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[\(/bow/species/weteag1/cur/introduction\)](#)



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+9

Golden Eagle

Aquila chrysaetos

LC Least Concern [Names \(39\)](#) [Subspecies \(6\) \(/bow/species/goleag/cur/systematics#subsp\)](#)

Todd E. Katzner, Michael N. Kochert, Karen Steenhof, Carol L. McIntyre, Erica H. Craig, and Tricia A. Miller

Version: 2.0 — Published September 17, 2020



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[cmd=list&r=world&spp=goleag&time=life](https://ebird.org/MyEBird?cmd=list&r=world&spp=goleag&time=life), [taxonCode=goleag&userId=USER190537&mediaType=p](https://ebird.org/media/catalog?taxonCode=goleag&userId=USER190537&mediaType=p), [taxonCode=goleag&userId=USER190537&mediaType=a](https://ebird.org/media/catalog?taxonCode=goleag&userId=USER190537&mediaType=a)

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(<https://americanornithology.org/>).

The Golden Eagle inhabits a wide range of latitudes and habitats throughout the Palearctic and into northern Africa, where it is largely resident. In North America, its breeding distribution includes most of Canada and Alaska, as well as the western half of the United States and northern and western Mexico. Most eagles that nest in northern Canada and interior and northern Alaska migrate thousands of kilometers to wintering grounds. Southern eagles tend to be resident year-round, but some make northward, latitudinal, or altitudinal migrations when not on territory. During the non-breeding season, Golden Eagle occurs in Mexico, every U.S. state, and in the southern parts of Canada. It is most common in western North America, especially near open spaces that provide hunting habitat with ample prey, near cliffs or trees that supply nesting sites, and topography that creates updrafts essential for flight. Recent research has shown that the Golden Eagle is more common than once thought in eastern North America as well as in forested areas continent-wide, and that young individuals may summer in large numbers in the vast and productive wetlands of northernmost North America.

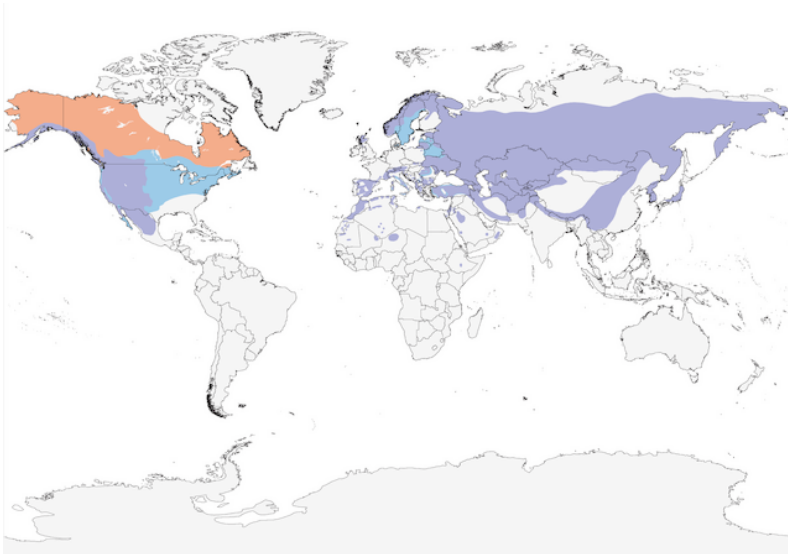
One of the world's largest predatory birds, the Golden Eagle is prominent in modern and ancient human lore and culture, inspiring awe, reverence, and sometimes fear and hatred. Humans kill Golden Eagles, both intentionally and accidentally, by trapping, shooting, poisoning, electrocution, and collision with infrastructure and vehicles. In addition, urbanization, construction of energy production and transmission infrastructure, agricultural development, and wildfires encroach on many traditional foraging and nesting habitats. Likewise, cascading effects of the rapidly warming climate, (i.e., extreme weather events, spread of disease and parasites) are expected to bring many new challenges to the Golden Eagle. Recent modeling suggests that some eagle populations are stable or even increasing, but most North American nesting populations are declining or below carrying capacity due, in part, to anthropogenic related mortality.

A highly efficient flier and effective predator, the Golden Eagle exhibits tremendous variability, speed and maneuverability in flight. This is reflected in the wide variety of habitats it occupies, and the hunting techniques used to capture prey. This species is capable of killing large prey such as cranes, wild ungulates, and domestic livestock, but it subsists primarily on medium-sized birds and mammals, especially rabbits, hares, ground squirrels, and prairie dogs. It scavenges year-round, but especially in winter.

Most Golden Eagles do not acquire a nesting territory until they are at least four years old. Once an individual establishes a territory, it tends to remain there during the nesting season, defending from conspecifics a territory of that generally ranges from 20–30 km², but that can be substantially smaller or larger depending on region, habitat quality and prey availability. This species usually builds and maintains many stick nests within their territories. Some of these are maintained and repaired annually as part of courtship. The nesting cycle, including the post-fledgling dependence period, spans as little as 5 months for migratory individuals, or as long as 12 months for non-migratory birds. Golden Eagle pairs raise 1 to 3 young per year, with an individual potentially producing many more than that over the course of its life ([1 \(/bow/species/goleag/cur/references#REF182272\)](#)). Females may refrain from laying eggs in some years, particularly when prey are scarce. The number of young produced each year depends on a combination of weather and prey conditions. For example, in some parts of the eagle's range (Idaho, Scotland), interactions between weather and populations of prey species are known to influence eagle reproductive rates.

Historically, most information on life history came from studies in Europe (2 (</bow/species/goleag/cur/references#REF182273>)) and the western United States (3 (</bow/species/goleag/cur/references#REF71403>)). More recently, research has expanded rapidly in Mexico (4 (</bow/species/goleag/cur/references#REF182444>)), eastern North America (5 (</bow/species/goleag/cur/references#REF182375>)), and throughout the western United States in response to increased concern about the growth of renewable energy and the demonstrated and potential effects of wind turbines on eagles (6 (</bow/species/goleag/cur/references#REF182445>)), 7 (</bow/species/goleag/cur/references#REF182274>) and other raptors (8 (</bow/species/goleag/cur/references#REF2136>)). Likewise, important studies are underway in Scandinavia, the Alps, and other parts of mainland Eurasia, northern Africa, and Japan (e.g., 9 (</bow/species/goleag/cur/references#REF182275>), 10 (</bow/species/goleag/cur/references#REF182277>), 11 (</bow/species/goleag/cur/references#REF182278>), 12 (</bow/species/goleag/cur/references#REF182279>), 13 (</bow/species/goleag/cur/references#REF171333>), 14 (</bow/species/goleag/cur/references#REF182280>), 15 (</bow/species/goleag/cur/references#REF182281>), 16 (</bow/species/goleag/cur/references#REF182282>), 17 (</bow/species/goleag/cur/references#REF182283>), 18 (</bow/species/goleag/cur/references#REF182276>), 19 (</bow/species/goleag/cur/references#REF156605>), 20 (</bow/species/goleag/cur/references#REF167550>), 21 (</bow/species/goleag/cur/references#REF182284>)). Despite this expanding research, data gaps still exist for the many threats the species' faces globally, for winter and migration biology, for the biology of pre-breeding age individuals and adults that do not hold territories, and in many places, for their breeding biology.

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(<https://cdn.download.ams.birds.cornell.edu/api/v1/asset/169655871>).

Year-round Breeding
Migration Non-Breeding

+ [Enlarge \(https://cdn.download.ams.birds.cornell.edu/api/v1/asset/169655871\)](https://cdn.download.ams.birds.cornell.edu/api/v1/asset/169655871)


Distribution of the Golden Eagle

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 **191,660**

Observations

(<https://ebird.org/species/goleag>).

 **29,237**


Photos

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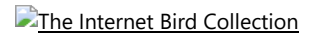
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SPECIES

Golden Eagle *Aquila chrysaetos*

Todd E. Katzner, Michael N. Kochert, Karen Steenhof, Carol L. McIntyre, Erica H. Craig, and Tricia A. Miller

Version: 2.0 — Published September 17, 2020

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Habitat



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Juvenile soaring over typical oak grassland habitat in California

© Brian Sullivan San Benito, California, United States | 24 Dec 2011

Macaulay Library ML 261665051 (<https://macaulaylibrary.org/photo/261665051>) | eBird S9408497 (<https://ebird.org/ebird/view/checklist/S9408497>)

The Golden Eagle occupies a wide variety of habitats, the use of which varies across time and space, and is often associated with season, age, breeding status, and specific behaviors. The species occurs at sea level, in the highest mountains, and at all intermediate elevations. Although often observed in association with open grassland, desert, alpine, or shrub-steppe habitats (e.g., western North America, Scotland, central Asia, the Alps and Apennines), the species occurs in many types of forested landscapes (e.g., eastern North America, Sweden, Japan). Perhaps the most consistent habitat association is that it often occurs near areas of high topographic relief (mountains, rolling hills). However, even that association is not absolute, particularly during the non-

breeding season, when wintering eagles may be found in more variable terrain wherever perches and prey are available. In northern Kazakhstan, Alaska's North Slope, and northern Quebec, for example, inhabited areas are remarkably flat. The species only occasionally occurs in marine habitats and it seems to avoid crossing large expanses of open water. It tends to avoid areas with dense human populations, but in California and Switzerland, and potentially elsewhere, some nest close to homes or other buildings.

Habitat in Breeding Range



(<https://macaulaylibrary.org/photo/242911251>).

Nesting habitat in Utah, United States.

Nest is in the center of the photo.

© Noel Zaugg Wasatch, Utah, United States | 12 Jun 2020

Macaulay Library ML 242911251

(<https://macaulaylibrary.org/photo/242911251>).

eBird S70367283

(<https://ebird.org/ebird/view/checklist/S70367283>).

Nests in a wide variety of habitats from near sea level to 3,630 m ([134](#) (</bow/species/goleag/cur/references#REF59100>); G. R. Craig, personal communication). Nesting habitat includes tundra, shrublands, grasslands, woodland-brushlands, and coniferous forests ([198](#) (</bow/species/goleag/cur/references#REF10274>), [144](#) (</bow/species/goleag/cur/references#REF182361>)). However, the species is also present in farmland and riparian habitats ([199](#) (</bow/species/goleag/cur/references#REF10273>), [200](#) (</bow/species/goleag/cur/references#REF56193>)) and in forested areas of eastern and western North America is more common than once recognized ([144](#) (</bow/species/goleag/cur/references#REF182361>)).

Nesting habitat is often associated with either cliffs or trees, although some nests are built on the ground. In northeastern Wyoming, nests frequently are in deciduous trees or, less often, ponderosa pine (*Pinus ponderosa*) close to water courses ([200](#) (</bow/species/goleag/cur/references#REF56193>)). Nesting territories in southwestern Montana are at lower elevations and contain more grassland-sagebrush (*Artemisia*) habitat than do unused areas ([201](#) (</bow/species/goleag/cur/references#REF33284>)). Nesting density in central Idaho is

higher in areas bordered by sagebrush and grass seedings than in areas bordered by agriculture ([202 \(/bow/species/goleag/cur/references#REF43258\)](#)). In northeastern Colorado, nests are primarily in grasslands near cliffs and not near cultivated areas ([203 \(/bow/species/goleag/cur/references#REF57538\)](#)). In eastern Utah, uses conifer–aspen (*Populus*) and pinyon–juniper (*Pinus–Juniperus*) habitats proportionate to their availability, and uses talus habitat less than expected ([204 \(/bow/species/goleag/cur/references#REF10210\)](#)). In northern Utah, nests mainly in grass, shrub, and juniper habitats ([205 \(/bow/species/goleag/cur/references#REF60858\)](#)). In Wyoming, nests primarily in grassland, shrubland, or riparian habitats; nests absent or rare in flat desert terrain, farmlands, and dense forests ([206 \(/bow/species/goleag/cur/references#REF10307\)](#)). Wyoming nests are also associated with high levels of topographic roughness ([207 \(/bow/species/goleag/cur/references#REF184624\)](#)). In central California, nests primarily in open grasslands and oak (*Quercus*) savanna and to a lesser degree in oak woodland and open shrublands ([208 \(/bow/species/goleag/cur/references#REF43278\)](#), [209 \(/bow/species/goleag/cur/references#REF10266\)](#)). In Arizona, uses desert grasslands and chaparral habitats ([210 \(/bow/species/goleag/cur/references#REF8575\)](#)). In eastern Canada, home ranges north of 60°N are dominated by tundra and those south of 55°N are dominated by forest ([144 \(/bow/species/goleag/cur/references#REF182361\)](#)). Shrublands or grasslands are the dominant cover types of home ranges at intermediate latitudes. Throughout this eastern Canadian nesting habitat, topography is highly variable, ranging from extremely rugged in Labrador and eastern Quebec, to flat in interior Quebec and into Ontario and Manitoba. In the eastern Hudson Bay region, nests in areas with cuesta relief (asymmetric hills or ridges with gentle slopes and steep escarpments) and rugged topography ([211 \(/bow/species/goleag/cur/references#REF10294\)](#)).

In interior and northern Alaska and interior western Canada, nests in a wide variety of habitats. In some places, uses habitat dominated by rugged topography or mountainous terrain, near or above timberline, and along riparian areas ([212 \(/bow/species/goleag/cur/references#REF43304\)](#), [174 \(/bow/species/goleag/cur/references#REF31791\)](#), [131 \(/bow/species/goleag/cur/references#REF10355\)](#)). In other areas, nests on bluffs and cliffs along rivers below timberline ([212 \(/bow/species/goleag/cur/references#REF43304\)](#)) or on sea cliffs (northwestern Alaska; K. Titus, personal communication). In Denali National Park and Preserve, nesting territories are common in mountainous areas between 300 and 1,525 m that are dominated by subalpine and alpine vegetation ([213 \(/bow/species/goleag/cur/references#REF182383\)](#)). However, they also may nest in flatter tundra-dominated areas, if there are rock outcrops or other suitable nest sites (EHC, CLM; T. Booms, personal communication). In east-central Yukon, breeding is associated with tundra, river outwash plains, and alpine-subalpine ecotypes ([214 \(/bow/species/goleag/cur/references#REF33299\)](#)). In coastal parts of the central Canadian Arctic, occurs in areas with high topographic relief dominated by low-arctic tundra plant species ([134 \(/bow/species/goleag/cur/references#REF59100\)](#)). Associated with open habitats in forests west of the Cascade Mountains ([215 \(/bow/species/goleag/cur/references#REF43241\)](#), [159 \(/bow/species/goleag/cur/references#REF10224\)](#)), but recent camera trapping suggests they may be more common than once recognized in forested habitats (B. Woodbridge, personal communication).

In North America, traditionally thought to forage in open habitats such as grasslands or steppe-like vegetation. However, telemetry data have revealed more frequent use of forested landscapes than previously recognized, especially in eastern North America (144 ([/bow/species/goleag/cur/references#REF182361](#))). In southwestern Idaho, prefers to forage in shrub habitat, and avoids agriculture, grassland, and burned habitats (176 ([/bow/species/goleag/cur/references#REF114159](#)); U.S. Geological Survey, unpublished data). In central California, forages in open grassland habitats (209 ([/bow/species/goleag/cur/references#REF10266](#))). In eastern North America, forages in open and semi-open mountainous or hilly terrain (216 ([/bow/species/goleag/cur/references#REF43313](#)), 196 ([/bow/species/goleag/cur/references#REF43309](#)), 142 ([/bow/species/goleag/cur/references#REF43253](#))). In Alaska, along the Kolomak River and Yukon-Kuskokwim Delta and in the Atigun and Sagavanirktok River valleys, forages in wet marsh tundra, heath tundra, tussock-heath tundra, and hillside heath tundra valleys (217 ([/bow/species/goleag/cur/references#REF16912](#)), 218 ([/bow/species/goleag/cur/references#REF13862](#))). In southwestern Alaska, forages on alpine tundra slopes at the edges of subalpine scrub and only rarely in open areas below timberline (174 ([/bow/species/goleag/cur/references#REF31791](#))). In northwestern Yukon, may frequent local dumps and roadways, presumably searching for road kills (219 ([/bow/species/goleag/cur/references#REF10225](#))).

Telemetry studies (220 ([/bow/species/goleag/cur/references#REF182381](#)), 221 ([/bow/species/goleag/cur/references#REF182380](#))) and results from aerial and ground surveys (222 ([/bow/species/goleag/cur/references#REF182382](#)), 223 ([/bow/species/goleag/cur/references#REF11895](#)), 224 ([/bow/species/goleag/cur/references#REF182378](#)), 225 ([/bow/species/goleag/cur/references#REF182377](#))), suggest that the vast wetlands and upland areas of Alaska's North Slope provide important pre-breeding hotspots for younger individuals who have not entered the breeding population. Similarly, telemetry studies in eastern North America have illustrated that a large expanse of land south and west of Ungava Bay, Quebec, is used by many non-territorial individuals (TEK, TAM). These areas have not been surveyed as extensively as in Alaska, but likely have similar habitats and an adequate prey base.

Nesting habitat in Eurasia and Africa is as varied as in North America. Although cliffs predominate as nesting sites in many regions, such as the United Kingdom, the Alps, parts of Scandinavia, and Japan (226 ([/bow/species/goleag/cur/references#REF184623](#)), TEK), trees are used and in some regions may even predominate as nesting sites (e.g., other parts of Scandinavia and central Asia; TEK, TAM). Across its wide distribution in the Old World, the main features of typical breeding habitats is that they are mostly open (i.e., low density of trees and low shrub cover) and support medium-sized prey species that Golden Eagle can effectively hunt. Typically, breeding habitats occur in rugged landscapes in the uplands that are remote from intensive human activity; e.g., in the British Isles, mostly open moorland or forests with low tree density near open moorland (2 ([/bow/species/goleag/cur/references#REF182273](#))). In the European Alps and Himalayas, eagles will hunt marmots just above the treeline, but nests on cliffs and in trees in more forested areas at lower elevations (e.g., 227 ([/bow/species/goleag/cur/references#REF96714](#)), 47 ([/bow/species/goleag/cur/references#REF123544](#)), 228 ([/bow/species/goleag/cur/references#REF37953](#)), 229 ([/bow/species/goleag/cur/references#REF184663](#))). In Arabia, nests in *Prosopis* trees surrounded by rather flat

desert or semi-deserts ([230 \(/bow/species/goleag/cur/references#REF143967\)](#)). In the Japanese Alps, uses open areas near treeline ([231 \(/bow/species/goleag/cur/references#REF184625\)](#)). Nevertheless, also uses other, rather atypical, habitats that are more forested, flatter or even closer to human activity (TEK, MJM, unpublished observations).

Habitat in Nonbreeding Range



(<https://macaulaylibrary.org/photo/261668621>).

