are those that place an emphasis on a high growth rate , typically exploiting less @-@ crowded ecological niches , and produce many offspring , each of which has a relatively low probability of surviving to adulthood (i.e. , high r , low K) . By contrast , K @-@ selected species display traits associated with living at densities close to carrying capacity , and typically are strong competitors in such crowded niches that invest more heavily in fewer offspring , each of which has a relatively high

probability of surviving to adulthood (i.e. , low r , high K) . Between these two extremes the American kestrel is one of the few raptor species that lean towards being r -selected . They are able to breed at one year old , have few non-breeding adults in the population , and have larger broods . Their population growth rate is high relative to larger raptors , which typically lean towards being K -selected .

== Stress physiology ==

=== Weather ===

American kestrels are often useful in scientific studies on animal physiology , and are typically captured using the balanced-chatri method or raised in nest boxes for experiments . Kestrel metabolic rate has been found to increase in response to rainfall , and at ambient temperatures below about 25 ° C. Kestrel metabolic responses to weather and temperature do not vary , however , with sex . Kestrels will increase their oxygen consumption , and therefore their metabolic rate in cold and wet conditions to counteract heat loss .

=== Environmental disturbance ===

American kestrels ' response to environmental stress is measured as blood concentration of corticosterone (CORT ,) a hormone produced by the hypothalamic-pituitary-adrenal (HPA) axis that releases stored energy for essential body functions . Extended periods of elevated blood CORT levels may direct metabolic energy away from growth and reproduction . Thus , high levels of traffic disturbance and human development surrounding American kestrel nests are found to increase stress hormones leading to reproductive failure . Among successful nests , however , nestlings do not typically experience a higher stress response to environmental human disturbance , suggesting that they can tolerate a considerable degree of human activity near the nest .

=== Environmental contaminants ===

Since American kestrels are carnivores , toxic chemical runoff ingested by their prey can concentrate at high levels in their blood . Wild kestrels are subject to immunomodulation , or an altered immune response , to polybrominated diphenyl ethers (PBDEs) , a group of industrial flame retardants that may leach from factories into the environment . When PBDEs accumulate in body tissues of kestrels , the T-cell mediated immune response decreases in efficiency . As a result , kestrels that ingest PBDEs may not respond sufficiently to viruses or other invading microorganisms . In addition , certain PBDEs may suppress growth and development of the spleen and bursa in American kestrels .

== Status and conservation ==

The American kestrel is likely the most abundant falcon in North America , although its total population is difficult to quantify , as local populations can change quickly due to resource availability . Count data from the USGS Breeding Bird Survey (BBS) indicate that the North American breeding population is experiencing long-term and gradual but sustained declines , with some regions , such as New England and coastal California , exhibiting more rapid declines . Count data from raptor migration corridors also indicate regional population declines and largely corroborate BBS data . The North American population has been estimated at 1-2 million pairs , with the Central and South American populations being as large . A smaller estimate is 236,000 birds wintering in North America . A population increase occurred in the 18th and 19th centuries , probably due to deforestation for agriculture . The resulting pastures provided an ideal habitat for kestrels .

The southeastern U.S. subspecies (*Falco sparverius paulus*) has declined 82 % since 1940 due to a decrease in nest site availability . This decline is a result of longleaf pines being cleared from agricultural fields . Despite this , the American kestrel is classed as Least Concern on the IUCN Red List .

The Peregrine Fund , a leading non @-@ profit organization advancing research and conservation of birds of prey worldwide , launched the American Kestrel Partnership in 2012 . The American Kestrel Partnership developed and maintains a web @-@ based network for citizen and professional scientists to enter , manage , and consolidate data from kestrel nest box monitoring programs in the Western Hemisphere . The database is being used by researchers to model and understand relationships between kestrel nesting parameters (e.g. , phenology , occupancy , survival , productivity , and nestling weight and exposure to environmental toxins) and environmental factors , such as land use , landscape composition and configuration , climate conditions (e.g. , drought) , and point sources of environmental toxins . Each breeding season , the American Kestrel Partnership features a live @-@ streaming video feed from the nest box located at The Peregrine Fund 's campus in Boise , Idaho .

