

SPECIES ASSESSMENT FOR BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*) IN WYOMING

prepared by

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Introduction

The bald eagle (*Haliaeetus leucocephalus*) is the second largest North American bird of prey, with an average wingspan of 7 feet. On 20 June 1782 it was chosen as the emblem of the United States of America because of its long life, great strength, and majestic appearance. This selection had its detractors, most notably Benjamin Franklin who expounded on the bald eagle's "bad moral character."

The bald eagle's scientific name signifies a sea (*halo*) eagle (*aetos*) with a white (*leukos*) head (*cephalus*). In adult birds, the distinctive white head and white tail contrast starkly with the dark brown body and wings.

When Europeans first arrived on the North American continent there were an estimated one-quarter to one-half million bald eagles. Eagle populations declined as North America was settled. Bald eagles were affected by deliberate killing for feathers and trophies, loss of prey, loss of habitat, intentional poisoning, and unintentional poisoning, especially via widespread use of the pesticide dichloro-diphenyl-trichloroethane (DDT). The continental population reached a low in 1963 with only 417 nesting pairs in the lower 48 states. In 1978, the bald eagle was federally listed as Endangered through the lower 48 states except in Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was designated as Threatened.

Under the protection of the Endangered Species Act (ESA), and the banning of the use of DDT, the bald eagle population has nearly doubled every 7 to 8 years over the past 30 years. The magnitude of the recovery has prompted the USFWS to propose removal of the bald eagle from the Endangered Species list (USFWS 1999).

Natural History

The bald eagle is the second largest North American bird of prey; only the California condor (*Gymnogyps californianus*) is larger. The natural history of this species, including identifying characteristics and reproductive rates are presented below. The information has been compiled primarily from Buehler (2000), Spencer (1976), Snow (1973), and American Eagle Foundation (2004).

Morphological Description

Few birds of prey are more distinctive than the bald eagle. The white head, neck and tail of the adult contrast starkly with the blackish-brown back, breast, and wings. The bald eagle is the only eagle confined to North America, and there are no other large, dark birds in North America with white heads and tails.

Body size varies widely, with adult total length 2.3 - 3.1 ft (71 to 96 cm) and wingspans 5.5 - 8.0 ft (168 to 244 cm). Adult body weights range from 10 -14 pounds. The largest birds tend to be found in the northern part of the bird's range in Alaska and Canada, with smaller birds produced to the south. As with many raptor species, the female is about 25% larger than the male; otherwise there is no distinction between the sexes.

When first hatched, a bald eagle is covered with thick, silky down. Coloration is smoke gray on the back, paler gray on the head and underparts of the body, and nearly white on the throat. At about 3 weeks of age the whitish down is replaced by shorter, thicker, and darker down. At 5 - 6 weeks of age blackish feathers begin to appear on the body and wings; at 7 - 8 weeks eaglets are fairly well feathered, with only a little down showing between feathers.

Juvenile plumage varies with timing and season of molt as well as age. The distinctive white head, neck, and tail are not attained until 5.5 years of age, which is the age of sexual maturity. Juvenile birds are a mixture of brown and white - the head, body, wings and tail are dark brown, while white mottling is found on the underwing in the wing lining and axillaries, and on the belly. The beak and cere are blackish gray, and the iris is dark brown.

Plumage after the first prebasic molt becomes increasingly variable. It is somewhat difficult to determine age of birds after their first molt by plumage. The head undergoes changes with progressive molts, from dark brown in juvenile to white in adult. Body color of immature birds varies in the amount and distribution of white mottling. A first year bald eagle is entirely blackish, except for the underwing coverts and the tail feathers, which are mottled with buff or buff-white and subterminally banded with dark brown.

Juvenile bald eagles, with their generally all-brown appearance, can be confused with adult golden eagles (*Aquila chrysaetos*). The lower tarsi of the golden eagle are completely feathered, whereas they are unfeathered in the bald eagle. In flight, juvenile bald eagles can also be confused with vultures and large buteos. Both the black vulture (*Coragyps atratus*) and the turkey vulture (*Cathartes aura*) are found within the bald eagle's range. The black vulture is glossy black and has white wing patches on the undersurfaces of its primaries, but it is much darker in appearance than juvenile bald eagles; its feet also extend beyond its tail in flight. The turkey vulture has two-toned wings; the coverts on the undersurfaces appear very dark, while the undersurfaces of the primaries and secondaries appear much lighter and gray toned. Its tail is long and narrow, and the head appears very small.

Taxonomy and Distribution

Eagles belong to the Family *Accipitridae*, which also encompasses hawks, kites, and old-world vultures. Of the 289 species of hawk-like birds, there are 59 species of eagles (Grossman and Hamlet 1964, USFWS 1989). Scientists loosely divide eagles into 4 groups based on physical characteristics and behavior: fish (or sea) eagles, booted eagles, snake eagles, and giant forest eagles. The bald eagle is classed in the first group; North America's other eagle, the golden eagle, is classed into the second. There are 8 species in the genus *Haliaeetus*, with the bald eagle being the only one that regularly occurs in North America. The bald eagle is closely related to the white-tailed eagle (*H. albicilla*) of temperate Eurasia, southwest Greenland and Scandinavia, with which it is said to form a “superspecies” [American Ornithologist’s Union (AOU) 1998].

Two subspecies or races of the bald eagle are sometimes recognized. The smaller "southern" bald eagle, *H. l. leucocephalus*, is found generally south of 40 degrees north latitude; the larger "northern" bald eagle, *H. l. alascanus*, is found generally north of that mark, with most occurring in Canada and Alaska. Research indicates quite a bit of mixing, however, as birds migrate and move to different breeding centers. This has led to a recent de-emphasis on using “northern” and “southern” distinctions as reliable taxonomic categories.