Typical winter habitat in central California

In California in winter, favors open areas, especially rangelands with surrounding foothills and mountains. At this particular site, ground-squirrels draw large concentrations of eagles and buteos in winter.

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In western North America from northwestern Alaska and Canada to central Mexico, primarily winters in humid temperate and dry ecoregion domains ([232 \(/bow/species/goleag/cur/references#REF10209\)](#)). These birds are seen most frequently in open habitats with native vegetation and less frequently in urban, agricultural, and forested areas ([210 \(/bow/species/goleag/cur/references#REF8575\)](#), [233 \(/bow/species/goleag/cur/references#REF19178\)](#), [234 \(/bow/species/goleag/cur/references#REF10229\)](#), [176 \(/bow/species/goleag/cur/references#REF114159\)](#)). Uses sagebrush communities, riparian areas, grasslands, and rolling oak savanna, often areas with low fragmentation and human population density ([235 \(/bow/species/goleag/cur/references#REF60669\)](#), [233 \(/bow/species/goleag/cur/references#REF19178\)](#), [236 \(/bow/species/goleag/cur/references#REF10258\)](#), [237 \(/bow/species/goleag/cur/references#REF43267\)](#), [238 \(/bow/species/goleag/cur/references#REF182392\)](#)). Generally, absent from harsh, dry areas (< 20 cm annual precipitation) of the Sonoran Desert and central Nevada, although even these areas occasionally support eagles ([239 \(/bow/species/goleag/cur/references#REF182394\)](#)). In Idaho and Montana, wintering habitat is made up of landscapes conducive to updraft with low human population density and limited fragmentation ([7 \(/bow/species/goleag/cur/references#REF182274\)](#)).

Infrequently observed to winter in forests in western North America. Winter habitat east of the Canadian Rockies skirts the northern edge of grasslands and excludes mixed mesophytic and deciduous forest. However, recent modeling of migrants wintering in the western states indicate that coniferous forest habitats may be used more often than previously thought ([240 \(/bow/species/goleag/cur/references#REF108023\)](#)). Carrion in forested areas may influence patterns of winter distribution ([241 \(/bow/species/goleag/cur/references#REF73688\)](#), [240 \(/bow/species/goleag/cur/references#REF108023\)](#), EHC; T. Craig, personal communication). In the midwestern United States, more frequently seen near reservoirs and wildlife refuges that provide foraging opportunities at winter waterfowl concentrations ([153 \(/bow/species/goleag/cur/references#REF43326\)](#)), but telemetry data show that forested regions are also used (M. Martell, TAM, unpublished data). In Idaho, wintering eagles forage primarily in shrubland and avoid grassland and agriculture, with foraging points concentrated in sagebrush-rabbitbrush (*Artemisia–Chrysothamnus*) habitat and cliff areas ([176 \(/bow/species/goleag/cur/references#REF114159\)](#)). In this region, the species is common in grazed areas.

In eastern North America, wintering eagles are strongly associated with forested areas with relatively high topographic relief and low human disturbance ([144 \(/bow/species/goleag/cur/references#REF182361\)](#)). These include higher elevations of the Appalachian Mountains, Allegheny Plateau, Cumberland Plateau, the Driftless Area of the upper Midwest, and the Ozark Mountains ([242 \(/bow/species/goleag/cur/references#REF182397\)](#), [144 \(/bow/species/goleag/cur/references#REF182361\)](#)). Rarely uses low elevation valleys and, when found in those areas, tends to be observed flying above ridges and slopes. The highest winter densities appear to be in the Ridge and Valley region of the Appalachian Mountains, especially along the Virginia-West Virginia border and into southern Pennsylvania (TEK, TAM). Winter home ranges of 66 eagles tracked in the eastern United States were composed of $79 \pm 14\%$ forest (range 6–97%); $15 \pm 8\%$ open areas (e.g., grassland, agricultural) (range 0–45%); $1 \pm 6\%$ wetlands (range 0–42%); and $4 \pm 1\%$ developed lands (range 0–8%) ([144 \(/bow/species/goleag/cur/references#REF182361\)](#)). Outside of mountainous areas, eastern Golden Eagles tend to have home ranges with a higher proportion of open areas.

Migration Habitat

In the western United States and Canada, migrating Golden Eagle has been observed hunting during the migration period over wetlands, agricultural areas, and grassy foothills ([243 \(/bow/species/goleag/cur/references#REF43261\)](#)). In western Canada, they select areas with strong thermal activity and updrafts ([244 \(/bow/species/goleag/cur/references#REF10235\)](#), [245 \(/bow/species/goleag/cur/references#REF33313\)](#)).

Eagles tracked by telemetry often follow leading lines, including ridges, coastlines, and rivers (TAM). Migration is concentrated in areas with high topographic relief that support updrafts, especially orographic updrafts. Where these features are lacking, Golden Eagle migrates over flat or featureless terrain, where it depends on thermal updrafts to support soaring flight ([186 \(/bow/species/goleag/cur/references#REF155696\)](#), [246 \(/bow/species/goleag/cur/references#REF182393\)](#), [247 \(/bow/species/goleag/cur/references#REF182398\)](#), TAM).

Perching and Roosting Habitat

Types and utilization of perch sites vary depending on perch availability, the landscape, and time of year. Common perches are on cliffs, bluffs, power poles, or trees (EHC, T. Craig, personal communication). During the nesting season, both males and females use preferred perches near the nest ([248 \(/bow/species/goleag/cur/references#REF10214\)](#)), and the female often roosts on the nest at night ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). Resident eagles usually perch above cliff nests, but below ridge tops ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). An adult Golden Eagle used an unoccupied Gyr Falcon (*Falco rusticolus*) (<https://birdsoftheworld.org/bow/species/gyrfal/cur/introduction>) nest as a winter roost north of Nome, Alaska (D. Johnson, personal communication).

In eastern North America, selection of perching sites varies by season and age ([250 \(/bow/species/goleag/cur/references#REF182395\)](#)). Eagles select perch sites on steep slopes that faced south in summer and east during migration. Adults show greater preferences for broadleaf forest in summer and for ridges in autumn.

In Scotland, two male Golden Eagles used 87 and 120 different roost sites over the course of 1 and 2 years, respectively ([251 \(/bow/species/goleag/cur/references#REF184617\)](#)). About 70% of roost sites were used only once and generally on low-wind nights. A small proportion were used very frequently and on nights with stronger winds, suggesting they provided better shelter from the wind.

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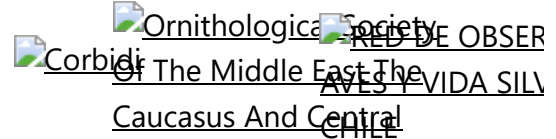
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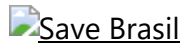


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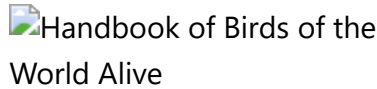


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SPECIES

Golden Eagle *Aquila chrysaetos*

Todd E. Katzner, Michael N. Kochert, Karen Steenhof, Carol L. McIntyre, Erica H. Craig, and Tricia A. Miller

Version: 2.0 — Published September 17, 2020

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Diet and Foraging



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Juvenile hunting from prominent perch

Uses many types of prominent perches for hunting, including trees, fences, and power poles.

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Generally takes prey of intermediate size (0.5–4 kg), but occasionally takes both smaller (e.g., mice, voles; [253 \(/bow/species/goleag/cur/references#REF182467\)](#)) and larger (cervids and canids) prey. Also scavenges at all times of the year, but this behavior is most common during the non-breeding season. Globally, diets of this species are catholic, consistent with their wide geographic distribution, and often focused on locally abundant species (e.g., [302 \(/bow/species/goleag/cur/references#REF184628\)](#), [303 \(/bow/species/goleag/cur/references#REF131024\)](#), [16 \(/bow/species/goleag/cur/references#REF182282\)](#), [253 \(/bow/species/goleag/cur/references#REF182467\)](#)), suggesting a role for learning and individual preference in dietary choices. Occasionally takes livestock, although most observations of Golden Eagle feeding on livestock are of scavenging, rather than predation. The majority of data on diet and foraging comes from observations of territorial birds. There is sparse information on diet and foraging of non-territorial birds during the nesting season.

Feeding



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Immature hunting ducks

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Main Foods Taken

In North America, the Golden Eagle tends to take small to medium-sized mammals, mainly leporids and sciurids, during the nesting season ([304 \(/bow/species/goleag/cur/references#REF155467\)](#), [Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)). Diet is diverse, and individuals in some parts of the range focus on other taxa, including many species of birds and larger mammals ([195](#)

([/bow/species/goleag/cur/references#REF182366](#)), [304 \(/bow/species/goleag/cur/references#REF155467\)](#)).

Throughout its range, the species scavenges extensively on carcasses of ungulates ([241 \(/bow/species/goleag/cur/references#REF73688\)](#)) and smaller and medium-sized species, especially during the non-breeding season. See [Diet and Foraging: Diet](#) (<https://speciesadmin.birds.cornell.edu/dash/bow/accounts/ACT1053401/view>).

Microhabitat for Foraging

Takes most prey on or near the ground in each of the many habitat types occupied; rarely takes food over water. For details on broader foraging habitat use, see [Habitat](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/habitat>).

Food Capture and Consumption

Hunts from flight, either when soaring or in low contoured flight, or from a perch ([305 \(/bow/species/goleag/cur/references#REF33293\)](#), [306 \(/bow/species/goleag/cur/references#REF38078\)](#), [243 \(/bow/species/goleag/cur/references#REF43261\)](#), [29 \(/bow/species/goleag/cur/references#REF38067\)](#)). Hunting strategy is determined by weather conditions, topography, prey species, and the prey's escape response ([243 \(/bow/species/goleag/cur/references#REF43261\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#)). Hunts from a soaring flight more often on sunny and windy days, and from perches on overcast, calm, or rainy days. May hunt by flying close to the ground ("contour flight") in broken topography, and they tend to hunt from a soar at higher altitudes in open habitats, although both types of flights occur in both types of habitats. They use contour flight to surprise prey that might escape to burrows. Contour hunting is said to be most common overall ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)), but perch hunting is most common in southwestern Idaho where habitat is open and perches (power lines, canyon rims, and rock outcrops) are abundant ([306 \(/bow/species/goleag/cur/references#REF38078\)](#)). Aerial attacks are most often from upwind ([29 \(/bow/species/goleag/cur/references#REF38067\)](#)). See [Behavior: Locomotion: Flight](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/behavior#locom>) for additional details.

When hunting, often attacks prey using one of at least seven techniques ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). These include: (1) "high soar with glide attack" from a thermal with a long (≥ 1 km), low angle glide to attack solitary or widely dispersed prey (hare, grouse [Phasianidae]); (2) "high soar with a vertical stoop" from a high soar to attack slow-flying or flocking prey, such as geese (*Branta* spp.) and cranes (*Grus* spp.) ([307 \(/bow/species/goleag/cur/references#REF33294\)](#)), and Greater Sage-Grouse (*Centrocercus urophasianus*) (EHC); (3) "contour flight with a short glide attack" from low-level flight quartering over the ground to surprise colonial prey (ground squirrels of many genera); (4) "glide attack with tail chase" from a low angle stoop to flush, chase, and capture agile mammals and birds; (5) "low flight with slow descent attack" from a low-level quartering flight and slow "parachute" stoop to capture slow-moving prey (tortoises and snakes); (6) "low flight with sustained grip attack" to kill ungulates by landing on the victim's back or neck, and riding it until the animal dies ([308 \(/bow/species/goleag/cur/references#REF10234\)](#), [309 \(/bow/species/goleag/cur/references#REF167565\)](#), [310 \(/bow/species/goleag/cur/references#REF182476\)](#));

and (7) “walk and grab attack” to forage for insects (Acrididae) and to capture quarry protected by an obstruction ([311 \(/bow/species/goleag/cur/references#REF43263\)](#), [312 \(/bow/species/goleag/cur/references#REF155255\)](#); M. Collopy, personal communication).



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Juvenile taking off after missing a ground squirrel

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In a “walk and grab attack”, an eagle lands next to or close to its potential prey, usually a slow-moving or defenseless individual ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)), and then walks up and grabs it (CLM). This behavior is frequently observed in Denali National Park and Preserve, Alaska, where eagles land near and walk up to colonies of arctic ground squirrel (*Urocitellus parryii*) and hoary marmot (*Marmota caligata*) in search of prey. Eagles also walk when searching for nestlings of ground-nesting birds such as Willow Ptarmigan (*Lagopus lagopus*) (CLM). Ellis ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)) observed eagles running very quickly while pursuing red fox (*Vulpes vulpes*). They also may dive onto prey, and run after them when the prey species tries to take cover under shrubby vegetation (CLM; R. Swisher, personal communication).

Frequently feeds on carrion, especially during winter, even when live prey are available ([313 \(/bow/species/goleag/cur/references#REF130129\)](#), [314 \(/bow/species/goleag/cur/references#REF10282\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#), [304 \(/bow/species/goleag/cur/references#REF155467\)](#)).

Some pairs also consume carrion during the nesting season ([315 \(/bow/species/goleag/cur/references#REF10219\)](#), [316 \(/bow/species/goleag/cur/references#REF182474\)](#)).

Locates carrion from high-soaring flight, often cueing on the activity of crows (*Corvus* spp.) and other scavengers ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). When approaching carrion, they use a variation of a “walk and grab” attack, often landing some distance from a carcass (> 40 m) and walking to it (TAM, TEK, P. Bloom, M. Lanzone, unpublished data).

Mated pairs sometimes cooperatively hunt jackrabbits and other prey. It is not known if unpaired eagles may hunt in tandem. During tandem hunts, pairs pursue prey with the female usually following the male at a lower height (317 ([/bow/species/goleag/cur/references#REF33290](#))). One pursuer diverts the prey's attention by stooping while the second makes the kill (318 ([/bow/species/goleag/cur/references#REF10352](#)), 319 ([/bow/species/goleag/cur/references#REF10264](#)), 317 ([/bow/species/goleag/cur/references#REF33290](#))). In southwestern Idaho, males were more likely than females to hunt solo, and tandem hunting was less successful than solo hunting (317 ([/bow/species/goleag/cur/references#REF33290](#))). Overall capture success for all hunts by eagles was 20% ($n = 115$ capture attempts), with capture success at 4.6% for tandem hunting ($n = 42$) and 29% for solo hunting ($n = 73$).

Occasionally hunts cooperatively with conspecifics. This type of hunting usually involves large prey targeted in winter (e.g., ungulates, red fox, Wild Turkey [*Meleagris gallopavo*]; 320 ([/bow/species/goleag/cur/references#REF10336](#)), 321 ([/bow/species/goleag/cur/references#REF33298](#)), 308 ([/bow/species/goleag/cur/references#REF10234](#)), 322 ([/bow/species/goleag/cur/references#REF182479](#))). Groups usually number 2 to 4, but can be as large as 8 (322 ([/bow/species/goleag/cur/references#REF182479](#))). Groups of 3 to 6 adult Golden Eagles were observed flying together during the nesting season in North Dakota (323 ([/bow/species/goleag/cur/references#REF182480](#))). Those birds flew in "wing-tip to wing-tip" formations at "tree-top" height on ≥ 12 occasions. It is uncertain if these groups were hunting because no capture attempts were ever observed.

May engage with canids in joint hunting behavior, described as either cooperative associations or exploitative competition (324 ([/bow/species/goleag/cur/references#REF182472](#)), 325 ([/bow/species/goleag/cur/references#REF43251](#)), 326 ([/bow/species/goleag/cur/references#REF182473](#)); R. Bruesewitz, personal communication in 327 ([/bow/species/goleag/cur/references#REF182475](#))). On one occasion in southwestern Wyoming, a Golden Eagle and a red fox were observed hunting a white-tailed jackrabbit (*Lepus townsendii*) at the same time (TEK). The eagle dove at the fox while the fox was chasing the hare. The hunt appeared unsuccessful, but a wounded jackrabbit was later seen ~500 m from the scene of the chase. It is unlikely that the two hunters coordinated their efforts, but the activity suggests that eagles may take advantage of disturbance by other predators to surprise prey (see below for similar responses of eagles to human disturbance of potential prey).

Less common feeding behaviors include kleptoparasitism, piracy, nest-robbing, and fishing. There are records of eagles taking prey from corvids (328 ([/bow/species/goleag/cur/references#REF59010](#)), 329 ([/bow/species/goleag/cur/references#REF33306](#))), foxes (330 ([/bow/species/goleag/cur/references#REF43291](#))), Great Horned Owl (331 ([/bow/species/goleag/cur/references#REF10259](#))), Northern Harrier (*Circus hudsonius*; MNK), Red-tailed Hawk (*Buteo jamaicensis*; 243 ([/bow/species/goleag/cur/references#REF43261](#))), Prairie Falcon (*Falco mexicanus*; J. McKinley, personal communication), and other Golden Eagle (243 ([/bow/species/goleag/cur/references#REF43261](#))) (see [Behavior: Social and Interspecific Behavior: Kleptoparasitism](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/behavior#social>) for additional

details). Also takes eggs and young from nests of many species including Canada Goose (*Branta canadensis*), Ferruginous Hawk (*Buteo regalis*), Prairie Falcon, Gyrfalcon (*Falco rusticolus*), Common Kestrel (*F. tinnunculus*), harriers (*Circus* spp.), Great Horned Owl (*Bubo virginianus*), Barn Owl (*Tyto alba*), Common Raven (*Corvus corax*), Yellow-billed Magpie (*Pica nuttalli*), Black-billed Magpie (*P. hudsonia*), and Rock Dove (*Columba livia*) (332 ([/bow/species/goleag/cur/references#REF50454](#)), 333 ([/bow/species/goleag/cur/references#REF10238](#)), 334 ([/bow/species/goleag/cur/references#REF10263](#)), 208 ([/bow/species/goleag/cur/references#REF43278](#)), 335 ([/bow/species/goleag/cur/references#REF33315](#)); U.S. Geological Survey, unpublished data, TEK). Fishing is rare, but Brown (336 ([/bow/species/goleag/cur/references#REF10223](#))) observed ≥ 5 individuals frequently capturing live trout from shallow streams and pools in Arizona during winter, and fresh salmon carcasses have been found in an occupied nest on the western Seward Peninsula (S. Lewis, personal communication).


Cannibalism occurs rarely. Collopy (337 ([/bow/species/goleag/cur/references#REF43255](#))) reported apparent cannibalism of a nestling by its sibling in a nest in southwestern Idaho. Partially eaten remains of a Golden Eagle nestling in a Montana nest suggest cannibalism by a sibling or parent (338 ([/bow/species/goleag/cur/references#REF43297](#))). Korňan and Macek (339 ([/bow/species/goleag/cur/references#REF182478](#))) documented infanticide followed by cannibalism in a Golden Eagle nest in Slovakia. Cannibalism may occur if a territorial battle results in death, with the loser consumed by the winner, as this has been noted for many raptor species including other *Aquila* eagles (TEK).