= = Use in falconry = =

One important use of American kestrels is in falconry . It is often considered a beginner 's bird , though the careful weight control needed to maintain the kestrel 's desire to aggressively hunt takes skill . Falconers experienced in extracting the best performance the species is capable of report they are highly reliable on the normal game of sparrows and starlings . More aggressive individuals are sometimes capable of capturing prey up to approximately twice their own body weight , allowing the occasional capture of true game birds such as quail and dove . However , most falconers interested in the reliable taking of such game do prefer larger falcons or hawks . The advantage the American kestrel offers the experienced falconer is its suitability to simple and urban falconry not requiring large tracts of land or the use of hunting dogs . This form of falconry is sometimes referred to as " micro @-@ falconry " or " micro @-@ hawking . " The other small raptor species commonly used in micro @-@ falconry are the Merlin , the Sharp @-@ shinned hawk (the smallest accipiter) , and the European kestrel (a true kestrel) .

Hawking with the American kestrel requires adapting to the strengths and weaknesses of the bird . It is a very small falcon , and even for its size it is less muscular than other small falcons such as the athletic and swift Merlin . It is more adapted to ambush hunting and short chases than to the longer aerial chases larger falcons often adopt . Used within its limits , it is effective . Experienced falconer Matthew Mullenix , author of the book " American Kestrels in Modern Falconry " , in an article comparing kestrels to merlins , summed their abilities up as follows :

1 . " Kestrels are thin @-@ winged , flat @-@ chested , under @-@ powered and lack acceleration compared to merlins . I say that with much affection for them and with thousands of kestrel kills to prove these are not necessarily damning differences . Comparing a red @-@ tailed hawk to a Harris ? or goshawk will conjure equally negative points of fact , yet we all know how good trained red @-@ tails can be ! "

2 . " The chief variable to choosing between a kestrel and a merlin may be your hawking land . If you live in open country , or have access at least to good pasture for cattle , a merlin can excel there . If you plan to hunt mostly in town or suburb , and especially if you plan to hawk from a car , I ? d recommend the kestrel . The consideration coming in at close second is your intended quarry . To snipe , dove , quail and open @-@ country sparrows , merlins are best suited . For most blackbirds (Icteridea) , either falcon can prove effective . Starlings in close are extremely vulnerable to kestrels ; but in the open are best prey for merlins . The same holds true for house sparrows , with this exception : sparrows in thick cover are better quarry for kestrels . This is the slip for which I feel the American kestrel is perfect . "

3 . " Once committed to an attack , trained kestrels tend to follow through to the end . They will stoop into cover , chase birds on foot , bind to quarry twice their size and never let go voluntarily . They have small feet , but as written elsewhere , also have the strongest feet for their size . It is a

simple fact that American kestrels hold starlings better than merlins , on average , and will gladly tackle larger quarry than will any jack (male merlin) . "

American kestrels do not train so easily as some larger falcons (particularly the Peregrine falcon) in the art of " waiting on " to perform a diving stoop on flushed prey . However , some individual kestrels do master this skill . Falconers sometimes train them to climb to a stooping position with tidbits on kites or balloons that the kestrels learn to climb after . More common hunting techniques are to " slip " them after spotted game from the fist , or to release them from a vehicle window close to spotted quarry . These techniques are more of a natural fit to the kestrel 's ambushing methods in the wild .

Falconers using the American kestrel should be alert to protect the falcon from larger predators that may attack the kestrel , particularly if it is distracted on the ground with captured prey . Domestic cats and dogs are the greatest threat to attack the falcon on the ground , but the Cooper 's hawk is well known to boldly attack kestrels . This mid @-@ sized American accipiter has sufficient size and strength to carry the kestrel away , though falconers have reported often being successful in recovering the kestrel unharmed by acting quickly to intimidate the larger hawk into releasing the kestrel .

American kestrels are bred in captivity for use in falconry , and are among the easier falcons to breed . They are also sufficiently common that " passage " birds in their first year are relatively easy to trap . Wild caught kestrels " tame down " fairly quickly . They will usually be eating from a falconer 's hand the day after capture , be training within a week , and be ready to hunt in three to five weeks . A very tame American kestrel will allow itself to be picked up around the body with one hand , while accepting tidbits from the other hand . Such tameness is very useful when checking or treating the bird for injury or illness .

Migratory raptors native to the United States are protected by the Migratory Bird Treaty Act of 1918 , so American kestrels are illegal to possess without a permit (such as a falconry permit) in the United States , Canada , and Mexico .

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