The bald eagle is found through much of the United States and Canada (Figure 1); the species occupies every U.S. state except Hawaii. Most breeding occurs to the north in Alaska and Canada, with an increasing number of known breeding sites to the south including places as far south as Baja California, Sonora, and the Gulf coasts of Texas and Florida (e.g., Brown et al. 1988). There are isolated breeding centers in the Great Basin, Great Plains, and Rocky Mountains; breeding range has apparently recently expanded into Nebraska and Kansas.

Non-breeding range is similar to breeding range, with the exception of far northern areas that are abandoned in winter (Figure 1; AOU 1983, Sibley and Monroe 1990). Bald eagles frequently winter in southern Alaska, southern Canada, and many points southward. The Chilkat Bald Eagle Preserve in Alaska supports the largest wintering population anywhere (Ehrlich et al. 1992). Winter concentrations occur along major rivers, lakes, coastlines, and reservoirs in many parts of the continental U.S.

It is assumed that bald eagles historically occupied virtually all suitable habitat in North America, then were restricted to primarily northern areas during the population low in the mid-20th century. Population recovery over the past 30 years has begun to “re-fill” historic range.

Habitat Requirements

The bald eagle is generally associated with large bodies of open water such as lakes, marshes, seacoasts, and rivers, where there are plenty of fish to eat and tall trees for nesting and roosting.

Breeding Habitat

Bald eagles typically nest in tall trees, or on cliffs, near large water bodies. Nests have been documented in many species of tree, with height apparently more important than species (NatureServe 2004). Ground nesting has been infrequently reported on the Aleutian Islands in Alaska, in Canada's Northwest Territories, and in Ohio, Michigan, and Texas. Nests located on cliffs and rock pinnacles have been reported historically in California, Kansas, Nevada, New Mexico and Utah, but currently are known to occur only in Alaska and Arizona.

Most breeding eagles construct nests within several hundred meters of open water (e.g., Robards and King 1966, Robards and Hodges 1977, Anthony and Isaacs 1989), though these

distances may increase in areas of high human density. Timbered shorelines provide fishing and loafing perches, nest trees, and open flight paths (Whitfield 1974). In most studies of nesting bald eagles, at least 90 percent of the nests were less than 200 m (219 yds) from open water. In Florida, most nests were located within 3 km (1.9 mi) of open water, substantially farther than other reported distances (McEwan and Hirth 1979, Wood *et al.* 1989).

Besides proximity to large water bodies, other features that influence nest location include diversity, abundance, and vulnerability of prey; presence and proximity of shallow water, and; absence of extensive human development and disturbance (Buehler 2000). In Wyoming, groves of mature cottonwoods found along streams and rivers are typical bald eagle nesting habitat (BLM 2003). Tall, riverside conifers are also used for nesting in the state (BLM 2003, Merkens *et al.* 1999). In Colorado and Wyoming, forest stands containing nest trees varied from large, old-growth stands of ponderosa pine to narrow strips of riparian trees surrounded by rangeland (Kralovec *et al.* 1992).

The Montana Bald Eagle Working Group (MBEWG 1991) characterized quality habitat as mature forest stands of low to moderate canopy closure consisting of cottonwood, Douglas fir, ponderosa pine or mixed conifer. High quality nest stands are generally recognized as >20 acres in size, <1 mile from open water, and having at least 2 suitable nest trees and >3 perching trees. Bald eagles in the Greater Yellowstone area breed in riparian or lacustrine areas and select large trees for nesting within 1.5 km (0.9 mi) of river or lake shores (Harmata and Oakleaf 1992).

Most nest trees are larger and taller than surrounding trees (Grubb 1980, Anthony *et al.* 1982, Anthony and Isaacs 1989), except in extreme southern Florida where nests are typically located in mangrove snags (Curnutt and Robertson 1994). Clear flight paths and lines of sight are essential;

nests are often found at or above the surrounding forest canopy in very large trees with open crowns and sturdy horizontal limbs. Nests are usually positioned below the treetop in live conifers. In British Columbia, nests with overhead canopies of foliage were most successful (Palmer 1988).

Perching trees serve many functions: hunting, feeding, displaying, loafing, and watchposts for territorial defense (MBEWG 1991). Night roosts in the vicinity of the nest are important for sleeping. It is assumed that suitable breeding season roosts are more common than suitable winter roosts because they do not need to provide as much protection from weather.

Migration Habitat

Most bald eagles migrate south in the fall to areas with sufficient food, and return north in the spring to nest. Spring migration is rather fast compared to the more leisurely fall migration. Many eagles in southern areas, such as Florida, remain year-round and do not migrate.

Bald eagles breeding in Canada and the northern U.S. move south for winter, migrating widely over most of the continent (AOU 1983). In northern Chesapeake Bay radio-tagged northern migrants arrived in late fall (a mean date of 21 December) and departed in early spring (a mean date of 27 March). Radio-tagged southern migrants arrived April - August and departed from June through October (Buehler et al. 1991).

Little information is available on the characteristics of stopover habitat used during spring and fall migrations. Migratory habitat is similar to wintering habitat (Section 2.3.3), except that prey used in stopovers may only be available during spring and/or fall. Food availability is the primary suitability factor for migratory corridors (Buehler 2000). Drastic declines in salmon availability at

Glacier National Park in Montana lead to abandonment of historic stopover sites (Spencer et al. 1991).

Wintering Habitat

Wintering bald eagles occur throughout the country but are most abundant in the West and Midwest. Abundant and readily-available food, close to one or more suitable night roosts, are the primary habitat requirements in winter (BLM 2003, Griffin et al. 1982, Dzus and Gerrard 1993). The majority of wintering bald eagles are found near open water where they feed on fish and waterfowl, often taking those that are dead or injured. When suitable conditions exist, particularly a lack of human disturbance, wintering bald eagles will forage in terrestrial habitats where they prey on small to medium sized mammals (e.g., prairie dogs, jackrabbits); they also scavenge roadkills, winter mortalities of big game, and livestock (USFWS 1983). Most bald eagle winter range occurs along major river systems and large bodies of water in the Midwest, Chesapeake Bay, Pacific Northwest, and Intermountain west including Wyoming, Utah, Colorado, New Mexico, and Arizona.