May also hunt in association with humans or human activity. For example, near Pikes Peak, Colorado, eagles captured two bighorn sheep (*Ovis canadensis*) lambs that had been hazed by people using helicopters to capture lambs for research (340 ([/bow/species/goleag/cur/references#REF182477](#))). Similar eagle behavior was noted during capture of Dall sheep (*O. dalli*) lambs in the central Alaska Range, where eagles pursued young lambs that the helicopter had separated from their mothers (S. Arthur, personal communication). In Idaho, an eagle captured a Barn Owl that flushed from a its daytime perch when a helicopter passed by the cliff (EHC; T. Craig, personal observation). Golden Eagles apparently followed and pounced upon squirrels flushed by a horse-drawn plough in San Diego County, California (311 ([/bow/species/goleag/cur/references#REF43263](#))). A pair of Golden Eagles in Georgia (USA) were observed to follow a farmer's tractor to get rabbits and mice flushed when the farmer was bush-hogging (M. Robertson and L. Wren, personal communication in 327 ([/bow/species/goleag/cur/references#REF182475](#))). In Idaho, Golden Eagles followed a person on horseback who was flushing jackrabbits in sagebrush habitats (KS). On two separate occasions eagles killed Greater Sage-Grouse flushed by a horseback rider (D.W. Ellis, personal communication), and in another case they killed a Greater Sage-Grouse flushed by hunters (EHC). Finally, in two separate events, Golden Eagles captured one gunshot and one unwounded Chukar (*Alectoris chukar*) that were flushed by a hunter (M. McGee, personal communication).





Diet

Major Food Items

A recent meta-analysis summarized diet in 35 nesting-season studies conducted in 45 areas of western North America ([304 \(/bow/species/goleag/cur/references#REF155467\)](#)). That study concluded that during the nesting season in western North America, Golden Eagle feeds mainly on mammals (84% of prey items) and secondarily on birds (15%); reptiles and fish are less frequently (2% and 0.2%, respectively) taken; insects occasionally taken ([312 \(/bow/species/goleag/cur/references#REF155255\)](#)). In parts of Europe, Golden Eagle relies heavily on avian prey, but mammalian prey are still generally the most important by biomass ([302 \(/bow/species/goleag/cur/references#REF184628\)](#), [303 \(/bow/species/goleag/cur/references#REF131024\)](#), [16 \(/bow/species/goleag/cur/references#REF182282\)](#), [253 \(/bow/species/goleag/cur/references#REF182467\)](#))

Mammalian prey observed at nests in western North America are primarily either leporids (jackrabbits, other hares, or cottontail rabbits) or sciurids (ground squirrels, marmots, or prairie dogs; [Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)). These two groups combined constitute, on average, 44–97% of prey items recorded, with leporids being primary prey in 78% of studies and sciurids primary prey in 18% of studies ([304 \(/bow/species/goleag/cur/references#REF155467\)](#)). Black-tailed jackrabbit (*Lepus californicus*) is the main prey in the southwestern United States, and white-tailed jackrabbit (*L. townsendii*) is more commonly taken in Wyoming and Montana ([304 \(/bow/species/goleag/cur/references#REF155467\)](#)). Hares and ground squirrels are primary prey in parts of Eurasia ([341 \(/bow/species/goleag/cur/references#REF104940\)](#), [20 \(/bow/species/goleag/cur/references#REF167550\)](#)).  2.

Avian prey observed at nests of Golden Eagles in western North America are predominantly gallinaceous birds (pheasants, grouse, and partridge) or waterfowl ([342 \(/bow/species/goleag/cur/references#REF10298\)](#), [304 \(/bow/species/goleag/cur/references#REF155467\)](#)). Ptarmigan (*Lagopus* spp.) are important prey in western and interior Alaska ([343 \(/bow/species/goleag/cur/references#REF10288\)](#), [344 \(/bow/species/goleag/cur/references#REF182489\)](#)), and waterfowl are taken frequently in arctic Canada and the Alaska tundra ([134 \(/bow/species/goleag/cur/references#REF59100\)](#), [344 \(/bow/species/goleag/cur/references#REF182489\)](#)). Ring-necked Pheasant (*Phasianus colchicus*) and Chukar are regularly taken in the Columbia Plateau of Washington, the Snake River Plain of southwestern Idaho, and the central Great Basin of Utah ([345 \(/bow/species/goleag/cur/references#REF56188\)](#), [346 \(/bow/species/goleag/cur/references#REF43242\)](#), [347 \(/bow/species/goleag/cur/references#REF10341\)](#), [314 \(/bow/species/goleag/cur/references#REF10282\)](#)). After wildfire caused large-scale habitat alteration and subsequently reduced jackrabbit numbers, waterfowl, mainly American Coot (*Fulica americana*) and Mallard (*Anas platyrhynchos*), were frequently taken by nesting Golden Eagle in southwestern Idaho ([348 \(/bow/species/goleag/cur/references#REF182481\)](#)). Golden Eagles that once nested in Maine took a wide variety of wading birds, ducks, seabirds, game birds, corvids, and other raptors ([195 \(/bow/species/goleag/cur/references#REF182366\)](#)). Chukar is taken in parts of Eurasia ([20 \(/bow/species/goleag/cur/references#REF167550\)](#)).

Scavenges extensively on, and occasionally kills, large prey, including seals (Phocoidea), ungulates, such as mountain goat (*Oreamnos americanus*), bighorn sheep (*O. canadensis*), Dall sheep (*O. dalli*), Asian mountain goat species (*Pseudois*, etc.) , chamois (*Rupicapra rupicapra*) , musk ox (*Ovibos moschatus*), caribou (*Rangifer* spp.), deer (*Odocoileus* spp., *Cervus* spp.), pronghorn (*Antilocapra americana*), Mongolian gazelle (*Procapra guttarosa*); carnivores including coyote (*Canis latrans*), badger (*Taxidea taxus*), arctic fox (*Vulpes lagopus*), bobcat (*Lynx rufus*), and Pallas's cat (*Felis manul*); and large birds of many types, including wild turkey, geese , Trumpeter Swan (*Olor buccinator*) and Tundra Swan (*O. columbianus*), Sandhill Crane (*Grus canadensis*) , Whooping Crane (*G. americana*), and Demoiselle Crane (*G. virgo*), Osprey (*Pandion haliaetus*), Upland Buzzard (*Buteo hemilasius*), Eurasian Eagle-Owl (*Bubo bubo*), Common Raven, and Great Blue Heron (*Ardea herodias*) ([73 \(/bow/species/goleag/cur/references#REF23961\)](#), [349 \(/bow/species/goleag/cur/references#REF10222\)](#), [320 \(/bow/species/goleag/cur/references#REF10336\)](#), [350 \(/bow/species/goleag/cur/references#REF43284\)](#), [342 \(/bow/species/goleag/cur/references#REF10298\)](#), [307 \(/bow/species/goleag/cur/references#REF33294\)](#), [9 \(/bow/species/goleag/cur/references#REF182275\)](#), [351 \(/bow/species/goleag/cur/references#REF10284\)](#), [352 \(/bow/species/goleag/cur/references#REF182492\)](#), [353 \(/bow/species/goleag/cur/references#REF182494\)](#), [354 \(/bow/species/goleag/cur/references#REF182495\)](#), [309 \(/bow/species/goleag/cur/references#REF167565\)](#), [310 \(/bow/species/goleag/cur/references#REF182476\)](#), [355 \(/bow/species/goleag/cur/references#REF182491\)](#); R. Ritchie, unpublished data; J. Rose, personal communication). When ungulates are taken, primarily young individuals are killed, though there are reports of Golden Eagle killing adults ([318 \(/bow/species/goleag/cur/references#REF10352\)](#), [248 \(/bow/species/goleag/cur/references#REF10214\)](#), [308 \(/bow/species/goleag/cur/references#REF10234\)](#), [327 \(/bow/species/goleag/cur/references#REF182475\)](#); J. Toynbee, personal communication). There are numerous on-line videos of Golden Eagle attacking ungulates; some of these videos are staged and some of the birds filmed are clearly flown by falconers.

Also preys on or scavenges domestic animals, including sheep, goats, calves (*Bos taurus*), pigs, poultry (*Gallus gallus*), dogs (*Canis familiaris*), and cats (*Felis catus*) ([73 \(/bow/species/goleag/cur/references#REF23961\)](#), [356 \(/bow/species/goleag/cur/references#REF43293\)](#), [342 \(/bow/species/goleag/cur/references#REF10298\)](#)). May kill livestock, even when principal prey are available ([357 \(/bow/species/goleag/cur/references#REF43300\)](#)), but such predation events are rare. Livestock remains, including both carrion and eagle kills, accounted for only 1.4% of 7,094 prey items identified in studies throughout the western United States ([342 \(/bow/species/goleag/cur/references#REF10298\)](#)). In studies in which domestic sheep and goat remains were found at nests, these species constituted 0.2 to 13.9% of remains ([358 \(/bow/species/goleag/cur/references#REF10312\)](#), [356 \(/bow/species/goleag/cur/references#REF43293\)](#), [359 \(/bow/species/goleag/cur/references#REF10216\)](#)).

In Japan, the species apparently specializes on Japanese hare (*Lepus brachyurus*; [231 \(/bow/species/goleag/cur/references#REF184625\)](#)). Other important prey were a variety of snakes and Copper Pheasant (*Syrnaticus soemmerringii*). In Arabia, hunts hares, gazelle, and spiny-tailed (*Uromastyx*) lizards ([230 \(/bow/species/goleag/cur/references#REF143967\)](#)).

Quantitative Analysis

Approaches to assessing diet and biases in those approaches

The methods used for sampling dietary information affect how the results are interpreted and applied. Golden Eagle dietary data are available primarily for the nesting season and are most frequently based on analyses of pellets and prey remains collected at nests ([304 \(/bow/species/goleag/cur/references#REF155467\)](#)). However, dietary data also may be obtained through direct observation of prey deliveries at nests ([337 \(/bow/species/goleag/cur/references#REF43255\)](#)) or, more recently, from motion sensitive cameras at nests ([360 \(/bow/species/goleag/cur/references#REF182487\)](#), [361 \(/bow/species/goleag/cur/references#REF182486\)](#)). Some of the earliest dietary estimates were based on analyses of stomach samples ([362 \(/bow/species/goleag/cur/references#REF10354\)](#), [313 \(/bow/species/goleag/cur/references#REF130129\)](#)), but the quantity of data collected from stomach samples from individual raptors is minimal compared to that collected via other methods ([363 \(/bow/species/goleag/cur/references#REF182490\)](#)). Stomach content analysis, collection of pellets and prey remains beneath roosts, and motion-sensitive trail cameras set over carcasses, are some of the only ways that dietary data have been collected during the non-breeding season.

Prior work suggests that analysis of prey remains and regurgitated pellets collected at nests tends to underestimate total prey biomass compared to direct observation, but the two methods do not differ significantly with regard to percent biomass or percent frequency ([337 \(/bow/species/goleag/cur/references#REF43255\)](#), [364 \(/bow/species/goleag/cur/references#REF182501\)](#), [304 \(/bow/species/goleag/cur/references#REF155467\)](#)). In contrast, cameras can detect more prey species than does identification of prey remains ([360 \(/bow/species/goleag/cur/references#REF182487\)](#)), and the probability of detecting small prey items may be higher for camera images than from analyses of prey remains and pellets ([253 \(/bow/species/goleag/cur/references#REF182467\)](#), [361 \(/bow/species/goleag/cur/references#REF182486\)](#)).

The frequency of data collection can influence results of dietary studies ([253 \(/bow/species/goleag/cur/references#REF182467\)](#)). Video or observational data are essentially continuous when a camera is operational or when a person can watch the nest. However, cameras often are installed after nestlings have reached a certain age ([361 \(/bow/species/goleag/cur/references#REF182486\)](#)), and observers cannot be present all day every day at nests. Similarly, the frequency of visits to nests for collection of pellets and prey remains can vary from as regularly as every 3–5 days during the nesting season for 10 years ([365 \(/bow/species/goleag/cur/references#REF10330\)](#)) to one collection per nest for only a single season (see Appendix 1 of [304 \(/bow/species/goleag/cur/references#REF155467\)](#)).

Major Prey in North America by Geographic Region—nesting season

The relative importance of prey taxa varies by ecoregion (diets reviewed in Bedrosian et al. [[304 \(/bow/species/goleag/cur/references#REF155467\)](#)], [Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)). Arctic ground squirrel is generally the primary prey in the Boreal Cordillera, Alaska Tundra, and Southern Arctic ecoregions (> 60° N; [Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)), but only after the squirrels awake from hibernation. Snowshoe hare, arctic hare (*L. arcticus*), and ptarmigan are secondary prey ([Table 2](#)

([/bow/appendix/ACT1053401/APP1005438](#)); see Bedrosian et al. ([304 \(/bow/species/goleag/cur/references#REF155467\)](#))) for ecoregion descriptions and maps), and are the primary prey species available while squirrels hibernate. Leporids (jackrabbits [mainly black-tailed jackrabbit] and cottontails) dominate Golden Eagle diets in western North America below 50° N latitude ([Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)). Sciurids (rock squirrels and California ground squirrels) are primary prey in the Western Cordillera and Mediterranean California ecoregions ([Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)). Sciurids (yellow-bellied marmot, prairie dogs, rock squirrel, and numerous ground squirrel species) are common secondary and tertiary prey ([Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#), [304 \(/bow/species/goleag/cur/references#REF155467\)](#)). Many species of birds, including but not limited to Black-billed Magpie, ducks, Chukar, Greater Sage-Grouse, Ring-necked Pheasant, forest grouse, and Rock Pigeon, are secondary and tertiary prey in the West Central Semi-Arid Prairie and Cold Desert ecoregions ([304 \(/bow/species/goleag/cur/references#REF155467\)](#), [Table 2 \(/bow/appendix/ACT1053401/APP1005438\)](#)). Reptiles comprise a higher proportion of Golden Eagle diet in the Mojave Desert than in any other area in western North America. Gopher snake (*Pituophis catenifer*) and chuckwalla (*Sauromalus ater*) were tertiary prey in two studies in warm deserts but do not comprise more than 10% of prey items ([304 \(/bow/species/goleag/cur/references#REF155467\)](#)). Other prey of Golden Eagles include gulls (*Larus* spp.) and tree squirrels (*Sciurus* spp.) in the Channel Islands and southern California, and tortoises in southern California and New Mexico ([360 \(/bow/species/goleag/cur/references#REF182487\)](#), [304 \(/bow/species/goleag/cur/references#REF155467\)](#); B. A. Kimsey, personal communication).

Recent studies suggest that diets of some Golden Eagle populations have changed over time in response to alterations in habitat ([348 \(/bow/species/goleag/cur/references#REF182481\)](#)). White-tailed jackrabbit and cottontails were the most commonly taken prey in south-central Montana during the 1960s ([366 \(/bow/species/goleag/cur/references#REF159648\)](#), [358 \(/bow/species/goleag/cur/references#REF10312\)](#)). However, jackrabbits accounted for < 4% of prey items in this same study area 50 years later, and Richardson's ground squirrel and cottontails are now the most frequently taken prey (R. Crandall, unpublished data). Similarly, black-tailed jackrabbits and cottontails accounted for 54% of prey items collected from Golden Eagle nests in southwestern Idaho between 1971–1981 ([348 \(/bow/species/goleag/cur/references#REF182481\)](#)). Thirty years later, jackrabbits and cottontails accounted for only 13% of prey items, and American Coots and Mallards increased from < 2% of prey items to 27% ([348 \(/bow/species/goleag/cur/references#REF182481\)](#)). Most studies of diet have been conducted prior to 2008 ([304 \(/bow/species/goleag/cur/references#REF155467\)](#)) and these two long-term studies suggest that historical knowledge about eagle diets may not accurately predict future diets.

Diet data from the nesting season are scarce for eastern North America. The few published historical records on the diet of breeding Golden Eagles in eastern Canada suggest that they feed on birds (particularly waterfowl and wading birds) with greater frequency than do eagles in western North America ([195 \(/bow/species/goleag/cur/references#REF182366\)](#), [5 \(/bow/species/goleag/cur/references#REF182375\)](#)). A high proportion of prey remains in Golden Eagle nests in Maine were from American Bittern (*Botaurus lentiginosus*),

Canada Geese, and Great Blue Heron (367 ([/bow/species/goleag/cur/references#REF10350](#)), 194 ([/bow/species/goleag/cur/references#REF43319](#))). Observations on the Canadian breeding grounds suggest that Golden Eagles prey on ducks in northern Labrador (368 ([/bow/species/goleag/cur/references#REF182488](#))), and indirect evidence suggests that Golden Eagles take fish-eating seabirds (Procelliformes) and scavenge marine mammal carcasses (TAM). However, snowshoe hare, cottontails, geese, and marmots also are thought to be common prey in eastern North America (216 ([/bow/species/goleag/cur/references#REF43313](#)), 142 ([/bow/species/goleag/cur/references#REF43253](#))).

Major Prey in North America by Geographic Region—Non-breeding Season

Information on diet of Golden Eagles during the non-breeding season (the period when eagles are not feeding young at nests, usually fall and winter) is much more limited than for the nesting season (304 ([/bow/species/goleag/cur/references#REF155467](#))). That said, one meta-analysis of these limited data suggested that winter diet of Golden Eagles in western North America does not appear to differ appreciably from nesting season diets except that hibernating sciurids are not available and thus not taken and carrion is more frequently taken (304 ([/bow/species/goleag/cur/references#REF155467](#))). Carrion is a highly important part of the winter diet of some eagles, and the amount consumed might be influenced by winter severity and local availability of other food (304 ([/bow/species/goleag/cur/references#REF155467](#))). Prey taken during the non-breeding season by territorial pairs in northeastern Wyoming and southwestern Idaho varied greatly among territories (236 ([/bow/species/goleag/cur/references#REF10258](#)), 176 ([/bow/species/goleag/cur/references#REF114159](#))). Winter diet in central Utah is reported to be composed almost entirely of black-tailed jackrabbit (97%; 305 ([/bow/species/goleag/cur/references#REF33293](#))), but it is unclear how changes in jackrabbit abundance have influenced winter diet of those birds. Eagles prey on young of the year and occasionally adult pronghorn in the Wyoming Basin during winter (313 ([/bow/species/goleag/cur/references#REF130129](#)), 369 ([/bow/species/goleag/cur/references#REF182493](#)), 308 ([/bow/species/goleag/cur/references#REF10234](#)), 310 ([/bow/species/goleag/cur/references#REF182476](#)), 304 ([/bow/species/goleag/cur/references#REF155467](#))). Hares and rabbits comprised 51% of 65 prey individuals identified in stomachs of 50 Golden Eagles killed in Colorado in March 1948, and leporids also comprised 59% of items identified in 63 eagle stomachs collected between November and March from 15 states throughout the western United States (362 ([/bow/species/goleag/cur/references#REF10354](#)), 313 ([/bow/species/goleag/cur/references#REF130129](#))). Sheep and goats constituted 11% of items in that study. Golden Eagles also prey on waterfowl during winter (313 ([/bow/species/goleag/cur/references#REF130129](#)), 370 ([/bow/species/goleag/cur/references#REF60306](#))).

Wintering eastern Golden Eagles regularly feed on carrion of white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces*), and caribou (*Rangifer tarandus*; 371 ([/bow/species/goleag/cur/references#REF4076](#)), 216 ([/bow/species/goleag/cur/references#REF43313](#)), 196 ([/bow/species/goleag/cur/references#REF43309](#))). Golden Eagles have been observed attacking wild turkey during winter (352 ([/bow/species/goleag/cur/references#REF182492](#))), and evidence suggests attempted predation on a porcupine (*Erethizon dorsatum*; 372 ([/bow/species/goleag/cur/references#REF182426](#)), EHC). Waterfowl are thought to be important in winter diets on Chesapeake Bay and eastern coastal areas (D. Buehler, personal communication).

Food Selection and Storage

Golden Eagles in North America focus on prey that range in size from 500 to 4,000 g ([2 \(/bow/species/goleag/cur/references#REF182273\)](#), [304 \(/bow/species/goleag/cur/references#REF155467\)](#); see [Diet and Foraging: Diet \(https://species.birds.cornell.edu/bow/species/goleag/2.0/foodhabits#diet\)](https://species.birds.cornell.edu/bow/species/goleag/2.0/foodhabits#diet)). The exception is the high percentage of smaller ground squirrels (200–300 g) taken in northern California and southwestern Idaho ([365 \(/bow/species/goleag/cur/references#REF10330\)](#), [348 \(/bow/species/goleag/cur/references#REF182481\)](#); B. Woodbridge, unpublished data in [304 \(/bow/species/goleag/cur/references#REF155467\)](#)). In southwestern Idaho, size of prey ranges from 10 to 5,800 g (geometric mean 690 g, $n = 2,203$ items; [365 \(/bow/species/goleag/cur/references#REF10330\)](#)). Generally eats large prey at kill sites, however, fresh limbs of young ungulates in nests suggest that eagles may disarticulate large prey before bringing parts to the nest ([313 \(/bow/species/goleag/cur/references#REF130129\)](#), MNK; T. Craig, personal communication).

Parents may bring more food to nests than young can eat. Excess food is only sometimes carried away from the nest (see [Breeding: Parental Care \(https://species.birds.cornell.edu/bow/species/goleag/2.0/parentalcare#parcare\)](https://species.birds.cornell.edu/bow/species/goleag/2.0/parentalcare#parcare)). Over-provisioning of prey with extensive fat reserves can have negative consequences from excess oiling of nestlings ([373 \(/bow/species/goleag/cur/references#REF182502\)](#)).

Rarely caches prey. However, there is a report that a pair in Scotland deposited prey on a cliff near the nest before feeding it to the young ([374 \(/bow/species/goleag/cur/references#REF10281\)](#)).

Foraging Response to Changes in Prey Availability

Some Golden Eagle populations exhibit dietary shifts in response to changing abundance of primary prey species. An increase in diet breadth and a decrease in the frequency of leporids in the eagle diet was correlated with a decrease in relative leporid abundance in Montana ([358 \(/bow/species/goleag/cur/references#REF10312\)](#)). Dietary breadth was negatively correlated to cottontail abundance in the Bighorn Basin of northwestern Wyoming, suggesting that as cottontails increase in abundance, eagles eat fewer alternative prey ([375 \(/bow/species/goleag/cur/references#REF182503\)](#)). Similarly, a large increase in diet breadth and a shift in major prey consumed has been related to habitat alteration in the Columbia Basin ([364 \(/bow/species/goleag/cur/references#REF182501\)](#), [348 \(/bow/species/goleag/cur/references#REF182481\)](#)).

The most comprehensive information about diet composition and dietary change of the Golden Eagle in North America comes from Morley Nelson Snake River Birds of Prey National Conservation Area (NCA) in southwestern Idaho where > 2,200 individual prey items were identified from 1971 to 1981 ([365 \(/bow/species/goleag/cur/references#REF10330\)](#)) and > 1,160 items from 2014–2015 ([348 \(/bow/species/goleag/cur/references#REF182481\)](#)). In these studies, the proportion of main prey in the diet varied annually, and the proportion of jackrabbits in the diet correlated positively with jackrabbit density in the environment. Black-tailed jackrabbit was preferred over Piute ground squirrel, and ground squirrels were

preferred over all other, non-jackrabbit prey. Diet breadth of these eagles was smaller than co-occurring Red-tailed Hawks but larger than that of Prairie Falcon. After wildfires caused large-scale habitat alteration and reduced available jackrabbit habitat, eagles in the NCA shifted from taking mostly leporids (mainly black-tailed jackrabbit) to waterfowl (American Coot and Mallard; [348 \(/bow/species/goleag/cur/references#REF182481\)](#)). Diet breadth increased after wildfires, and the altered diet included more birds and fewer black-tailed jackrabbits and cottontails compared to pre-burn years. Jackrabbits, however, still contributed the most biomass to the post-burn eagle diet ([348 \(/bow/species/goleag/cur/references#REF182481\)](#)).

Diet also varies within the nesting season, often reflecting opportunistic hunting and suggest a functional response to changes in prey availability. In southwestern Idaho, Ring-necked Pheasant is the most common prey in nests in April, coinciding with the peak of pheasant breeding activity; however, once pheasants began to incubate eggs, they were commonly detected as prey in eagle nests ([199 \(/bow/species/goleag/cur/references#REF10273\)](#)). Diet in the early nesting season in interior Alaska, when sciurids are hibernating, consists mainly of hares and ptarmigan. Ground squirrels (mainly juveniles) form a large proportion of prey delivered to nests later in the season (CLM). In Norway, captured fewer mountain hare (*Lepus timidus*) and Willow Ptarmigan (*Lagopus lagopus*) and more thrushes as the nesting season progressed, (*Turdus* spp.; [253 \(/bow/species/goleag/cur/references#REF182467\)](#)).

Nutrition and Energetics

Golden Eagle pairs delivered ~0.885 kg of prey biomass per day to nests in western Texas ([376 \(/bow/species/goleag/cur/references#REF43287\)](#)) and ~1.417 kg per day in southwestern Idaho ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). Pairs in Montana brought an estimated 1.47 kg of prey per day to a nest ([377 \(/bow/species/goleag/cur/references#REF10287\)](#)). Eaglets in multiple-young broods receive more food from adults than do eagles in one-young broods ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). See [Breeding: Parental Care \(https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#parcare\)](https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#parcare), for additional information on prey delivery rates.

Estimates from feeding trials suggest that between 24 and 33 kg of food is needed to raise a nestling from hatching to fledging (10 weeks; [378 \(/bow/species/goleag/cur/references#REF10226\)](#)). Prey biomass consumed by nestlings increases during brood-rearing and peaks at 7–9 weeks of age ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). The amount of food consumed daily by 2 male and 2 female captive nestlings increased steadily from 11 to 15 days of age, peaked at 28–44 days, and declined slightly until experiments ended at 53–57 days ([379 \(/bow/species/goleag/cur/references#REF33291\)](#)). Food consumption did not differ between male and female nestlings. During late brood-rearing (47–57 days old), captive eaglets consumed 12–15% of their body mass per day. This is much greater than published consumption rates of free-flying adults and juveniles (5.7–6.6% of body mass per day; [380 \(/bow/species/goleag/cur/references#REF46302\)](#)). Greater food consumption by nestlings likely reflects the

intense energetic costs of producing body tissue and feathers. Assimilation efficiency (ratio of energy metabolized to energy ingested) of 4 captive nestlings averaged 74.4% (range 73.9–74.8%) and did not differ between males and females ([379 \(/bow/species/goleag/cur/references#REF33291\)](#)). In the case of adults, and probably for nestlings, greater food consumption results in birds being more able to withstand thermal stresses ([381 \(/bow/species/goleag/cur/references#REF9616\)](#), [382 \(/bow/species/goleag/cur/references#REF43314\)](#)).

Metabolism and Temperature Regulation

Mean gross and net energy efficiency (proportion of total ingested and metabolized energy, respectively, converted to feathers, fat, and other body parts) of the 4 captive nestlings described in [Nutrition and Energetics \(https://species.birds.cornell.edu/bow/species/goleag/2.0/foodhabits#nutri\)](#) was 31% and 42%, respectively, and did not differ between sexes ([378 \(/bow/species/goleag/cur/references#REF10226\)](#)). Metabolized energy is energy ingested minus energy egested in the form of feces and pellets. Growth efficiency (ratio of biomass produced to biomass consumed) of nestlings decreased linearly with age, from 27%, at 2 weeks of age, to < 5%, at fledging, and did not differ between males and females ([379 \(/bow/species/goleag/cur/references#REF33291\)](#)). As eaglets aged, more of their energy budget is allocated to maintenance. Trends in metabolized energy paralleled food consumption and peaked at ~2,500 kJ/d, with no difference between sexes. Metabolized energy of wild male nestlings peaks at 7–8 weeks of age at ~2,000 kJ/d, and females peaks at ~3,100 kJ/d at 8 weeks of age ([379 \(/bow/species/goleag/cur/references#REF33291\)](#)). Energy metabolism ranged from 4.3 to 4.0 W/kg for 2 other captive Golden Eagles ([383 \(/bow/species/goleag/cur/references#REF43268\)](#)). Body temperature of a telemetered nestling ranged from 38 to 39°C during 18 days when the bird was 35 to 53 days old ([384 \(/bow/species/goleag/cur/references#REF10316\)](#)). During a single nocturnal recording, the nestling's body temperature dropped to approximately 38°C within 1 hour after sunset and remained near that temperature until about sunrise.

Drinking, Pellet-Casting, and Defecation

Drinks occasionally, but most or all liquid requirements, particularly for nestlings, are met by ingesting prey ([32 \(/bow/species/goleag/cur/references#REF9577\)](#)). In Nevada and Arizona, reported to drink from small creeks and in mountain bogs and springs and to ingest snow near or above timberline ([385 \(/bow/species/goleag/cur/references#REF33289\)](#), [386 \(/bow/species/goleag/cur/references#REF107723\)](#); D. Driscoll, personal communication). Trail cameras commonly capture Golden Eagle drinking at stock tanks and "guzzlers" in desert environments ([120 \(/bow/species/goleag/cur/references#REF182324\)](#), TEK). Drinking can be a frequent daily activity of captive individuals ([387 \(/bow/species/goleag/cur/references#REF10272\)](#), [388 \(/bow/species/goleag/cur/references#REF182504\)](#)).

Usually casts pellets once per day, often early in the day (M. Collopy, personal communication). When casting pellets, an eagle arches its neck with face down and forward and gapes widely while rapidly shaking its head laterally. This behavior is repeated several times, with brief pauses between head shakes. Soft squeaks or whistles often accompany casting. Individuals often bob their heads prior to casting, and conspicuous swallowing often follows a casting attempt. Young cast 1–3 pellets per day from age 20 days to fledging, but some young do not cast every day ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)). Two captive male and two captive female young produced an average of 8 g and 7 g per day of pellets (all measurements dry mass), respectively ([378 \(/bow/species/goleag/cur/references#REF10226\)](#)). The same captive eaglets defecated an average of 57 and 60 g per day, respectively ([378 \(/bow/species/goleag/cur/references#REF10226\)](#)). Number of defecations per day increases linearly to about day 20 in wild nestlings ($n = 4$), and then levels off to 10–16 per day until fledging ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)).

◀ **[Movements and Migration \(/bow/species/goleag/cur/movement\)](#)**

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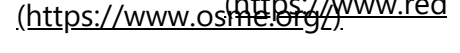
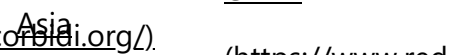
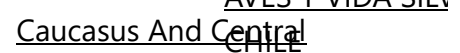
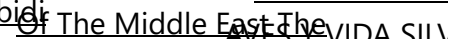
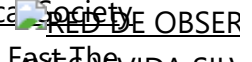
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SPECIES

Golden Eagle *Aquila chrysaetos*

Todd E. Katzner, Michael N. Kochert, Karen Steenhof, Carol L. McIntyre, Erica H. Craig, and Tricia A. Miller

Version: 2.0 — Published September 17, 2020

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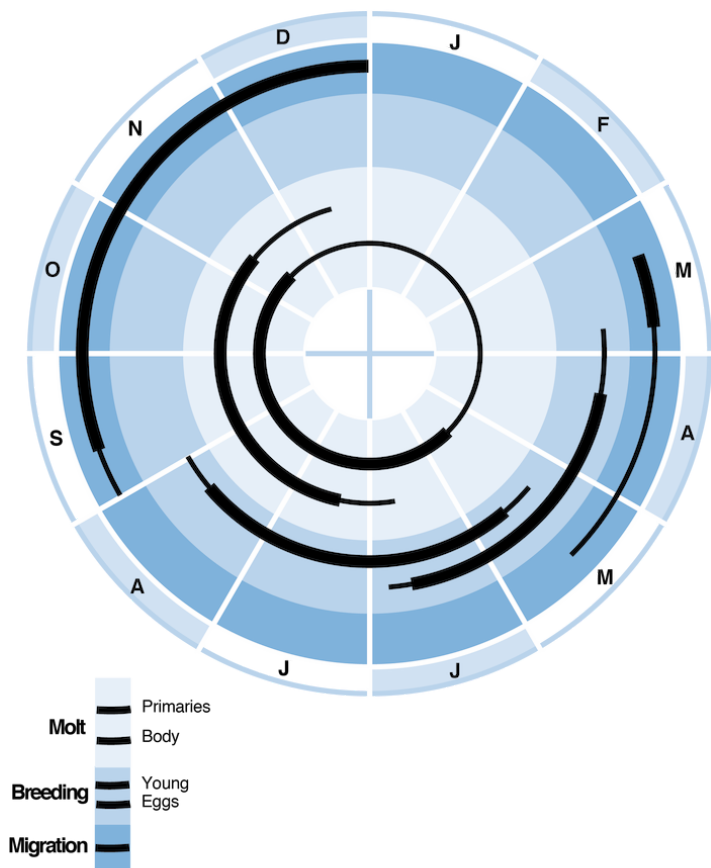


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Breeding

The Golden Eagle is generally monogamous and slowly reproducing (i.e., *k*-selected). Nests, which are on cliffs, in trees, or on the ground, are frequently reused, from year to year, and pair bonds can be maintained across many years. The time from egg-laying until fledging can last 100 days. However, territoriality can start long before egg-laying, and post-fledging dependence can last long after fledging. Thus, the nesting cycle of southern populations may start in October with increased territory defense, and last up to 12 months, when the young finally depart from the territory. In contrast, northern populations, which are generally migratory, have a much shorter nesting cycle that can start in March and finish in September.

Phenology



* Timing pertains to North American populations

(<https://cdn.download.ams.birds.cornell.edu/api/v1/asset/261817851>).

Figure 1. Annual cycle of breeding, migration, and molt.

Thick lines show peak activity; thin lines, off-peak.

Pair Formation and Courtship

In temperate areas where pairs remain on or near nesting territories year-round, new pairs form throughout the year, soon after mates are lost ($n = 13$) ([311 \(/bow/species/goleag/cur/references#REF43263\)](#), [424 \(/bow/species/goleag/cur/references#REF10265\)](#); U.S. Geological Survey [USGS], unpublished data). In these populations, aerial display, stick-carrying, vocalizing, and even copulation may occur year-round, but often peak prior to egg-laying in January and February ([345 \(/bow/species/goleag/cur/references#REF56188\)](#), [470 \(/bow/species/goleag/cur/references#REF182665\)](#); F. Isaacs, D. Stahlecker, J. Watson, personal communication; USGS, unpublished data). This process of courtship, nest selection, and nest refurbishment can last > 1 month (MNK).

In the Diablo Range, California, resident pairs participate in courtship behaviors from December to January ([424 \(/bow/species/goleag/cur/references#REF10265\)](#)). In southwestern Idaho, these behaviors start in late January, and peak in mid-February ([345 \(/bow/species/goleag/cur/references#REF56188\)](#)). In the Mojave Desert of California, home ranges are their smallest in October, suggesting that is when pair formation and courtship are initiating ([165 \(/bow/species/goleag/cur/references#REF182364\)](#)). Finally, in Alaska, these behaviors begin about one week after the migratory birds return to their nesting grounds ([471](#)

([/bow/species/goleag/cur/references#REF182666](#)), [343 \(/bow/species/goleag/cur/references#REF10288\)](#), CLM; T. Booms, personal communication; see [Movements and Migration: Timing and Routes of Migration](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/movement#migroute>)).

Nest-Building

Non-migratory adults add material to nests and may build new nests at any time of the year. However, they frequently begin refurbishing nests in autumn, with activity peaking from late January to early March ([2 \(/bow/species/goleag/cur/references#REF182273\)](#); F. Isaacs, personal communication). In southern California, nest construction begins in fall and continues through winter ([311 \(/bow/species/goleag/cur/references#REF43263\)](#)). In Oklahoma and Texas, nest-building begins in December and January (R. Strandtman in [29 \(/bow/species/goleag/cur/references#REF38067\)](#)), respectively. In southwestern Idaho, a pair of adult eagles was observed building a nearly completed new nest on 26 May after a nesting attempt failed earlier that same year (MNK).

The duration of the nest building cycle varies, but it is probably longer for residents than migrants. This is primarily because migrants do not remain on their territories year-round. For non-migratory eagles, nest construction or refurbishment usually begins 1–3 months prior to egg-laying ([444 \(/bow/species/goleag/cur/references#REF10206\)](#)). In areas where the Golden Eagle is migratory, nest-building probably starts soon after eagles arrive on their breeding grounds (CLM). Bowl construction (see [Breeding: Nest: Structure and Composition](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#nest>)) is the last phase of nest-building and occurs a few weeks before egg-laying ([2 \(/bow/species/goleag/cur/references#REF182273\)](#), CLM).