Stalmaster (1987) defined a roost as “an area where eagles rest and sleep during the night.” Wintering bald eagles roost in small areas that protect them from cold weather. High quality roosts are often used consistently for many years. Mature forest stands are preferred, as are forest and landform configurations that provide shelter from nighttime winter winds. Eagles may switch to alternate roosts when winds shift to unusual directions. Roosts that are closer to daytime feeding areas reduce the energetic cost of movement, and may be preferred. Roosts may also have a social function in that younger eagles have a chance to observe and emulate mature birds (Stalmaster 1987). Communal roost sites used by up to 100 eagles, sometimes even more, are known.

In Wyoming and the region, winter roosts are commonly situated in riparian forests (cottonwoods or conifers) or upland conifer forests, particularly northeast facing stands of ponderosa pine. Roost trees are usually the tallest tree in the surrounding forest and are selected to provide protection from the wind and cold (Keister and Anthony 1983, Stalmaster 1987). Winter communal roosts in northern Chesapeake Bay tended to be in stands with greater canopy height, more canopy cover, and more snags than random sites. Roost sites were also closer to water and farther from paved roads and buildings than random sites (Buehler et al. 1991a).

Mixed-conifer forests provide important roosting habitat for some of the largest wintering concentrations of bald eagles in the United States in the Klamath Basin in Oregon (Anthony et al. 1982, Isaacs and Anthony 1987, Keister et al. 1987). Bald eagles in Oregon roosted in the largest diameter, tallest, and most open-structured trees (DellaSala et al. 1998; see also Anthony et al. 1982, Stohlgren 1993, Stohlgren and Farmer 1994). Minnesota roost sites typically had mature forest cover (Hall 2004) with slopes ranging from flat to 55 degrees.

Area Requirements

Winter Range

Bald eagles can form dense concentrations in winter. Little data is available on actual spacing in communal roosts or communal foraging sites. Multiple birds are known to perch in the same winter roost tree (and occasionally on the same limb), but usually with at least one wingspan separation (Buehler 2000). Density and spacing at communal foraging sites is assumed to depend on food abundance. During food scarcity, aggressive interaction increases and tolerance of close approaches by other eagles decreases (Hansen 1986).

Breeding Range

The active nest, nearby perches and night roosts, and high-use areas around the nest comprise the nesting territory. The size and shape of a defended nesting territory varies greatly depending on the terrain, vegetation, food availability, and local eagle density. Bald eagles defend their territories from other adult eagles by perching atop dominant trees, threat vocalizations, circling displays, and territorial chases. Subadult eagles are usually tolerated to a greater degree than intruding adults. Eagles occasionally fight using their talons to grasp the opponent while in flight. Such fights can be fatal and are responsible for many of the injured birds brought to rehabilitation centers.

Estimates of territory size, as defined as the defended part of the home range, vary widely based on nesting density, food supply, and method of measurement. Stalmaster (1987) suggested 1 to 2 km² (298 to 598 acres) as a typical territory size. In Minnesota, average territory radius for 10 bald eagles was 580 m (0.36 mi) (Mahaffy and Frenzel 1987). The highest reported density of breeding bald eagles was reported for Kruzof Island, Alaska. Assuming half the distance between nests is defended and circular territories, territory size was 0.5 km² (150 acres), which is probably a minimum territory size for this species (Hodges and Robards 1982).

Reproduction and Survivorship

Bald eagles are monogamous; annual courtship behavior reinforces pair bonds (Palmer 1988). Pair bond formation includes dramatic pursuit flights, high soaring, talon locking and cartwheeling (Johnsgard 1990). Pair bonding behaviors, territory establishment, and territorial defense probably form a complex of interrelated behaviors. Pair formation ultimately leads to nest site selection and nest construction for newly-formed pairs, and also for previously-formed pairs

without access to existing nests. For previously-formed pairs that have access to an existing nest, copulation may be concurrent with nest repair activities.

The bald eagle breeds at approximately 5 - 6 years of age. Nests are often massive structures of branches and sticks with an interior cup lined with grass, pine needles, and plant stems (Baicich and Harrison 1997). Nests may be used year after year, resulting in huge constructions approaching 12 feet in height and 8 feet in diameter.

The nesting season varies with latitude. In southern regions, such as Florida and the Gulf Coast, nesting is prolonged, lasting from late fall to early spring. In the northern regions, including Alaska and Canada, it is fairly synchronized with early spring (Buehler 2000). Compared to most other raptors that nest April - May, bald eagles are early breeders: nesting in mid-February (Call 1978), egg laying in late February, and incubation mid March - early May. Eggs hatch from mid April - early May, and the young fledge late June - early July.

In the Greater Yellowstone Ecosystem in Wyoming eggs are laid early March - mid April, with the later dates found at higher elevations (Swenson et al. 1986). Bald eagles produce only one brood per season; replacement clutches are possible if eggs are destroyed during incubation, especially at southern latitudes (Buehler 2000).

The clutch is most often 2 eggs (79%), occasionally 1 (17%) or 3 (4%) (Stalmaster 1987). Clutches of 4 are extremely rare. Eggs are white, non-glossy, short ovals averaging 3 x 2 inches (71 x 54 mm) (Baicich and Harrison 1997). Incubation is primarily by females, with some assistance from males. Eggs are turned about every hour and are sometimes covered with soft nesting material when left unattended for a short time. Incubation lasts about 35 days. The first eaglet to hatch has a significant advantage in competing for food; mortality for subsequent

hatchlings is relatively high. In nests with more than one eaglet the largest chick often receives the most food. Adults preferentially respond to the most noticeable eaglet, both in terms of size and noise. Sibling competition and mortality is greatest early in the nestling period, when size differences are greatest (Bortolotti 1986).