Timing of the Nesting Cycle

Variation in Timing of the Nesting Cycle

Raises only one brood per season but will occasionally re-nest when eggs fail to hatch (see [Breeding: Eggs](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#eggs>)). Laying dates vary among populations ([Table 3 \(/bow/appendix/ACT1053401/APP1005439\)](#)) and among years ([345 \(/bow/species/goleag/cur/references#REF56188\)](#), [472 \(/bow/species/goleag/cur/references#REF56184\)](#), [473 \(/bow/species/goleag/cur/references#REF10212\)](#); USGS, unpublished data). Latitude and elevation account for at least some of the variation in laying dates among populations, such that eggs are laid later at more northern latitudes and higher elevations ([Table 3 \(/bow/appendix/ACT1053401/APP1005439\)](#)). Even within the fairly small area of the Front Range of the Rocky Mountains of Wyoming, Colorado, and New Mexico, eagles at more southerly locations and at lower elevations lay eggs earlier in the year than do others in more northern and higher elevation locations ([268 \(/bow/species/goleag/cur/references#REF43249\)](#)). However, substantial differences among individuals and years commonly occur within a single region (see [Table 3 \(/bow/appendix/ACT1053401/APP1005439\)](#) for date ranges from a single site spanning 6–8 weeks).

Factors besides latitude and elevation also influence laying dates. In western Arizona, laying dates may be synchronized with rainfall patterns and reproduction by prey ([210](#) ([/bow/species/goleag/cur/references#REF8575](#))). Eagles in interior Alaska may lay eggs earlier in years when snowshoe hare and willow ptarmigan are in the higher phases of their population cycles (CLM). In southwestern Idaho, hatching dates, which relate to laying dates, are related to both winter severity and jackrabbit abundance. Eagles hatch earlier when rabbits are abundant and later after severe winters ([474](#) ([/bow/species/goleag/cur/references#REF10331](#))).

Timing of Laying

Eggs are laid from late January to mid-February in Washington, southeastern Oregon, southwestern Idaho, north-central Utah, the Four Corners Region, west-central California, and southern California ([311](#) ([/bow/species/goleag/cur/references#REF43263](#)), [Table 3](#) ([/bow/appendix/ACT1053401/APP1005439](#))). Egg-laying begins slightly later (early to mid-March) in Wyoming and northeastern Colorado ([Table 3](#) ([/bow/appendix/ACT1053401/APP1005439](#))). Laying usually occurs from late March through early May on the northern breeding grounds in Alaska and western Canada, with most clutches completed by mid-April ([475](#) ([/bow/species/goleag/cur/references#REF182664](#)), [131](#) ([/bow/species/goleag/cur/references#REF10355](#)), CLM; [Figure 1](#) (<https://cdn.download.ams.birds.cornell.edu/api/v1/asset/261817851>)).

Timing of Hatching

Hatching dates in western North America range from 10 March to 25 June ([Table 3](#) ([/bow/appendix/ACT1053401/APP1005439](#))). In general, hatching dates are earlier at territories in the southern part of the distribution of the species and later farther north.

In the Yukon Territory, Canada, eagles hatch in the first week of June ([137](#) ([/bow/species/goleag/cur/references#REF61433](#))). On the Seward Peninsula, in western Alaska, most hatching, occurs during the first half of June, with some earlier clutches hatching by the third week of May ([172](#) ([/bow/species/goleag/cur/references#REF61012](#)), T. Booms, personal communication). In north-central Quebec (50 to 52°N latitude), hatching occurs in late May and early June ($n = 22$ nests, 7 years; [476](#) ([/bow/species/goleag/cur/references#REF182363](#))).

Timing of Fledging

Young fledge when 45–81 days old, although the average is ~64 days ([390](#) ([/bow/species/goleag/cur/references#REF10249](#)), Steenhof et al. 2017; USGS, unpublished data; see [Breeding: Fledgling Stage](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#fledge>)). The timing of fledging depends on the timing of egg laying and hatching and the duration of the nestling stage. For 1,553 broods monitored between 1966 to 2012 in southwestern Idaho, young were in nests from mid-March to mid-July, and most broods (75%) reached mean fledging age (64-days old) by mid-June (USGS, unpublished data). In central and northern Alaska, most young fledge by early August ([343](#) ([/bow/species/goleag/cur/references#REF10288](#)), [131](#) ([/bow/species/goleag/cur/references#REF10355](#)), CLM; [Figure 4](#)).

Timing of Post-fledging Dependence Period

The length of the post-fledging dependence period varies among regions and with migratory behavior (see [Breeding: Fledgling Stage](http://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#fledge) (<http://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#fledge>)). Seven young telemetered in southwestern Idaho fledged between late May and early June and dispersed from their natal territory between mid-August and 31 December (USGS, M. Stuber unpublished data). In southern California, two eagles telemetered as nestlings fledged in May and stayed within their natal territory until October (TEK, TAM, unpublished data). Nine young telemetered in southwestern Montana fledged between late-June and mid-July and dispersed between early October and mid-March the following year (R.H. Crandall, unpublished data).

In contrast, migratory populations have much shorter dependence periods that usually end with the onset of autumn migration. The length of the post-fledging dependence period for 45 telemetered individuals in Denali National Park and Preserve, Alaska, averaged $50 \text{ d} \pm 6 \text{ d}$ ([269](#) (</bow/species/goleag/cur/references#REF167566>)). In that study, young that hatched earlier did not start migration any earlier than young that hatched later ([269](#) (</bow/species/goleag/cur/references#REF167566>)).

Nest Site

Selection Process

It is not known how eagles select their nest site, nor which sex is responsible for this selection. Early accounts suggested that females select nest sites ([311](#) (</bow/species/goleag/cur/references#REF43263>)). Many territories have multiple nests and it is not known why one nest is chosen for use in any given year (see [Breeding: Nests: Maintenance or Reuse of Nests, Alternate Nests](#) (<https://species.birds.cornell.edu/bow/species/goleag/draft/breeding#nest>), below)

Determinants of Nest Location

Despite the lack of knowledge about how nests are selected, there are patterns reported in locations of eagle nests. Local geography is clearly one important determinant. Many nests have a wide view of the surrounding area ([418](#) (</bow/species/goleag/cur/references#REF43245>)) or are on prominent escarpments ([204](#) (</bow/species/goleag/cur/references#REF10210>)) that provide updraft to subsidize flight ([311](#) (</bow/species/goleag/cur/references#REF43263>)). Proximity to hunting grounds is probably an important factor in nest-site selection ([472](#) (</bow/species/goleag/cur/references#REF56184>)). Finally, protection from predators is



also likely relevant. Most nests are inaccessible to humans and mammalian predators (requiring either a ladder or ropes to be reached by humans). In Idaho and in Denali National Park and Preserve, Alaska, > 80% and > 90% of nests, respectively, required rope access (USGS, unpublished data; EHC, CLM).

Weather and microclimate also influence nest location. In southwestern Montana, eagles usually build nests

below areas that receive > 500 cm of snow ([201 \(/bow/species/goleag/cur/references#REF33284\)](#)). Weather conditions at the beginning of the nesting season may be critical in nest-site selection in some northern areas ([211 \(/bow/species/goleag/cur/references#REF10294\)](#)). However, the amount of snow accumulated on nests at the start of the nesting season may be, in some locations, more important than local weather ([105 \(/bow/species/goleag/cur/references#REF33287\)](#), CLM). Elevation also may limit distribution of nests at northern latitudes, as higher elevation sites are often covered with snow or ice long after eggs should be laid (CLM). For example, none of the 377 nests monitored in Denali National Park and Preserve, Alaska for > 30 years were above 1,585 m (U.S. National Park Service, unpublished data). The highest eagle nest detected in the Brooks Range in northern Alaska was at 1,535 m in elevation (EHC, T. Craig, J. Herriges, unpublished data). Farther south, in the Southern Lakes region of Yukon Territory, Canada, elevation of 218 nests averaged 1,268 m (range 670–1,768). In another study in east-central Yukon, 80% of 101 nests were between 1,372 to 1,829 m in elevation (range 1,067–1,981 m; [477 \(/bow/species/goleag/cur/references#REF182668\)](#)).

Nest site exposure may be a factor in nest-site selection ([478 \(/bow/species/goleag/cur/references#REF43294\)](#), [479 \(/bow/species/goleag/cur/references#REF182680\)](#)). Eagles nesting at higher latitudes tend to use south-facing locations, while those at lower latitudes tend to use north-facing locations (see [Breeding: Nest: Microclimate: Nest Exposure \(https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#nest\)](#)).

Microhabitat

Mainly builds nests on cliffs and in trees. However, when not on cliffs or in trees, eagle nests are occasionally found on the ground ([200 \(/bow/species/goleag/cur/references#REF56193\)](#), [480 \(/bow/species/goleag/cur/references#REF107711\)](#)), clay embankments ([334 \(/bow/species/goleag/cur/references#REF10263\)](#)), river banks ([436 \(/bow/species/goleag/cur/references#REF10305\)](#), EHC), boulder strewn hillsides ([480 \(/bow/species/goleag/cur/references#REF107711\)](#)), and structures made by humans. Structures used for nesting include windmills , observation towers ([472 \(/bow/species/goleag/cur/references#REF56184\)](#)), nesting platforms ([436 \(/bow/species/goleag/cur/references#REF10305\)](#)) , abandoned gold dredges ([174 \(/bow/species/goleag/cur/references#REF31791\)](#)), and electrical transmission towers ([481 \(/bow/species/goleag/cur/references#REF8222\)](#), [209 \(/bow/species/goleag/cur/references#REF10266\)](#)). In areas where eagles nest on multiple substrates (i.e., both trees and cliffs), there is little indication of differences in survival of nests on different substrates ([482 \(/bow/species/goleag/cur/references#REF146935\)](#))

Cliff nests are most common throughout much of western North America and in some parts of northeastern North America. Tree nests are more common than cliff nests in northeastern Wyoming ([200 \(/bow/species/goleag/cur/references#REF56193\)](#), [436 \(/bow/species/goleag/cur/references#REF10305\)](#)), the central Coast Range in California ([209 \(/bow/species/goleag/cur/references#REF10266\)](#)), coastal Washington ([483 \(/bow/species/goleag/cur/references#REF10241\)](#), [159 \(/bow/species/goleag/cur/references#REF10224\)](#)), southern Quebec ([476 \(/bow/species/goleag/cur/references#REF182363\)](#)), and Sweden ([484 \(/bow/species/goleag/cur/references#REF184634\)](#)). Eagles occasionally nest on the ground in Nevada ([485 \(/bow/species/goleag/cur/references#REF43307\)](#)), Wyoming ([200](#)

[\(/bow/species/goleag/cur/references#REF10346\)\), Wyoming \(\[200\]\(#\)](#)


[\(/bow/species/goleag/cur/references#REF56193\)\), North Dakota \(\[151\]\(#\)](#)

[\(/bow/species/goleag/cur/references#REF10346\)\), and Alaska \(T. Booms, unpublished data;, CLM, EHC\). A similar pattern is observed in Eurasia, where cliff nest sites appear to be preferred when they are available in appropriate habitat \(\[435\]\(#\) \[\\(/bow/species/goleag/cur/references#REF43272\\)\]\(#\)\). In Scotland, Bulgaria, Spain, Italy, Switzerland, France, and the former Yugoslavia, only occasionally nests in trees \(< 10% of the time\) \(\[486\]\(#\) \[\\(/bow/species/goleag/cur/references#REF56199\\)\]\(#\), \[487\]\(#\) \[\\(/bow/species/goleag/cur/references#REF184635\\)\]\(#\), \[488\]\(#\) \[\\(/bow/species/goleag/cur/references#REF153095\\)\]\(#\), \[489\]\(#\) \[\\(/bow/species/goleag/cur/references#REF184636\\)\]\(#\), \[490\]\(#\) \[\\(/bow/species/goleag/cur/references#REF184637\\)\]\(#\), \[435\]\(#\) \[\\(/bow/species/goleag/cur/references#REF43272\\)\]\(#\), \[491\]\(#\) \[\\(/bow/species/goleag/cur/references#REF184638\\)\]\(#\), \[492\]\(#\) \[\\(/bow/species/goleag/cur/references#REF77332\\)\]\(#\)\). In Mongolia and southern Kazakhstan, most nests are on cliffs, but some are also flat on the ground at the edge of cliffs or on boulder strewn hillsides \(\[480\]\(#\) \[\\(/bow/species/goleag/cur/references#REF107711\\)\]\(#\), TEK\). In northern Xinjiang, China, all nests in one study were on cliffs \(\[15\]\(#\) \[\\(/bow/species/goleag/cur/references#REF182281\\)\]\(#\)\). Tree nests predominate in Sweden, Finland, Czechoslovakia, Estonia, Belarus, northern Kazakhstan and the Baltic States \(\[2\]\(#\) \[\\(/bow/species/goleag/cur/references#REF182273\\)\]\(#\), TEK\).](#)

In eastern Oregon and eastern Washington, 87% of nests are on rocky substrates such as linear, steep cliffs, disjunct outcrops or talus slopes, and 13% are in trees ([407](#) [\(/bow/species/goleag/cur/references#REF182405\)](#)). Of 1,908 nesting attempts documented in the Snake River Plain in southwestern Idaho, 94% occurred on cliffs or rock outcroppings, 4% on powerline structures, and only 1% in trees (USGS, unpublished data). These data may be influenced because surveys focused on habitats where trees are lacking. In a southwestern Montana study area, 24 nests were in trees (46%) and 28 on cliffs (54%) ([493](#) [\(/bow/species/goleag/cur/references#REF182667\)](#)), and nest survival did not differ between the two substrates ([482](#) [\(/bow/species/goleag/cur/references#REF146935\)](#)). In western Wyoming at 34 nesting territories, two known nests were in eastern cottonwood (*Populus deltoides*), and the remainder were all on cliffs ([375](#) [\(/bow/species/goleag/cur/references#REF182503\)](#)). In non-mountainous sagebrush steppe and grassland regions of Wyoming, 14 of 36 occupied known nests were on cliffs, 17 were in cottonwood trees, one was on an artificial structure, and four were on rocks or rims ([494](#) [\(/bow/species/goleag/cur/references#REF71936\)](#)). Eagles also use tree nests in interior and southwestern Alaska, but infrequently, and most nests are on cliffs ([212](#) [\(/bow/species/goleag/cur/references#REF43304\)](#), CLM, EHC; T. Booms, T. Craig, personal communication;).

A given pair of eagles typically use either cliff or tree nests, but pairs sometimes switch between the two. One occupied nest in Idaho was found in a Douglas Fir tree adjacent to a cliff with a vacant eagle nest on it (T. Craig, personal communication; EHC). The following year the tree nest was vacant but the cliff nest was occupied. From

1981 to 2019, eagles in a single southwestern Idaho nesting territory used nests on cliffs 16 times and a nest on a nearby transmission tower 14 times (MNK, KS).

<https://n>  [/photo/8\(https://macaulaylibrary.org/photo/4](https://macaulaylibrary.org/photo/4)





Nest site (Hentiy, Mongolia)



Nest site (Çanakkale, Turkey).



Nest site (Utah, United States).

Nest

+8

(<https://macaulaylibrary.org/photo/162036391>).

Cliff Nest Substrate

Eagles build nests on cliffs composed of many types of rock including sandstone, shale, schist, gneiss, greenstone, phyllite, limestone, basalt, and granite ([495 \(/bow/species/goleag/cur/references#REF10318\)](#), [480 \(/bow/species/goleag/cur/references#REF107711\)](#), CLM; USGS, unpublished data). They build nests along old volcano flows on the Seward Peninsula, Alaska (CLM) and in the Mojave Desert (TEK, TAM). Eagles appear to avoid building nests on loosely cemented materials such as breccias, conglomerates, or agglomerate sluff ([201 \(/bow/species/goleag/cur/references#REF33284\)](#)). However, some nests in interior Alaska are on loose conglomerates and talus slopes (CLM), sometimes supported by piles of guano produced by Cliff Swallows (*Petrochelidon pyrrhonota*; [496 \(/bow/species/goleag/cur/references#REF182379\)](#)). A unique cliff nest on the Seward Peninsula, Alaska, was on an artificial nest platform placed in a road-cut about 20 m off a well-used gravel road (T. Booms, personal communication).

Tree Nest Substrate

The Golden Eagle builds nests in a wide variety of tree species, including ponderosa pine ([436 \(/bow/species/goleag/cur/references#REF10305\)](#); T. Craig, personal communication, EHC), oaks, California laurel (*Umbellularia californica*), eucalyptus (*Eucalyptus*), California sycamore (*Platanus racemosa*; [208 \(/bow/species/goleag/cur/references#REF43278\)](#)), Douglas-fir (*Pseudotsuga menziesii*; [366 \(/bow/species/goleag/cur/references#REF159648\)](#), [364 \(/bow/species/goleag/cur/references#REF182501\)](#), [493 \(/bow/species/goleag/cur/references#REF182667\)](#), EHC; T. Craig, personal communication), Fremont cottonwood (*Populus fremontii*; [204 \(/bow/species/goleag/cur/references#REF10210\)](#)), plains cottonwood ([375 \(/bow/species/goleag/cur/references#REF182503\)](#)), cottonwoods (*Populus*); [493 \(/bow/species/goleag/cur/references#REF182667\)](#); USGS, unpublished data), black locust (*Robinia pseudoacacia*; USGS, unpublished data), and white spruce (*Picea glauca*; [212 \(/bow/species/goleag/cur/references#REF43304\)](#), CLM, EHC).

Despite the wide range of trees used by eagles, not all trees are used with equal frequency. Live trees are most commonly used, but eagles may continue to use a nest built in a tree that died after nest construction (TEK), or they may occasionally build nests in dead trees. For example, in southwestern Montana, of 28 known tree nests, 7 nests were in live cottonwoods, 19 were in live Douglas-fir, and 2 were in dead Douglas-fir ([482 \(/bow/species/goleag/cur/references#REF146935\)](#)). In a study in northern Wyoming, eagles used large pines

([/bow/species/goleag/cur/references#REF140222](#)). In a study in northern Wyoming, eagles used large pines more than they used cottonwoods ([436 \(/bow/species/goleag/cur/references#REF10305\)](#)), although in another study, birds in northeastern Wyoming nested more frequently in deciduous trees than in pines ([200 \(/bow/species/goleag/cur/references#REF56193\)](#)).

Tree size and location also may influence eagle use. Larger trees may improve nest stability and longevity ([200 \(/bow/species/goleag/cur/references#REF56193\)](#)). Eagles may avoid building nests in densely wooded stands ([436 \(/bow/species/goleag/cur/references#REF10305\)](#)). Nesting trees are usually among the largest trees in a stand ([200 \(/bow/species/goleag/cur/references#REF56193\)](#)), isolated or on the fringe of small stands of timber ([201 \(/bow/species/goleag/cur/references#REF33284\)](#)), and < 500 m from large clear-cuts or open fields ([159 \(/bow/species/goleag/cur/references#REF10224\)](#)). In western Washington, eagles nest near clearcuts < 10 years old and they may benefit from openings in dense timber formed by fire and logging ([497 \(/bow/species/goleag/cur/references#REF10335\)](#), [498 \(/bow/species/goleag/cur/references#REF10321\)](#), [215 \(/bow/species/goleag/cur/references#REF43241\)](#)).

Characteristics of Nest Substrate

Cliffs on which nests are built may exceed 200 m in parts of the Wrangell Mountains in eastern interior Alaska (CLM) and in some parts of east-central Idaho (EHC). Cliff nests are 9–61 m above the Noatak River, Alaska (mean 37 m, $n = 25$; [499 \(/bow/species/goleag/cur/references#REF43240\)](#)). Nesting cliff and nest heights averaged 22.8 and 13.0 m respectively in the Central Canadian Arctic; 71.9 and 37.2 m in eastern Hudson Bay; 25.2 and 17.6 m in southwestern Idaho; and 21.7 and 15.1 m in northern Utah ([134 \(/bow/species/goleag/cur/references#REF59100\)](#), [205 \(/bow/species/goleag/cur/references#REF60858\)](#), [211 \(/bow/species/goleag/cur/references#REF10294\)](#); USGS, unpublished data). Ground nests tend to be on hillsides ([151 \(/bow/species/goleag/cur/references#REF10346\)](#)). However, one nest in southwestern Idaho and another in interior Alaska were at the base of the nest cliff (MNK, CLM). Another ground nest in western Alaska was on a river bank (< 5 m above the water) (EHC; T. Craig, personal communication).

In western Washington, builds nests in trees that range from 38 to 72 m tall, with nests at heights ranging from 20 to 64 m high ($n = 6$; [215 \(/bow/species/goleag/cur/references#REF43241\)](#)). Tree nests are on slopes ranging from 30 to 88% ($n = 6$; [215 \(/bow/species/goleag/cur/references#REF43241\)](#), [159 \(/bow/species/goleag/cur/references#REF10224\)](#)). In Wyoming, usually nests in the upper one-third of the nest tree ([495 \(/bow/species/goleag/cur/references#REF10318\)](#), [200 \(/bow/species/goleag/cur/references#REF56193\)](#), [436 \(/bow/species/goleag/cur/references#REF10305\)](#)).

Golden Eagle nests also may be positioned close to water. In northeastern Wyoming, tree nests are close to water courses ([200 \(/bow/species/goleag/cur/references#REF56193\)](#)). Similarly, nests in northern Wyoming and southeastern Montana can be in large trees in the bottom of isolated drainages ([500 \(/bow/species/goleag/cur/references#REF43301\)](#)). All nests within a survey corridor along the Porcupine River, Alaska were < 400 m of the river, with 84% of them < 100 m from the river ($n = 37$; [212](#)

Alaska, were < 400 m from the river, with 64% of them < 100 m from the river (*n* = 37, [414](#)

([/bow/species/goleag/cur/references#REF43304](#)). Nests were 0.05–1.2 km from water in a study in southeastern Wyoming (mean 0.3 km ± 0.05 SE, *n* = 30; [501](#) ([/bow/species/goleag/cur/references#REF33305](#))), 1–8 km from water in western Washington (*n* = 6; [215](#) ([/bow/species/goleag/cur/references#REF43241](#))), and 2–8 km from water in northern Utah (mean 2 km ± 3 SD, *n* = 7; [205](#) ([/bow/species/goleag/cur/references#REF60858](#))).

Nest

Construction Process

Adults build new nests and refurbish and reuse existing nests within their nesting territory ([502](#) ([/bow/species/goleag/cur/references#REF182681](#))). Occasionally eagles build new nests on or near sites of nests that had been destroyed or had fallen off the cliff ([502](#) ([/bow/species/goleag/cur/references#REF182681](#))). New nests may or may not be used the year they are constructed ([311](#) ([/bow/species/goleag/cur/references#REF43263](#)), [502](#) ([/bow/species/goleag/cur/references#REF182681](#))). Of 135 nests in southwestern Idaho for which year of construction was known, pairs used most (86%) nests in the year of construction; a small proportion (5%) were used 1 year after construction, and the remainder (9%) were used 2–11 years after construction ([502](#) ([/bow/species/goleag/cur/references#REF182681](#))). Of nests built and used > 1 year after construction, 50% were built by pairs that did not lay eggs that year, and 50% were built by pairs that laid eggs in other nests in the year of construction.

In Denali National Park and Preserve, Alaska, new nest construction may be associated with periods of non-breeding, as most new nests likely are built in years when the territorial pair did not lay eggs (CLM). This behavior suggests that migratory populations of Golden Eagle may be time constrained, with insufficient time to build new nests while also tending eggs or raising offspring. In one instance in Denali National Park, a Golden Eagle laid an egg on a bare cliff and then built the nest around it ([503](#) ([/bow/species/goleag/cur/references#REF182682](#)))

In parts of the range where eagles remain on the breeding ground year-round, the nest building process begins in autumn or winter, when the eagles start bringing sticks and branches to at least one nest (for additional details on seasonal timing, see [Breeding: Phenology: Timing of the Nesting Cycle](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#pheno>)). The nest construction process is sometimes rapid but can take 4–6 weeks (R. Strandtman in [29](#) ([/bow/species/goleag/cur/references#REF38067](#))). Resident eagles start to prepare the nest bowl for eggs approximately one month before egg-laying. ([2](#) ([/bow/species/goleag/cur/references#REF182273](#))). They also sometimes add material to alternative nests prior to laying eggs ([248](#) ([/bow/species/goleag/cur/references#REF10214](#)), MNK). Both sexes participate nearly equally in nest building ([248](#) ([/bow/species/goleag/cur/references#REF10214](#)), [444](#) ([/bow/species/goleag/cur/references#REF10206](#)), MNK). Dixon ([311](#) ([/bow/species/goleag/cur/references#REF43263](#))) reported that nest-building in southwestern California (San Diego County) occurred between 10:00–13:00, or after the morning hunt had finished. R. Strandtman reported (in [29](#) ([/bow/species/goleag/cur/references#REF38067](#))) that nest-building in Texas occurred between dawn and

([42 \(/bow/species/goleag/cur/references#REF182273\)](#)) that nest-building in Texas occurred between dawn and 11:00.

Once the nesting season has started, both sexes of eagles continue to add greenery and fresh material to the nest (see also [Breeding: Parental Care: Nest Sanitation](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#parcare>)). The female makes most deliveries of nest material during incubation and brood-rearing ([248 \(/bow/species/goleag/cur/references#REF10214\)](#), [444 \(/bow/species/goleag/cur/references#REF10206\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#)). Half of nests in southwestern Idaho and southeastern Oregon contain fresh nesting material during later stages of the nesting cycle ([345 \(/bow/species/goleag/cur/references#REF56188\)](#)). All successful nesting attempts monitored in Denali National Park and Preserve, Alaska ($n = 805$) contained fresh nesting material or greenery during late brood-rearing (CLM). It is not uncommon for eagles to place greenery in alternative nests within a territory (EHC, T. Craig, personal communication). Such behavior may function as a signal of territorial occupancy to other eagles ([504 \(/bow/species/goleag/cur/references#REF184639\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#)) or to repel ectoparasites at occupied nests ([505 \(/bow/species/goleag/cur/references#REF33319\)](#) in [2 \(/bow/species/goleag/cur/references#REF182273\)](#)).

Structure and Composition Matter

Uses a wide variety of vegetation for nest-building, usually reflective of the flora in the immediate vicinity of the nest ([345 \(/bow/species/goleag/cur/references#REF56188\)](#), CLM). When collecting nesting materials, eagles in Alaska glide low across hillsides, land, walk up to vegetation, and then begin pulling on it with either their bill or their feet (CLM). The pulling action is often accompanied by vigorous wing-flapping and head twisting as the eagle attempts to tear off a piece of vegetation or rip the vegetation from the ground ([388 \(/bow/species/goleag/cur/references#REF182504\)](#), CLM). They carry sticks and other vegetation to the nest in their bill or feet, depending on the size of the item. Nesting material may include animal bones and shed antlers ([506 \(/bow/species/goleag/cur/references#REF10244\)](#), [480 \(/bow/species/goleag/cur/references#REF107711\)](#), EHC; K. Titus, J. Shook, personal communication). Other nesting materials include human-made objects, like wire, parts of fence posts ([495 \(/bow/species/goleag/cur/references#REF10318\)](#)), rarely, paper money and even, once, a steel muskrat trap ([480 \(/bow/species/goleag/cur/references#REF107711\)](#)). These materials are usually woven into the existing nest structure ([29 \(/bow/species/goleag/cur/references#REF38067\)](#)).

Typically gathers softer materials, including lichens, mosses, and grasses, to form a bowl within the nest ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). The nest also may be lined with a wide variety of other vegetative materials, including shredded or dried yucca (*Yucca* spp.) ([507 \(/bow/species/goleag/cur/references#REF10323\)](#), [311 \(/bow/species/goleag/cur/references#REF43263\)](#)), strips of inner bark, dead and green leaves, ([508 \(/bow/species/goleag/cur/references#REF56655\)](#)), and Douglas-fir and pine boughs ([389 \(/bow/species/goleag/cur/references#REF10269\)](#)).





Nest (Hentiy, Mongolia)



Nest (Alaska, United States)



Nest (Montana, United States)

Nest

+2

(<https://macaulaylibrary.org/photo/158621351>).

Dimensions

In its first year of use, a Golden Eagle nest is about a meter in diameter and less than a meter deep. After many years of reuse, each of which involves addition of nest material, a nest can be very large. A wide range of nest sizes is reported in the literature. A nest in southeastern Mongolia containing one eaglet was comprised of only a few scattered sticks on an exposed basalt ledge ([480 \(/bow/species/goleag/cur/references#REF107711\)](#)). A tree nest in Scotland was estimated to be 5.2 m tall ([105 \(/bow/species/goleag/cur/references#REF33287\)](#)) and a nest in northern British Columbia, ~6.1 m tall ([73 \(/bow/species/goleag/cur/references#REF23961\)](#)). In western Washington, 6 tree nests were 0.9 m deep and 1.2–1.5 m in diameter ([215 \(/bow/species/goleag/cur/references#REF43241\)](#)). A nest near Rock Springs, Wyoming was 6.0 m tall, and a nest in Sun River, Montana, was 7.0 m tall and 2.6 m wide ([509 \(/bow/species/goleag/cur/references#REF43265\)](#), [480 \(/bow/species/goleag/cur/references#REF107711\)](#)). Nests in Arizona ($n = 12$) measured 1.8 m long (range 1.2–2.6 m), 1.2 m wide (range 0.8–2.0 m), and 0.7 m high (range 0.1–2.0 m; [510 \(/bow/species/goleag/cur/references#REF10252\)](#)); the lined portions of 8 of the 12 nests were 0.9 m long (range 0.5–1.9 m) and 0.8 m wide (range 0.4–1.6 m); sticks used to build the 12 nests averaged 58 cm long (range 8–178 cm), 1 cm in diameter (range 0.4–5 cm), and 64 g in mass (range 5–820 g; [510 \(/bow/species/goleag/cur/references#REF10252\)](#)). Two nests in southeastern Mongolia contained sticks of up to 276 cm in length and 6.8 cm in diameter ([480 \(/bow/species/goleag/cur/references#REF107711\)](#)).

Microclimate and Nest Exposure

Certain exposures may protect nests from prevailing inclement weather ([486 \(/bow/species/goleag/cur/references#REF56199\)](#), [211 \(/bow/species/goleag/cur/references#REF10294\)](#)), minimize intense (direct) sunlight that puts nestlings at risk of overheating ([478 \(/bow/species/goleag/cur/references#REF43294\)](#), [486 \(/bow/species/goleag/cur/references#REF56199\)](#), [479 \(/bow/species/goleag/cur/references#REF182680\)](#)), reduce exposure to cold ([478 \(/bow/species/goleag/cur/references#REF43294\)](#), [134 \(/bow/species/goleag/cur/references#REF59100\)](#)), avoid prevailing winds ([501 \(/bow/species/goleag/cur/references#REF33305\)](#), [134 \(/bow/species/goleag/cur/references#REF59100\)](#), [511 \(/bow/species/goleag/cur/references#REF182313\)](#)), or minimize exposure to down-drafts but provide exposure to updrafts that provide flight subsidy ([483 \(/bow/species/goleag/cur/references#REF102411\)](#)).

At northern latitudes, may select south-facing cliffs for nesting because they are the only cliffs free of snow when territories are first occupied in spring (499 [\(/bow/species/goleag/cur/references#REF43240\)](#)). In these areas, snow accumulated over the long winter may remain on nests on north-facing cliffs much longer than those on south-facing slopes (CLM).

Alternatively, selection for south-facing cliffs may be a strategy to minimize exposure of incubating eagles to cold (478 [\(/bow/species/goleag/cur/references#REF43294\)](#), 134 [\(/bow/species/goleag/cur/references#REF59100\)](#)). Early in nesting season, south-facing nests across much of the Subarctic and Arctic benefit from direct and reflected radiation, while also being in the lee of prevailing northerly winds (134 [\(/bow/species/goleag/cur/references#REF59100\)](#), CLM). However, nestlings in nests on south-facing cliffs that do not have adequate shade may be exposed to high temperatures during the brood-rearing period (390 [\(/bow/species/goleag/cur/references#REF10249\)](#), 134 [\(/bow/species/goleag/cur/references#REF59100\)](#)). As a consequence, parent eagles may spend more time brooding or shading to protect young from overheating in unshaded south-facing nests (478 [\(/bow/species/goleag/cur/references#REF43294\)](#)). Thus, there may be a trade-off for eagles between the thermal benefit of using south-facing cliffs in late winter and spring and the cost to those eagles, which then must spend more time brooding and being shaded during the peak of the Arctic and Subarctic summer.

In temperate areas, eagles may select nest sites that avoid direct sunlight, presumably to protect nestlings from overheating and to decrease brooding time required of adults (478 [\(/bow/species/goleag/cur/references#REF43294\)](#), 479 [\(/bow/species/goleag/cur/references#REF182680\)](#)). No nest measured in Boulder County, Colorado was in direct sunlight for > 2–4 h/d (389 [\(/bow/species/goleag/cur/references#REF10269\)](#)), and 33% of nests in southwestern Montana had exposures that provided shade from hot afternoon sun (366 [\(/bow/species/goleag/cur/references#REF159648\)](#)). Of 399 nests measured in the Snake River Canyon, Idaho, 69% were classified as shaded (> 25% afternoon shading) and 39% were exposed (< 5% afternoon shading) (479 [\(/bow/species/goleag/cur/references#REF182680\)](#)). Significantly more breeding attempts occurred in shaded nests. However, in 37 territories with both shaded and exposed nests, eagles showed no clear preference for shaded (500 attempts) or exposed nests (430 exposed attempts; USGS, unpublished data).

Nest orientation varies extensively across the range of eagles. However, some of the differences reported among study areas may represent variation in survey methods rather than in eagle preference (CLM). In northern breeding areas (> 60°N latitude), more eagle nests are found on south-facing cliffs. Of 963 studied nesting cliffs, 53% were south-facing, 17% north-facing, 16% west-facing, and 13% east-facing (Alaska, $n = 585$; [212 [\(/bow/species/goleag/cur/references#REF43304\)](#), 512 [\(/bow/species/goleag/cur/references#REF182683\)](#); NPS, unpublished data], Yukon Territory, $n = 337$ [513 [\(/bow/species/goleag/cur/references#REF43275\)](#), 514 [\(/bow/species/goleag/cur/references#REF43328\)](#)], and Nunavut, $n = 41$; 134 [\(/bow/species/goleag/cur/references#REF59100\)](#)]). However, aspects of nest cliffs vary among these northern study areas. For example, 49% of monitored nest cliffs in Denali National Park and Preserve, Alaska were south-

study areas. For example, 45% of monitored nest sites in Denali National Park and Preserve, Alaska were south-facing, 27% north-facing, 13% west-facing, and 12% east-facing (NPS, unpublished data). Further, nests near Norton Bay in western Alaska are more likely to face east, away from prevailing coastal storms ([511](#) ([/bow/species/goleag/cur/references#REF182313](#))). Pairs farther south are less likely to construct nests on south-facing sites. Of 423 nests in Montana, Wyoming, Idaho, Oregon, and Nevada, 37% were on south-facing cliffs, 22% were on north-facing cliffs, 21% were on east-facing cliffs, and 20% were on west-facing cliffs ([345](#) ([/bow/species/goleag/cur/references#REF56188](#)), [366](#) ([/bow/species/goleag/cur/references#REF159648](#)), [201](#) ([/bow/species/goleag/cur/references#REF33284](#)), [485](#) ([/bow/species/goleag/cur/references#REF43307](#)), [495](#) ([/bow/species/goleag/cur/references#REF10318](#)); USGS, unpublished data). Nest orientations also can differ within study areas, with more southwest-facing nests at higher elevations ([202](#) ([/bow/species/goleag/cur/references#REF43258](#))). In many study areas, eagles nest on cliffs with all exposures ([366](#) ([/bow/species/goleag/cur/references#REF159648](#)), [376](#) ([/bow/species/goleag/cur/references#REF43287](#)), [485](#) ([/bow/species/goleag/cur/references#REF43307](#))).

A number of other factors also influence nest exposure, one of the most prominent being the presence of overhang. Overhangs protect nests from sun, rain, snow, and ice formation ([199](#) ([/bow/species/goleag/cur/references#REF10273](#)), [134](#) ([/bow/species/goleag/cur/references#REF59100](#))), but falling rocks or soil from overhangs can kill incubating or brooding eagles or nestlings ([500](#) ([/bow/species/goleag/cur/references#REF43301](#))). Sixteen of 30 nests (53%) in eastern Hudson Bay and 107 of 337 nests (32%) in Denali National Park and Preserve, Alaska had overhangs ([211](#) ([/bow/species/goleag/cur/references#REF10294](#)), CLM). Ten of those in Denali were built in small caves or large potholes in cliffs. Percent of nest covered by overhangs averaged 38% at 41 nests in the central Canadian Arctic compared to only 4% at 7 nests in northern Utah ([134](#) ([/bow/species/goleag/cur/references#REF59100](#)), [205](#) ([/bow/species/goleag/cur/references#REF60858](#))).

Maintenance or Reuse of Nests, Alternate Nests

An alternative nest is one of potentially several nests within a nesting territory that is not being used for laying eggs in the current or given year ([433](#) ([/bow/species/goleag/cur/references#REF146239](#)), [515](#) ([/bow/species/goleag/cur/references#REF184640](#))). Alternative nests are a common and important feature of nesting territories across the species' range ([390](#) ([/bow/species/goleag/cur/references#REF10249](#)), [2](#) ([/bow/species/goleag/cur/references#REF182273](#)), [502](#) ([/bow/species/goleag/cur/references#REF182681](#)), [433](#) ([/bow/species/goleag/cur/references#REF146239](#))). Core use areas (50% utilization distributions) within home ranges of territory holders typically include all known alternative nests ([407](#) ([/bow/species/goleag/cur/references#REF182405](#)), [433](#) ([/bow/species/goleag/cur/references#REF146239](#))).