Nestlings are tended primarily by the female, secondarily by the male. For the first 2 - 3 weeks of the nestling period at least one adult is at the nest almost 100% of the time (Fraser 1981, Wallin 1982). Adult nest attendance drops off considerably after 5 - 6 weeks; adults then often roost in trees adjacent to the nest tree. Both sexes hunt and feed the young; males provide most of the food during the first two weeks (Wallin 1982, Gerrard and Bortolotti 1988).

Fledging occurs 10 - 12.5 weeks of age, but up to half of nest departures are unsuccessful and the young may remain on the ground for weeks before regaining flight ability. In most such cases, the parents will continue to feed the young even if they're on the ground. The adults continue to care for the young and they may remain around the nest for several weeks after fledging.

Bald eagles typically begin breeding at age 6, but sometimes defer breeding until age 7 or 8 (Gerrard et al. 1992, Harmata et al. 1999, Buehler 2000). Raptors breed at a younger age than usual in years when food is particularly abundant, or when a population decline has left many territories vacant (Newton 1979). Where there is less competition for food, and limited potential mates, bald eagles may attempt to breed at age 3 or 4 (Gerrard et al. 1992, Buehler 2000).

Population Demographics

Fecundity and Survivorship

The longevity record for bald eagles in the wild is >28 years (Schempf 1997). Captive birds have lived to 47 years, and they are believed to be capable of reproducing for 20-30 years (Stalmaster 1987). Based on survival data, Harmata et al. (1999) estimated a maximum life span of 15.4 years for bald eagles in the Greater Yellowstone Ecosystem; most of the known fatalities in this study were human-related.

Cumulative survival to adulthood, which is 4.5 years, was 55% for Chesapeake Bay, 50% in Florida, and 61% in Prince William Sound (Buehler et al. 1991, Wood 1992, Bowman et al. 1995). It was much lower, only 30%, in Yellowstone National Park (Harmata et al. 1999). Given an adult survival rate of 0.88/year, Bowman et al. (1995) estimated that once eagles reach maturity (5 years) their average life span in Prince William Sound is 19 years. There's no indication of substantially different survival rates between the two sexes (Wood 1992, Bowman et al. 1995).

Limiting Factors

There are many known causes of bald eagle mortality. Eggs and hatchlings may be taken by black bears (*Ursus americanus*), raccoons (*Procyon lotor*), wolverines (*Gulo gulo*), gulls (*Larus* spp.), red-tailed hawks (*Buteo jamaicensis*), ravens (*Corvus corax*), crows (*Corvus* spp.) or magpies (*Pica hudsonia*) (McKelvey and Smith 1979, Nash et al. 1980, Doyle 1995, Perkins et al. 1996). Adult eagles occasionally die in aggressive encounters with other bald eagles, golden eagles, or peregrine falcons (*Falco peregrinus*) (Jenkins and Jackman 1993, Driscoll et al. 1999). Bowman et al. (1995) reported that at least 4 of 8 dead adults in Alaska probably died in fights between eagles in a dense population.

Parasites of the bald eagle include 10 genera of helminthes, but there is no evidence of significant pathogenicity or mortality attributable to them (Marine Coastal Species Information System 1996). Bald eagles are susceptible to diseases such as avian cholera, streptococcal infection, aspergillosis, pneumonia, and septicemia.

Nestlings are rarely killed by their nestmates. Similar to other young birds, juvenile eagles are particularly vulnerable to accidents, predation, or starvation during their first year (Stalmaster 1987).

Full grown bald eagles have few natural enemies, and the most frequently reported causes of adult bald eagle mortality are human-related (Stalmaster 1987, Harmata et al. 1999). Major threats include habitat loss, disturbance by humans, biocide contamination, decreasing food supply, and illegal shooting (Evans 1982, Green 1985, Herkert 1992).

As secondary and tertiary consumers bald eagles can accumulate high levels of toxic chemicals. Dieldrin, DDT, and PCB accumulation substantially lower bald eagle reproductive success. DDT is thought to be principally responsible for the historic decline of bald eagles, as the chemical interferes with birds' ability to produce strong eggshells. The use of DDT was banned in Canada in 1970 and in the U.S. in 1972, a significant factor that has contributed to the population rebound in the last 3 decades. Lead poisoning is a danger in areas where eagles feed on waterfowl that have been killed or crippled by lead pellets. This is assumed to have lessened in recent years as lead shot has been replaced by non-toxic metals. Breeding success still is being affected by environmental contaminants along Lake Superior in Wisconsin (Kozie and Anderson 1991). The Chilkat Bald Eagle Preserve, Alaska, which supports the largest wintering population anywhere,

was threatened by a proposed copper mine (and the likelihood of produced contaminants) in the early 1990s (Ehrlich et al. 1992).

Studies of the effects of human disturbance on bald eagle nesting success have yielded variable results. Mathisen (1968), McEwan and Hirth (1979), and Fraser (1985) found that recreational activities, logging, and pedestrian and vehicular traffic had no effect on eagle nesting success. In contrast, Grubb (1980), Nash et al. (1980), Gerrard et al. (1985), Stalmaster and Kaiser (1998), and Anthony and Issacs (1989) concluded that human disturbance lowered nest success. A study of bald eagle habitat use at Chesapeake Bay found no clear indication that eagles were adapting to disturbances or disturbed habitats (Buehler et al. 1991b). However, a few pairs in Washington have recently shown a remarkable ability to nest in suburban areas with unusually close and high levels of human activity (Watson et al. 1999; see also Grubb et al. 1992).

Individual eagles and pairs apparently vary widely in their responses to disturbance, depending on previous experience, availability of alternative nest sites, amount and type of disturbance, predictability of disturbance (e.g., constant noise from a consistently-traveled road vs. infrequent and sudden appearance of people on foot), and, presumably, habitat quality and eagle density (Therres et al. 1993). It is reasonable to assume that previously undisturbed eagles will react more negatively to disturbance than “experienced” eagles, and that both types of birds react more strongly to closer and more intense disturbances.

Other human-caused mortalities include collisions with trains and vehicles, electrocution on powerlines (Anthony and Issacs 1989, Booth and Farr 1993), and egg collection (Booth and Farr 1993, Wood and Collopy 1993, Watson and Pierce 2001). Illegal shooting still poses some threat, but increased law enforcement and public awareness have reduced shooting deaths to a small

fraction of those occurring in the early 1900s (USFWS 1995). Habitat loss and modification to logging, residential development, motorized recreation, and other industrial activities remains a major threat, and probably will for the foreseeable future.

Food Habits

Food Items

Bald eagles are rather opportunistic feeders. Fish are the most common food item, followed generally by waterfowl and shorebirds (e.g., Stalmaster 1987). In interior North America, medium-sized mammals (e.g., prairie dogs, jackrabbits) and carrion from big game and livestock are locally important. Bald eagles prey on live animals, but also readily scavenge injured or dead ones (Brown and Amadon 1968). Specific dietary composition depends on geography and season (Evans 1982). In South Florida, Broley (1947) found catfish (*Ictalurus* spp.), mullet, and turtles to be the most common food items found at nests. McEwan (1977) also reported a high incidence of catfish, as well as American coot (*Fulica americana*). Bald eagles appear to easily shift their diet in response to changes in prey availability.

Diet studies usually depend on direct observation of foraging eagles, or collection of prey remains from under perches and nests. These techniques may over-represent larger fish, birds, and mammals and under-represent smaller prey items (Knight et al. 1990, Mersmann et al. 1992).

Foraging Strategy

The bald eagle typically hunts from perches or while soaring over suitable prey habitat. Most foraging occurs early in the morning, with a less intense feeding period in the late afternoon (Mersmann 1989). Prey is often taken on the wing; e.g., snatching fish from surface waters, capturing swimming or flying waterfowl, and diving and pouncing on small mammals. Bald

eagles commonly pirate prey from one another and from other raptors, and appear to spend much energy defending and fighting over captured prey.

In Wyoming, bald eagle foraging habitats include large lakes, reservoirs, and rivers with abundant fish and waterbirds. Those that remain ice-free in winter are especially important from October - May. Concentrations of big game and livestock are locally important, especially when they produce reliable carrion (e.g., winter-killed animals, road-killed animals), as are large complexes of prairie dogs and shrublands that produce high densities of other ground squirrels and rabbits.

Conservation

Conservation Status

In 1918 the Migratory Bird Treaty Act prohibited, except under specific conditions, the taking, selling, transporting, and importing of migratory birds, their nests, eggs, parts, or products. The bald eagle was further protected under the Bald Eagle Protection Act of 1940, making it illegal to kill harass, possess (without a permit) or sell bald eagles. In 1967 the bald eagle was officially declared Endangered under the Endangered Species Protection Act, the law that preceded the Endangered Species Act. This designation was subsequently modified to Threatened, and delisting has been proposed (USFWS 1995; 1999). These actions, along with others (e.g., Lacey Act), continue to provide protection to recovering populations.

Federal Endangered Species Act

In 1978 the U.S. Fish and Wildlife Service amended the bald eagle's status under the Endangered Species Act to Endangered in all of the coterminous United States with the exception

of Minnesota, Wisconsin, Michigan, Oregon, and Washington, where it was classified as Threatened (USFWS 1978). In 1995 the species was reclassified to Threatened throughout the lower 48 states (USFWS 1995). In 1999, the bald eagle was proposed for delisting (USFWS 1999); this proposal has not been finalized nor withdrawn to date.

USDI Bureau of Land Management

The bald eagle does not appear on USDI Bureau of Land Management (BLM) Sensitive Species lists. By design, these lists do not include species already designated as formally Threatened or Endangered; i.e., the BLM defers to the more legally-restrictive designation.

USDA Forest Service

Similar to the BLM, the USDA Forest Service (USFS) does not list the bald eagle as Sensitive due to the precedence of the formal Endangered designation.

State Wildlife Agencies

The Wyoming Game and Fish Department lists the bald eagle as NSS2, indicating that the population is declining and extirpation is possible, and that habitat is restricted or vulnerable but not undergoing recent or significant loss.

Heritage Ranks and Wyoming Contribution Rank

The bald eagle has been assigned a rank of **G4/ S3B/ S5N** by the Wyoming Natural Diversity Database (WYNDD, University of Wyoming; Keinath et al. 2003). The **G4** rank indicates moderately high security from global extinction, which is appropriate for a species that is still widespread and abundant in Canada and Alaska and apparently expanding elsewhere. The **S3B**

rank indicates a moderate risk of extirpation of breeding birds from Wyoming; **S5N** reflects low risk of extirpation of non-breeding (i.e., migrating and wintering) birds from the state.

The Wyoming Contribution rank for bald eagles is **Low**. This is based on a ranking system developed by WYNDD (Keinath and Beauvais 2003) that measures the contribution of Wyoming populations of a taxon to the rangewide persistence of that taxon, and considers several factors. For the bald eagle, the **Low** rank is primarily a consequence of a low amount of the species' rather large continental range falling within the state.