The number of alternative nests within a Golden Eagle territory varies greatly within and among study areas. Eagles used between 1 and 18 nests per territory in the Snake River Canyon (mean = 7, SD = 4) and have used > 1 nest in 61 of 62 cliff nesting territories ([502](#) ([/bow/species/goleag/cur/references#REF182681](#))). In nearly half of territories, these birds use between 5 and 8 nests. In eastern Oregon and western Washington, 14 territories contained 38 alternative nests (mean = 3), plus 14 used nests ([407](#)

contained 30 alternative nests (mean = 3), plus 14 used nests (407

(/bow/species/goleag/cur/references#REF182405)). Golden Eagle nesting territories in Denali National Park and Preserve, Alaska ($n = 111$), averaged 2 alternative nests (range 0–7). Most nests were within 100 m of the occupied nest (CLM). All but one of the 111 territories had alternative nests (CLM). The number of nests per territory in northeastern Quebec averaged 3 (range 1–8, $n = 20$ territories; 476 (/bow/species/goleag/cur/references#REF182363)). In a 2-year study in Utah, 11 of 21 pairs had > 1 nest (472 (/bow/species/goleag/cur/references#REF56184)), and in a 5-year study in Montana, 20 of 36 pairs had alternative nests (366 (/bow/species/goleag/cur/references#REF159648)).

Alternative nests within a territory can be separated by < 1 m or > 6 km (366 (/bow/species/goleag/cur/references#REF159648)). The number of nests and the distances between them may be related to terrain features and proximity of other nesting pairs (268 (/bow/species/goleag/cur/references#REF43249)). In southwestern Idaho, mean distance between nearest alternative nests average 191 m (range: < 1 to 1,822 m) (502 (/bow/species/goleag/cur/references#REF182681)). In central Utah, mean distance averages 513 m (range: < 1 to 12,665 m) (516 (/bow/species/goleag/cur/references#REF147666)). Telemetered eagles in three territories in eastern Oregon and western Washington used cliff nests 1 to 3 km apart (407 (/bow/species/goleag/cur/references#REF182405)). Most of the alternative nests were in high-use areas of eagle home ranges (407 (/bow/species/goleag/cur/references#REF182405)). At a single territory in southwestern Montana, in different years a tracked eagle occupied nests 4 km apart (R. Crandall, unpublished data). An eagle pair in southwestern Idaho laid a replacement clutch in a nest 436 m from the nest where the first clutch failed (USGS, unpublished data.).

It appears that not all alternative nests are used for egg-laying (but most studies are too short in duration to confirm this). Number of nests in a territory that were used for egg laying varies from a mean of 3 (range 1–8) in central Utah (25–38 years; 516 (/bow/species/goleag/cur/references#REF147666)) to 7 (range 1–18) in southwestern Idaho (46 years; 502 (/bow/species/goleag/cur/references#REF182681)).

Once an alternative nest has been used, Golden Eagles often re-use it (433 (/bow/species/goleag/cur/references#REF146239)). Mean times between re-use of individual nests vary between 3 years (range 1–24 years) in central Utah (516 (/bow/species/goleag/cur/references#REF147666)) to 4 years (range 1–39 years, $n = 1,250$ nestings) in southwestern Idaho (502 (/bow/species/goleag/cur/references#REF182681)). Some pairs use the same nest repeatedly, constantly repairing and adding material to alternative nests (366 (/bow/species/goleag/cur/references#REF159648), 268 (/bow/species/goleag/cur/references#REF43249), 502 (/bow/species/goleag/cur/references#REF182681)).

Re-use of nests is not associated with nest success in the previous year (268 (/bow/species/goleag/cur/references#REF43249), 502 (/bow/species/goleag/cur/references#REF182681), 516 (/bow/species/goleag/cur/references#REF147666)). From 1966–2011, Golden Eagles at 66 territories in southwestern Idaho used each of 454 individual nests from 1 to 26 times (mean = 4 uses; 502 (/bow/species/goleag/cur/references#REF182681)). Most of those nests (75%) were used < 4 times and 36%

[\(/bow/species/goleag/cur/references#REF102001\)](#)). Most of those nests (75%) were used > 4 times and 50% were used only once. During a 5-year study in southwestern Montana, Golden Eagles used 10 of 28 tree nests once, 6 nests were used twice, 7 nests were used 3 times, and 5 nests were used 4 times ([482 \(/bow/species/goleag/cur/references#REF146935\)](#)). No nest was used all 5 years of the study. Golden Eagles in that area used 9 of 32 cliff nests once, 9 nests were used twice, 5 nests were used 3 times, 3 nests were used 4 times, and 6 nests were used all 5 years of the study ([482 \(/bow/species/goleag/cur/references#REF146935\)](#)).

Eggs

Shape

Short-ovate to ovate or rarely elliptical-oval ([73 \(/bow/species/goleag/cur/references#REF23961\)](#)).

Size

Length of 59 eggs from North America averaged 74.5 mm (range 67.5–85.7), and width averaged 58.0 mm (range 49.4–64.3) ([73 \(/bow/species/goleag/cur/references#REF23961\)](#)); another egg measured 89.0 × 66.6 mm (C.S. Sharp in [73 \(/bow/species/goleag/cur/references#REF23961\)](#)). In another study of 20 clutches, eggs averaged 74.4 mm ± 3.4 SD × 57.3 mm ± 1.63 SD ([29 \(/bow/species/goleag/cur/references#REF38067\)](#)). Eggs from Scotland were similar in dimensions to North American eggs, averaging 75 × 59 mm ([2 \(/bow/species/goleag/cur/references#REF182273\)](#), no sample size given). Eggs from central Asia are reported to be 70–80 mm in length and 56 - 64 mm in diameter ([84 \(/bow/species/goleag/cur/references#REF128142\)](#)). Finally, a more recent study of > 1,000 species of birds, included measurements of 391 Golden Eagle eggs ([517 \(/bow/species/goleag/cur/references#REF171436\)](#)). Of these, average length was 77.3 mm, asymmetry was 0.1192, and ellipticity was 0.3058 (see Stoddard et al. [[517 \(/bow/species/goleag/cur/references#REF171436\)](#)] for definition of these terms).

Mass

Weight of 30 eggs from southern California averaged 141 g (range 114–177 g; [518 \(/bow/species/goleag/cur/references#REF43273\)](#)). Mean empty weight of 1,083 eggs from North America was 13 g (range 11–14 g; [358 \(/bow/species/goleag/cur/references#REF10312\)](#), [519 \(/bow/species/goleag/cur/references#REF46340\)](#), [199 \(/bow/species/goleag/cur/references#REF10273\)](#)). Average weight of newly laid eggs from Scotland was 145 g ([2 \(/bow/species/goleag/cur/references#REF182273\)](#), no sample size given).

Eggshell Thickness

Thickness of shells of eggs collected pre-1947 in North America differed little from those collected after that period, when DDT influenced thickness of eggshells of other species ([519 \(/bow/species/goleag/cur/references#REF46340\)](#), [199 \(/bow/species/goleag/cur/references#REF10273\)](#)). Shell thickness of pre-1947 clutches from western North America averaged 0.583 mm ± 0.003 SD ($n = 290$). Shell thickness of eggs collected during the 1960s and 1970s ([358 \(/bow/species/goleag/cur/references#REF10312\)](#), [418 \(/bow/species/goleag/cur/references#REF43245\)](#), [519 \(/bow/species/goleag/cur/references#REF46340\)](#), [199](#)

([/bow/species/goleag/cur/references#REF10273](#))) averaged 0.59 mm for Idaho ($n = 51$), 0.64 mm for Montana ($n = 7$), 0.58 mm for Alaska ($n = 4$), 0.61 mm for California ($n = 9$), and 0.62 mm for Utah ($n = 17$). One hypothesis for a lack of difference is that the diet in North America is dominated by mammals (see [Diet and Foraging: Diet](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/foodhabits#diet>)) and, as a consequence, there is little opportunity for biomagnification of organochlorine pesticides that thinned the eggs of other species ([519](#) ([/bow/species/goleag/cur/references#REF46340](#)), [199](#) ([/bow/species/goleag/cur/references#REF10273](#))). In contrast, dieldrin in sheep dips has been implicated in affecting thickness of Golden Eagle eggs in west Scotland ([520](#) ([/bow/species/goleag/cur/references#REF182704](#)), [521](#) ([/bow/species/goleag/cur/references#REF42159](#))).

We know of no measurements of eggshell thickness for Golden Eagles in Canada or the northeastern United States. Despite this, reduction in eggshell thickness is suspected in causing population declines of the Golden Eagle population in eastern North America that regularly fed on avian piscivores ([195](#) ([/bow/species/goleag/cur/references#REF182366](#))).

Color

Base color varies from white to "cream-buff" or pinkish white ([2](#) ([/bow/species/goleag/cur/references#REF182273](#)), [73](#) ([/bow/species/goleag/cur/references#REF23961](#))). Usually eggs are marked with evenly spaced small blotches, spots, or fine dots that are unevenly distributed or concentrated at one end. Some are evenly sprinkled throughout with small dots. Colors of markings are various shades of browns. Some eggs have large blotches overlaid with browns ([73](#) ([/bow/species/goleag/cur/references#REF23961](#))). The reason for differences in color patterns and degree of pigmentation are unknown, but in Scotland egg coloration may vary regionally, by nest substrate (trees vs. cliffs), or even between eggs within a clutch, with the first egg more heavily pigmented ([2](#) ([/bow/species/goleag/cur/references#REF182273](#))).

Surface Texture

Surface texture is similar to that of a chicken egg.

Clutch Size

Typically 1–3 eggs and rarely 4 eggs ([522](#) ([/bow/species/goleag/cur/references#REF43260](#)), [523](#) ([/bow/species/goleag/cur/references#REF10310](#)), [390](#) ([/bow/species/goleag/cur/references#REF10249](#)), [2](#) ([/bow/species/goleag/cur/references#REF182273](#))). DeGroot ([522](#) ([/bow/species/goleag/cur/references#REF43260](#))) reported on a nest in California that contained 5 eggs, but concluded that 1 egg was laid much earlier than the others, perhaps in the prior year. It is not known whether age affects clutch size.

The number of eggs in 332 clutches from eight studies in five western states averaged 2 (northern California, $n = 21$ nests; northern Colorado, $n = 52$; central Utah, $n = 49$; southwestern Idaho, $n = 160$; southwestern Montana, $n = 50$). Of these nests, 14% contained 1 egg, 76% contained 2 eggs, and 10% contained 3 eggs ([507](#)

([/bow/species/goleag/cur/references#REF10323](#)), [389 \(/bow/species/goleag/cur/references#REF10269\)](#), [472 \(/bow/species/goleag/cur/references#REF56184\)](#), [358 \(/bow/species/goleag/cur/references#REF10312\)](#), [346 \(/bow/species/goleag/cur/references#REF43242\)](#), [203 \(/bow/species/goleag/cur/references#REF57538\)](#); USGS, unpublished data). In southwestern Idaho, clutches with 3 eggs are more common in years when prey is abundant (USGS, unpublished data). Clutch size in southwestern Idaho is not related to laying date ($n = 115$; USGS, unpublished data).

Egg-Laying

In captivity, most eggs are laid at intervals of 3 to 4 days (mean 3.5 days, $n = 35$) ([387 \(/bow/species/goleag/cur/references#REF10272\)](#), [415 \(/bow/species/goleag/cur/references#REF43281\)](#), [524 \(/bow/species/goleag/cur/references#REF10253\)](#), [525 \(/bow/species/goleag/cur/references#REF10251\)](#)). However, Grier ([525 \(/bow/species/goleag/cur/references#REF10251\)](#)) reported two cases of captive birds with intervals of 7 and 10 days between the second and third eggs, possibly due to handling of the females during insemination. Laying intervals in the wild range from 3 to 5 days ($n = 4$) ([390 \(/bow/species/goleag/cur/references#REF10249\)](#), [444 \(/bow/species/goleag/cur/references#REF10206\)](#)).

Golden Eagle rarely re-nests when the first clutch is destroyed ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). Re-nesting occurred in only 2 of 384 nesting attempts in southwestern Idaho (USGS, unpublished data). Replacement clutches were suspected in 2 of over 200 nesting attempts in Scotland ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). Replacement clutches generally are laid 19 to 30 days after failure of the first clutch (mean 24 days, $n = 13$; [311 \(/bow/species/goleag/cur/references#REF43263\)](#) (California), [472 \(/bow/species/goleag/cur/references#REF56184\)](#) (Utah), [526 \(/bow/species/goleag/cur/references#REF59983\)](#) (North America), [440 \(/bow/species/goleag/cur/references#REF10236\)](#) (United Kingdom).

Incubation

Onset of Broodiness and Incubation in Relation to Laying

Incubation begins with the first egg, leading to asynchronous hatching ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). The female settles into incubation posture on the nest before the first egg is laid ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)).

Incubation Patch

Present on both sexes but more developed and conspicuous on females (R. Jackman, personal communication).

Incubation Period

The estimated incubation period averages 42 days (range 41–45, $n = 11$ clutches; [527 \(/bow/species/goleag/cur/references#REF10202\)](#), [390 \(/bow/species/goleag/cur/references#REF10249\)](#), [528 \(/bow/species/goleag/cur/references#REF10291\)](#), [472 \(/bow/species/goleag/cur/references#REF56184\)](#), [358](#)

([/bow/species/goleag/cur/references#REF10312](#)), [418 \(/bow/species/goleag/cur/references#REF43245\)](#), [444 \(/bow/species/goleag/cur/references#REF10206\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#)).

Parental Behavior

In southwestern Idaho, females did all nocturnal incubation and 83% of diurnal incubation ($n = 11$ nesting attempts; [249 \(/bow/species/goleag/cur/references#REF10227\)](#)). In that study, males relieved incubating females 2 times (± 0.1 SD) per day, and male incubation bouts averaged 49 min (± 5 SD). Seventeen of 111 male-initiated change-overs involved food transfers to the female on or near the nest. It has been suggested that inattentiveness by the male may force the female off eggs to forage and ultimately abandon the nesting effort ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)).

Hardiness of Eggs Against Temperature Stress; Effect of Egg Neglect

Eggs can tolerate some degree of cooling, but the precise amount is unknown. At least 1 egg in a clutch of 2 eggs in southwestern Idaho hatched after being exposed to snowy and cold conditions (0° C) for 1–5 hr during late incubation (MNK).

Hatching

Hatching of eggs is asynchronous ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). The hatching interval between the first and second eggs was, in a single case, 96.5 hours ([444 \(/bow/species/goleag/cur/references#REF10206\)](#)).

Detailed observations of the hatching process at a single nest in western Montana suggested that eagles in eggs may begin vocalizing 2–3 days before hatching ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)). Activity of the hatchling increases after the egg is pipped (when a small hole is opened in the eggshell), and the process from pipping to hatching can take ~ 1.5 days. At one nest, the adult female appeared to assist hatching by pulling on the egg; whether this was purposely meant to aid the eaglet in breaking out of the egg is unknown ([388 \(/bow/species/goleag/cur/references#REF182504\)](#)).

Young Birds

Condition at Hatching

Newly hatched young are altricial, weak, and only capable of limited locomotion. They must be fed by a parent for many days after hatching.

When they hatch, young are covered with short grayish-white “pre-pennae” down ([32 \(/bow/species/goleag/cur/references#REF9577\)](#)). Their ear holes are open, the beak is black, the egg tooth is prominent, their feet and legs are pale pinkish, and their talons are white to pinkish ([392 \(/bow/species/goleag/cur/references#REF10334\)](#), [77 \(/bow/species/goleag/cur/references#REF10333\)](#), MNK). Their eyes are partially open, but may not be able to detect movement ([392](#)

([/bow/species/goleag/cur/references#REF10334](#)), [77 \(/bow/species/goleag/cur/references#REF10333\)](#)). Newly hatched young are damp when they emerge from the egg, but down dries within 2 hours of hatching ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). Within a day of hatching, young average 110 g (range 105–115, $n = 7$) ([392 \(/bow/species/goleag/cur/references#REF10334\)](#), [77 \(/bow/species/goleag/cur/references#REF10333\)](#), [529 \(/bow/species/goleag/cur/references#REF56186\)](#)).

Growth and Development

Increases in mass of Golden Eagle nestlings follow a general sigmoid growth pattern ([78 \(/bow/species/goleag/cur/references#REF10243\)](#), [379 \(/bow/species/goleag/cur/references#REF33291\)](#)). Mass at hatching is about 100 g and increases to about 500 g at 10 d. From then growth is linear until about 40–45 days, at which point growth slows down. Nestlings attain maximum body mass at approximately 50 – 60 days after hatching ([379 \(/bow/species/goleag/cur/references#REF33291\)](#)). Female nestlings have slower growth rates but significantly higher maximum body mass (mean 3,803 g; $n = 102$) than do males (mean 3,233; $n = 85$) ([378 \(/bow/species/goleag/cur/references#REF10226\)](#), [379 \(/bow/species/goleag/cur/references#REF33291\)](#)).

Growth rate of feathers in the alar, caudal, humeral, spinal, ventral, capital, crural, and femoral feather tracts is linear with no apparent difference between sexes ($n = 3$ [[78 \(/bow/species/goleag/cur/references#REF10243\)](#)]; $n = 23$ [[378 \(/bow/species/goleag/cur/references#REF10226\)](#)]). Feathers in the alar and caudal tracts continue to grow to full length after fledging ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)). In southwestern Idaho, growth of the foot-pad is linear between 6 and 31 days with the foot reaching full size between 31 and 35 days ($n = 23$; [199 \(/bow/species/goleag/cur/references#REF10273\)](#)). Mean foot-pad size differs significantly between male and female nestlings beginning at 21–25 days ([199 \(/bow/species/goleag/cur/references#REF10273\)](#)).

For the first ~20 days after hatching, Golden Eagles depend on their parents to help regulate their body temperature ([2 \(/bow/species/goleag/cur/references#REF182273\)](#)). Parents do this by brooding (sitting over the young) or shading (creating a shadow for the young). In extreme heat, young are prone to heat stress and death ([479 \(/bow/species/goleag/cur/references#REF182680\)](#)). They respond to heat by moving to cool objects, to shaded portions of the nest, or by panting ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)). They also may droop or spread their wings, presumably to dissipate heat ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)).