Biological Conservation Issues

Thirty years ago the bald eagle was in danger of extinction from the combined effects of habitat loss, shooting, and especially inadvertent poisoning by the pesticide DDT. Since that time, DDT has been banned in Canada and the United States and the bald eagle has been protected by the Endangered Species Act and other Federal and state laws. These actions have spurred an impressive recovery, with the continental population doubling every 7-8 years over the past 3 decades.

Abundance in Wyoming

Bald eagles occur year-round in Wyoming. The largest nesting concentration is in the Greater Yellowstone area along the Yellowstone and Snake Rivers. Other major rivers in the state, such as the Green, Upper North Platte, and Bighorn, also support locally high numbers of breeding pairs (WGFD 2000).

Breeding season observations reported on the Wyoming Natural Diversity Database (WYNDD) are shown in Figure 2. The species is widespread across the State of Wyoming, with

reports in every county. Bald eagles can be seen virtually anywhere in the state during the winter, but reach high winter densities only locally.

Trends

The bald eagle was reclassified from Endangered to Threatened in 1995, then proposed for delisting in 1999, as a result of the significant increase in numbers of nesting pairs, productivity, and distribution. Recovery continues and, in the past 15 years, the bald eagle's nesting population has increased at an average rate of about 8 percent per year, going from a low of 417 nesting pairs in 1963 to 6,471 nesting pairs in 2000 (Figure 3). Bald eagle recovery goals have generally been met or exceeded for the species on a rangewide basis (USFWS 1999). There is no sizeable area in the lower 48 states where surveys have not shown substantial increases in bald eagle numbers. Conversely, there is no sizeable area where eagle numbers continue to decline.

Surveys in Wyoming echo these larger-scale findings. Annual surveys indicate that bald eagles are increasing in Wyoming, and have exceeded management goals since 1987. In 1999, 97 bald eagle pairs produced 85 young in Wyoming (WGFD 2000); this compares to 20 pairs producing 13 young in 1978. Winter counts show similarly-scaled increases,

Context in Wyoming

The bald eagle is found throughout Wyoming and is common in winter, rarer in summer (Dorn and Dorn 1990). Wyoming is a crossover state, in that some breeding bald eagles remain year-round to also winter in the state, other breeding pairs migrate south in the winter, and some northern-nesting birds migrate into the state in winter. The bald eagle has wide continental distribution, with only a relatively small portion falling within the state of Wyoming.

Intrinsic Vulnerability

A variety of factors can contribute to a species being intrinsically vulnerable to disturbance and extirpation, including poor dispersal ability, poor competitive ability, and/ or high susceptibility to disease, among others. Bald eagles appear to have moderately low intrinsic vulnerability. They clearly depend on large, productive, and ice-free water bodies with forested borders, but can range widely to locate such habitats and are rather flexible in diet. Bald eagles are somewhat sensitive to disturbance, too, but also appear to have some ability to adapt to consistent and low levels of human activity. Populations are obviously susceptible to environmental toxins, but the major contaminant involved in the historic decline (DDT) is now banned from use and others, such as lead shot, are being addressed by recent regulations.

Extrinsic Threats and Reasons for Decline

The decline of nesting bald eagle populations in the lower 48 states during the last century has been attributed to several factors, with the most prominent being DDT contamination, habitat loss and modification, deliberate poisoning, shooting, and electrocution on powerlines. Of these, habitat loss and modification remain substantial challenges.

Pesticides and Other Contaminants

The decline of bald eagles coincided with the introduction of the pesticide DDT in 1947. Bioaccumulation led to high concentrations of DDT in the fatty tissue of eagles, which in turn sharply reduced reproductive output. Since its ban from the U.S. (1972) and Canada (1970), environmental levels of DDT have lessened and most bald eagle population segments have rebounded. Some areas of the country (e.g., Great Lakes region) still harbor high remnant concentrations of DDT, and reproduction of bald eagles in those areas is predictably depressed.

Residues of PCBs, which are persistent and toxic much like DDT, have also declined throughout the U.S. but remain local problems (again, most notably in the Great Lakes region; see Bowerman 1993).

High concentrations of mercury cause a variety of neurological problems in bald eagles (USFWS 1999). High mercury concentrations may also reduce the hatching rate of eggs. Concentrations of mercury in fish declined significantly from 1969 through 1974 as a result of regulations, but concentrations have not changed appreciably since 1974.

Recent regulations requiring the use of non-toxic shot for waterfowl hunting has greatly reduced the threat of lead poisoning to bald eagles.

Disturbance at Nest and Roost Sites

As discussed earlier bald eagles are sensitive to disturbance by people, but also appear to have some ability to adapt to consistent and minor disturbances that occur in the general vicinity of nests and roosts. Intense, unpredictable, and repeated disturbances, especially when occurring very close to nests or roosts, can reduce reproduction and survival (Grubb 1980, Stalmaster 1987, Anthony and Isaacs 1989, Buehler *et al.* 1991, Montana Bald Eagle Working Group 1991, Anthony *et al.* 1995). In general, this type of disturbance occurs most frequently in areas of high human density and development; thus, it is difficult to separate simple “disturbance” from overall “habitat degradation”, as discussed below.

Habitat Degradation

Bald eagles and people prefer the same general environment - the forested margins of large water bodies. There is little doubt that anthropogenic development of these environments has reduced the quantity and quality of bald eagle habitat throughout North America over the past 2

centuries; the process continues today and will continue into the future (Buehler *et al.* 1991, Fraser *et al.* 1996). Urbanization and agricultural development were likely the main culprits in the past, and may continue to be important vectors of habitat degradation for bald eagles in some areas. In Wyoming, rural residential development and expanding recreational use of waterways, including increases in motorized watercraft use, are important impacts to breeding bald eagles. Rural residential development also has the potential to impact wintering birds, especially when it occurs close to traditional winter roosts; similar concerns apply to increases in snow-machine use.

Collisions

Bald eagles are susceptible to collision with and electrocution from aboveground utility lines (BLM 2003). In open habitats, eagles may collide with new or unfamiliar support structures or electrical lines. It is assumed that an increase in the number and type of wind-power turbines will generally increase the number of bald eagle deaths by aerial collisions, especially if such turbines are positioned with little consideration of bald eagle habitat. Bald eagles often scavenge carcasses from roadways, resulting in collisions with vehicles.

Other

Illegal shooting still poses a minor threat to bald eagle populations. Increased law enforcement and public awareness have reduced shooting deaths to a small fraction of the number of mortalities that once occurred in the early 1900s (USFWS 1995).

Conservation Action

Existing or Future Conservation Plans

In the context of the Endangered Species Act a species is “recovered” and de-listable when it is no longer in danger of extinction, nor likely to become endangered within the foreseeable

future, throughout all or a significant portion of its range, and the threats that led to the species' listing have been reduced or eliminated. These benchmarks are operationalized in official recovery goals that are established when a species is first listed under the Act. It is widely recognized that the bald eagle has met its recovery goals throughout the country, and the species was proposed for delisting in 1999 (USFWS 1999).

Wyoming is within the Pacific Recovery Region along with Montana, Idaho, Washington, Oregon, Nevada, and California. The de-listing goals for this region are: a minimum of 800 nesting pairs with an average reproductive rate of 1.0 fledged young per occupied breeding area; an average success rate for occupied breeding areas of not less than 65% over a 5 year period; attainment of breeding population goals in at least 80% of management zones, and; wintering populations stable or increasing. These goals were largely met by 1995, and trends continued to improve in subsequent years (USFWS 1999).

Conservation Elements

General

It is difficult to distill the myriad of existing recovery plans, management protocols, and conservation advice for bald eagles into a single coherent list of recommendations. Most such documents promote a general set of actions that apply to almost all ESA listed, or otherwise “of-concern”, species: map known nesting sites, roosts, and use-areas, and make the map available to all managers and affected parties in the region; monitor distribution, abundance, productivity, and habitat quality; plan land and resource uses with an explicit consideration of bald eagle life cycle and habitat requirements; prepare and implement bald eagle-specific management plans for areas

of especially high use and productivity; conduct public information and education campaigns regarding bald eagles; support more intensive research that can inform and advance management.

Historical Conservation Measures

There is a long and somewhat complex history of management and recovery plans targeting the bald eagle, involving a host of federal, regional, and state agencies and organizations. Many of the earlier efforts have been abandoned (e.g., captive breeding of bald eagles, ending 1988) or replaced by others as eagle populations recovered. The official federal status of Threatened remains the primary impetus for continued recovery and management, and will continue to do so until the species is de-listed.

Captive Breeding and Reintroduction Programs

Bald eagles were bred in captivity to provide stock for wild release until 1988, at which point most wild populations were deemed sufficiently healthy to continue recovery without such assistance. Injured birds are occasionally captured, re-habilitated, and released back into the wild, but there are no large-scale captive breeding or re-habilitation programs currently in operation.

Specific Management Guidelines

In 1983 a working group was established to provide guidelines for managing bald eagles in the Greater Yellowstone Ecosystem. This group advocated a straightforward zone system of managing bald eagle habitat, whereby a known nest or roost is considered as the center of a series of concentric zones which receive different levels of protection and management attention. Although specific management actions and regulations must be tailored to particular situations, this zone system appears to be a reasonable overall framework for managing bald eagles.

Zone I: Occupied or potentially occupied nests.

The central management zone, Zone I, is all area within about 0.5 miles of an occupied nest; alternatively, all area within the distance to the nest at which adults tend to flush or change alert status upon being disturbed. Activities with the potential to disturb breeding eagles should be most tightly regulated within this zone, with special attention to the period between eagle arrival and 2 weeks post fledging (ca. 1 February - 15 August). A variation on this strategy would be to apply Zone I management regulations to all nests known to have ever been occupied in a target area, starting at the date of eagle arrival. Then, once pairs have nested and are beyond the point at which they could safely re-nest if necessary, Zone I management regulations could be “lifted” from all unoccupied nests. In years when nests are not occupied, land use regulations should recognize the potential for future occupation; i.e., avoid any changes to the environment that could preclude re-occupation in subsequent years.

Zone II: Primary use area.

Zone II encompasses the area generally between 0.5 - 1.0 miles of occupied nests (and, in a more comprehensive application, all alternative nests). Intensive study of nesting pairs would allow for more precise mapping of this zone to include the area where a significant portion of adult foraging and loafing occurs during the nesting season (outside of Zone I). In some cases, Zone II could be discontinuous from Zone I; this could be determined by intensive study, or perhaps even by cursory observations of eagle activity. Land uses with the potential to disturb breeding eagles should be regulated within this zone, again with special attention to the breeding and rearing period, but regulations probably do not need to be as strict as in Zone I. Similar to Zone I, however, land managers should recognize the potential for eagles to re-occupy currently

unoccupied nests. Major environmental changes should be avoided in Zone II, even when associated with nests that are periodically unoccupied.

Zone III: Home range.

Ideally, the home range of a breeding pair should be delineated by a detailed mapping of eagle movements. Lacking such data, Zone III can be assumed to include all potential foraging habitat between 1.0 and 2.5 miles of the nest. Exclusion of apparently non-foraging habitat (e.g., dry uplands, non-forest land cover types) from Zone III should be done with caution and an awareness of eagle use of alternative prey and perches. Activities with the potential to disturb breeding eagles and substantially reduce habitat quality should be regulated within this zone, but such regulations are expected to be proportionally less strict than those in Zones I or II.

Zone IV: Winter roost.