Behavior

Conflicts between siblings occur frequently and occasionally result in siblicide, particularly when food is limited ([78 \(/bow/species/goleag/cur/references#REF10243\)](#), [530 \(/bow/species/goleag/cur/references#REF43264\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#)). The notion that only one of two nestlings ever survives ([48 \(/bow/species/goleag/cur/references#REF56413\)](#)) is incorrect (but it is likely true for Bonelli's Eagle [*Aquila fasciata*], Verreaux's Eagle [*A. verreauxii*], and other species of *Aquila* eagles; see [Table 4 \(/bow/appendix/ACT1053401/APP1005440\)](#) for details on brood sizes of Golden Eagles).

Aggressive interactions between siblings can occur throughout the nesting cycle. The larger, most aggressive nestling often receives the most food ([378 \(/bow/species/goleag/cur/references#REF10226\)](#)). The subordinate nestling is sometimes starved or forced from the nest ([531 \(/bow/species/goleag/cur/references#REF33311\)](#)). The probability of siblicide depends on sex and hatching sequence, with siblicide more than likely to occur when a female eagle hatches before a male ([530 \(/bow/species/goleag/cur/references#REF43264\)](#), [532 \(/bow/species/goleag/cur/references#REF10220\)](#)). Aggression occurred in all 7 nests with 2 young observed from blinds in southwestern Idaho, and it resulted in death in 3 of those 7 broods ([378 \(/bow/species/goleag/cur/references#REF10226\)](#)). In other studies, siblicide accounted for 7% of 41 nestling mortalities in southwestern Idaho ([473 \(/bow/species/goleag/cur/references#REF10212\)](#)) and 40% of 15 nestling losses in central Europe ([533 \(/bow/species/goleag/cur/references#REF56190\)](#)).

Young generally exhibit non-aggressive social behavior after fledging but before independence ([396 \(/bow/species/goleag/cur/references#REF10300\)](#)). Fledglings mutually preen when perched together ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)), they catch and pluck prey together ([396 \(/bow/species/goleag/cur/references#REF10300\)](#)), occasionally grab at each other or their parents ([388 \(/bow/species/goleag/cur/references#REF182504\)](#)), and they stoop, talon-touch, and talon grapple ([255 \(/bow/species/goleag/cur/references#REF10250\)](#)). Agonistic interactions between parents and offspring or between siblings are uncommon, except just before or after fledglings gain independence ([398 \(/bow/species/goleag/cur/references#REF10345\)](#), [534 \(/bow/species/goleag/cur/references#REF33317\)](#), [400 \(/bow/species/goleag/cur/references#REF33285\)](#), [255 \(/bow/species/goleag/cur/references#REF10250\)](#), [396 \(/bow/species/goleag/cur/references#REF10300\)](#), [2 \(/bow/species/goleag/cur/references#REF182273\)](#)).

Behavioral observations of eaglets at nests reported by Ellis ([78 \(/bow/species/goleag/cur/references#REF10243\)](#); $n = 7$) and Collopy ([378 \(/bow/species/goleag/cur/references#REF10226\)](#); $n = 12$) suggest that during the first week after hatching, young spend > 95% of the day lying on their chest and belly. As they age, the proportion of time in this position decreases. They begin sitting at one day old and standing at 17–20. These studies report no sex-specific differences in development of locomotion in the nest. Wing-flapping, performed while sitting, is first seen at about 9–10 days old and, once the young grow older, they flap their wings while standing. Flapping increases in frequency from week five until fledging.

Sex Ratios and Sex Allocation

See [Behavior: Sexual Behavior: Sex Ratio](#)

(<https://species.birds.cornell.edu/bow/species/goleag/2.0/behavior#sex>).

Parental Care



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Adult with nestling at nest.

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Adult with nestling at nest.

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Brooding

Observations to date suggest that the male almost never broods, and the female broods and shades young from hatching to about 45 days of age ([78 \(/bow/species/goleag/cur/references#REF10243\)](#), [249 \(/bow/species/goleag/cur/references#REF10227\)](#)). At the early part of the nesting cycle, time spent brooding

appears related to severity of wind ([78 \(/bow/species/goleag/cur/references#REF10243\)](#)). Percentage of the day brooding or shading decreases linearly from > 80% at 1–10 days of age to < 5% at 40 days ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). The female broods young nightly until 17–42 days after hatching (mean = 29 days) and roosts on the nest until 17–54 days after hatching (mean = 40 days; [249 \(/bow/species/goleag/cur/references#REF10227\)](#)).

Feeding

In two observational studies, both parents brought prey to the nest, but the male rarely fed young directly ([78 \(/bow/species/goleag/cur/references#REF10243\)](#), [249 \(/bow/species/goleag/cur/references#REF10227\)](#)). Adults did not always feed nestlings on the day that they hatch. Mean number of adult-fed meals per day increased rapidly during week one, but then declined over the rest of the nesting season ($n = 10$ broods). The amount of biomass fed directly by the female increased until about the fifth week, then decreased with a linear increase in the proportion of meals that the young feed to themselves. The estimated morsel size fed by the female to the nestlings ranged from 6 mm at hatching to 15 mm at fledging ([78 \(/bow/species/goleag/cur/references#REF10243\)](#), [378 \(/bow/species/goleag/cur/references#REF10226\)](#)). Adults exhibited no bias in apportioning food, but the dominant nestling usually received food first ([378 \(/bow/species/goleag/cur/references#REF10226\)](#), [530 \(/bow/species/goleag/cur/references#REF43264\)](#)).

Young eagles begin self-feeding at 34–37 days old, and successfully tear carcasses at 45–55 days of age. By week 8, young consume more food by self-feeding than they are fed by adults. The increase in self-feeding coincides with development of standing behavior.

Eaglets in multiple-young broods receive more food from adults than do eagles in 1-young broods ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)), but prey delivery rates do not differ between the two ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). The rate at which prey were delivered to the nest during brood-rearing averaged two items per day in southwestern Idaho (range 1–3) and one item per day in western Texas ([376 \(/bow/species/goleag/cur/references#REF43287\)](#), [249 \(/bow/species/goleag/cur/references#REF10227\)](#)). On average, eagles delivered larger prey in Idaho (1,153 g) than in Texas (947 g). Mean delivery rates in southwestern Idaho increased from 2 per day during first 5 weeks of brood-rearing to 3 per day during weeks 6 and 7, then decreased to 2 per day during the final 2 weeks.

Both sexes hunt throughout the brood-rearing period ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)). Over the course of the nesting season in southwestern Idaho ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)), males delivered more prey per day (1 delivery/d \pm 0.28 SE; 1,030 g/d \pm 284.6 SE; $n = 8$) than do females (0.6 deliveries/d \pm 0.44 SE; 387 g/d \pm 270 SE; $n = 8$). Males provided almost all food during the first two weeks (83% of deliveries and 95% biomass). Females increased the rate of prey deliveries in the third week of brood-rearing, with their maximum contribution in weeks 7–9 (43% of biomass). Delivery rates were similar for sexes during weeks 7–10. The size of delivered prey did not differ between the male and the female, but it does differ among nesting pairs ([249 \(/bow/species/goleag/cur/references#REF10227\)](#)).

Few data exist on provisioning behavior on breeding grounds after fledging. During the post-fledging period at one nest in the United Kingdom, the male parent delivered food at perches near the nest (398 ([/bow/species/goleag/cur/references#REF10345](#))). In southwestern Idaho, females made < 5% of prey deliveries to fledged young (M. Collopy, personal communication). An adult eagle in Arizona transferred prey to an 8-month old juvenile (29 ([/bow/species/goleag/cur/references#REF38067](#))).

There is no conclusive evidence that eagles feed their offspring when away from their territory and there is no evidence that migratory adults winter with their offspring. However, a camera trap placed over a deer carcass on wintering grounds in Virginia captured an image of a juvenile eagle apparently food begging from an adult (TEK). The relationship between the two birds and the context for the behavior both were unclear.

Nest Sanitation

As early as the first day after hatching, young are able to expel feces several centimeters outside the nest bowl. By day 30, young consistently defecate over the nest rim (78 ([/bow/species/goleag/cur/references#REF10243](#))). Food accumulates at nests, and nests may contain prey in various stages of decomposition (MNK, CLM, EHC). Adults are thought to sometimes remove or consume prey remains uneaten by young (374 ([/bow/species/goleag/cur/references#REF10281](#)), 319 ([/bow/species/goleag/cur/references#REF10264](#)), 57 ([/bow/species/goleag/cur/references#REF60456](#))). However, during 1,012 hours of observation of eight broods in Idaho, uneaten prey was never removed (337 ([/bow/species/goleag/cur/references#REF43255](#))). Parents also may remove dead nestlings (338 ([/bow/species/goleag/cur/references#REF43297](#)); USGS, unpublished data). Fat-laden prey that is not removed can result in oiling of nestlings (373 ([/bow/species/goleag/cur/references#REF182502](#))).

Adult eagles bring in green plant material throughout the season to cover debris or perhaps to repel ectoparasites (505 ([/bow/species/goleag/cur/references#REF33319](#)), 2 ([/bow/species/goleag/cur/references#REF182273](#)), 535 ([/bow/species/goleag/cur/references#REF182705](#))). In southwestern Idaho, adults select gray rabbitbrush (*Ericameria nauseosa*) as nest material. This plant is, relative to other local plants, higher in concentrations of phenols. Evidence suggests that addition of this material reduced numbers of ectoparasites on nestlings (535 ([/bow/species/goleag/cur/references#REF182705](#))). This is important because ectoparasites can be abundant in nest material and can have negative effects on nestling eagles (see [Demography and Populations: Disease and Body Parasites](#) (<https://species.birds.cornell.edu/bow/species/goleag/draft/demography#disease>)).

Carrying of Young

Reports of parents carrying fledging-age young are rare and anecdotal ($n = 4$) (29 ([/bow/species/goleag/cur/references#REF38067](#))). This behavior has not been recorded during a large number of other intensive studies of eagle behavior (306 ([/bow/species/goleag/cur/references#REF38078](#)), 78 ([/bow/species/goleag/cur/references#REF10243](#)), 378 ([/bow/species/goleag/cur/references#REF10226](#)), 398 ([/bow/species/goleag/cur/references#REF10345](#)), 400 ([/bow/species/goleag/cur/references#REF33285](#)), 396 ([/bow/species/goleag/cur/references#REF10300](#))).

Cooperative Breeding

Occasional reports of trios (see [Behavior: Sexual Behavior](#) (<https://species.birds.cornell.edu/bow/species/goleag/draft/behavior#sex>)).

Brood Parasitism by Other Species

None reported.

Cooperative Breeding

No indication of cooperative breeding (i.e., non-breeding helpers at the nest). However, there are occasional reports of breeding trios (see [Behavior: Sexual Behavior](#) (<https://species.birds.cornell.edu/bow/species/goleag/2.0/behavior#sex>)).

Brood Parasitism by Other Species

None reported.

Fledgling Stage

Departure from Nest

For several weeks prior to fledging, nestlings flap their wings and hop, apparently as a means to practice wing flapping and gain strength in the muscles required for flight ([78](#) (</bow/species/goleag/cur/references#REF10243>)). The intensity of this behavior increases as fledging approaches (see [Breeding: Young Birds](#) (<https://species.birds.cornell.edu/bow/species/goleag/draft/breeding#young>)). Young have successfully left nests as early as 45 days of age (Steenhof et al. 2017, USGS, unpublished data) and as late as 81 days ([390](#) (</bow/species/goleag/cur/references#REF10249>)). In southwestern Idaho, 101 eaglets from 61 broods departed from the nest at an average age of 64 d (range 45–77 d) ([515](#) (</bow/species/goleag/cur/references#REF184640>)); USGS, unpublished data). Half of these young fledged by 65 days of age, and nearly 75% of the young had left their nests by 70 days. Mean age at first flight is 10 wk ($n = 28$) in western North Dakota ([396](#) (</bow/species/goleag/cur/references#REF10300>)).

Adults may facilitate fledging by decreasing prey deliveries during the last few weeks of brood-rearing ([249](#) (</bow/species/goleag/cur/references#REF10227>)). There is no evidence, other than a single anecdotal report ([536](#) (</bow/species/goleag/cur/references#REF10289>)), that adults force young out of nests. Departure from the nest can occur by the young falling, jumping, walking, or flying. Flying in this case is most often gliding, and rarely powered flapping flight. Departure usually involves the young jumping off or being blown out of the nest

while wing flapping. Post-departure, the bird usually flaps in a series of short, stiff, wing-beats and then glides a short distance, followed by an uncontrolled landing ([472 \(/bow/species/goleag/cur/references#REF56184\)](#), CLM, EHC); this is sometimes accompanied by a series of loud, vocalizations (EHC).

Stressors can cause nestlings to jump or fall from the nest before being capable of flight. In southwestern Idaho, early fledging is usually associated with eaglets exposed to heavy nest parasite infestation or heat stress from sun exposure ([535 \(/bow/species/goleag/cur/references#REF182705\)](#), MNK). This behavior can result in death and therefore can be an important cause of nest failure (see [Demography and Populations: Disease and Body Parasites \(https://species.birds.cornell.edu/bow/species/goleag/draft/demography#disease\)](#)). Young that leave the nest before they are capable of flight are usually fed and cared for by the parents ([345 \(/bow/species/goleag/cur/references#REF56188\)](#), MNK, CLM). In one case, a nestling fell out of a cliff nest in Washington, and the parents continued to provision it while building a new nest on the ground next to the nestling ([537 \(/bow/species/goleag/cur/references#REF182706\)](#)).

Growth

After fledging, muscle mass of juveniles develops, and flight feathers reach full growth ([24 \(/bow/species/goleag/cur/references#REF10268\)](#)). Because skeletal growth usually ceases prior to fledging ([378 \(/bow/species/goleag/cur/references#REF10226\)](#)), body mass of fledglings fluctuates depending on food intake.

Association with Parents or Other Young

Fledged young associate with parents and siblings for some time after fledging. Migrants likely disassociate from their parents sooner than do residents (see [Movements and Migration: Timing and Routes of Migration: Post-breeding Timing \(https://species.birds.cornell.edu/bow/species/goleag/draft/movement#migroute\)](#)). See [Breeding: Immature Stage: Post-fledging Independence \(https://species.birds.cornell.edu/bow/species/goleag/2.0/breeding#imm\)](#) for details on timing of dispersal and associations during dispersal.

Ability to Get Around, Feed, and Care for Self

Flying ability of juveniles develops slowly, partly a consequence of incomplete flight-feather growth ([398 \(/bow/species/goleag/cur/references#REF10345\)](#)). Sustained flight usually is not achieved until > 64 days of age ([32 \(/bow/species/goleag/cur/references#REF9577\)](#)). In Israel, females develop flying skills, fly longer distances, and move farther from their nest, sooner than do males ([400 \(/bow/species/goleag/cur/references#REF33285\)](#)). Distance of fledglings from the nest increases significantly with time in western North Dakota, but the sexes do not differ in the distance they move ([396 \(/bow/species/goleag/cur/references#REF10300\)](#)). In that same study, movements > 5 km were not observed until > 29 days after fledging, and movements > 10 km not until > 98 days after fledging ([396 \(/bow/species/goleag/cur/references#REF10300\)](#)). First hunting attempts occur 28–68 days after fledging in Alaska, Israel, and England ([398 \(/bow/species/goleag/cur/references#REF10345\)](#), [400 \(/bow/species/goleag/cur/references#REF33285\)](#), CLM). Young may feed at carcasses 35 days after fledging, and bathe 30 days after fledging ([398 \(/bow/species/goleag/cur/references#REF10345\)](#)).

Immature Stage

Post-fledgling Independence

Characteristics of movements after fledging vary by geographic region and migratory status. For migratory populations, dependence is shorter than it is for non-migratory populations. In Denali National Park and Preserve, Alaska, dispersal and independence occurs 50 days (range 39–63) after fledging and coincides with initiation of migration ([269 \(/bow/species/goleag/cur/references#REF167566\)](#)). Dependence on parents is probably also ≤ 2 months throughout northern Alaska, where early winters require an early start to migration ([172 \(/bow/species/goleag/cur/references#REF61012\)](#), [269 \(/bow/species/goleag/cur/references#REF167566\)](#)).

In populations where migration usually does not occur, dependence is relatively longer. In the United Kingdom, fledglings stay ≤ 70 m from the nest for 2 weeks ([398 \(/bow/species/goleag/cur/references#REF10345\)](#)). Independence of those birds appears to start 75–85 days after fledging, when adults begin territorial defense displays toward their young ([534 \(/bow/species/goleag/cur/references#REF33317\)](#)). For 66 tracked fledglings in the Colorado Plateau and southern Rocky Mountains, the time between fledging date and the onset of dispersal is 4–9 months ([104 \(/bow/species/goleag/cur/references#REF170046\)](#)). Two young telemetered in the Mojave Desert dispersed from their natal territory 5 months after fledging in May (TEK, TAM). Seven telemetered young left their natal territory in southwestern Idaho in 3 to 7 months (mean = 4) after fledging (USGS, unpublished data), and 9 telemetered young in southwestern Montana left their nesting territory 3–9 months (mean = 4) after fledging (R. Crandall, unpublished data).

A number of factors may influence timing of dispersal from the natal area. Murphy et al. ([104 \(/bow/species/goleag/cur/references#REF170046\)](#)) detected no overall sex bias in the timing of dispersal for 40 male and 26 female young. However, among birds dispersing short distances (< 120 km), males tended to disperse earlier than females. Likewise, Murphy et al. ([104 \(/bow/species/goleag/cur/references#REF170046\)](#)) also found no overall relationship between age and date of the onset of dispersal, but longer-distance dispersers initiated movements at younger ages than did shorter-distance dispersers. Similarly, in Denali National Park and Preserve, Alaska, hatching date did not predict the date on which eagles departed their natal area, but the post-fledging dependence period was generally longer for fledglings that hatched early ([269 \(/bow/species/goleag/cur/references#REF167566\)](#)).

Siblings occasionally disperse together. After fledging in western North Dakota, siblings moved together and usually stayed within 300 m of each other up to 121 days after fledging ([396 \(/bow/species/goleag/cur/references#REF10300\)](#)). In contrast, sibling fledglings from Denali National Park and Preserve, Alaska, leave their natal area from 1 to 13 days apart and within 60 days of fledging, and they do not stay together once they leave their natal area ([269 \(/bow/species/goleag/cur/references#REF167566\)](#)). There is no evidence that young accompany parents at the onset of autumn migration or that siblings migrate together ([269 \(/bow/species/goleag/cur/references#REF167566\)](#)). Similarly, in the Colorado Plateau and the southern Rocky Mountains, dispersal dates of siblings differ by as little as three days or as much as 3–5 months ([104 \(/bow/species/goleag/cur/references#REF170046\)](#)).

< [Behavior \(/bow/species/goleag/cur/behavior\)](#)

[Demography and Populations \(/bow/species/goleag/cur/demography\)](#) >

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