In the absence of more detailed data on the movements and use patterns of wintering eagles, Zone IV is assumed to be all area within 1.0 miles of a known winter roost. Most of the considerations outlined above for nest management have analogous considerations in roost management, including an awareness of nearby alternative roosts and the potential for eagles to re-occupy roosts after years of absence. Land use regulations targeting winter roosts would apply from about 1 November to 1 April.

Alternatively, managers may elect to establish a concentric I-II-III system around major roosts, echoing the system proposed above for nests. If known, especially important foraging sites that are used by eagles from a particular roost should be considered in roost management plans. Significant migratory concentrations of bald eagles may rise to the level of zone management as well.

Information Needs

The bald eagle is the most studied North American avian species with >2,000 published accounts (see Lincer et al. 1979). Population numbers have been monitored extensively across much of the species' range since 1980, especially in the lower 48 states.

Populations that have been slow to recover are obvious targets of additional research (Buehler et al. 2000), including those in the Great Lakes and Maine (likely impacted by persistent environmental contaminants), and Chesapeake Bay (likely impacted by massive landscape conversion). Southern populations that are slowly beginning to recover, such as those in Mexico, Arizona, and southern California, probably warrant extra research attention as well.

More applicable to populations in Wyoming and the surrounding region would be studies of eagle responses to different disturbance types, frequencies, and intensities, with special attention to disturbances that attend rural residential development and motorized recreation.

Tables and Figures

Figure 1. Map of the current distribution of the Bald Eagle. (Data provided by NatureServe, 2003, in collaboration with Robert Ridgely, James Zook, The Nature Conservancy - Migratory Bird Program, Conservation International - CABS, World Wildlife Fund - US, and Environment Canada - WILDSPACE.).

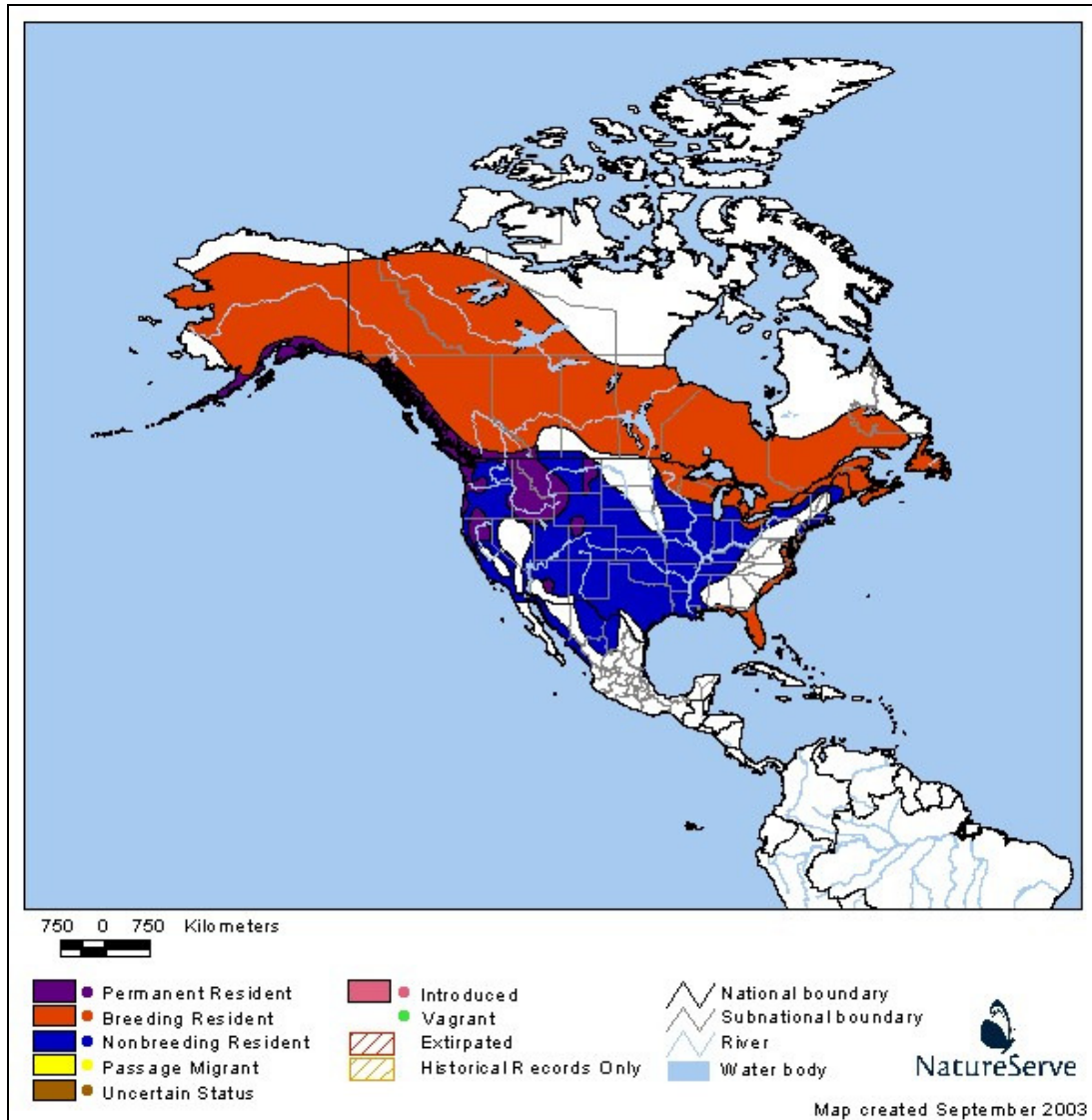


Figure 2. Bald eagle occurrence records (breeding season only) in WYNDD database (April 5, 2004). Note there are 935 records total; 136 are pre-1980 and 799 are post-1980.

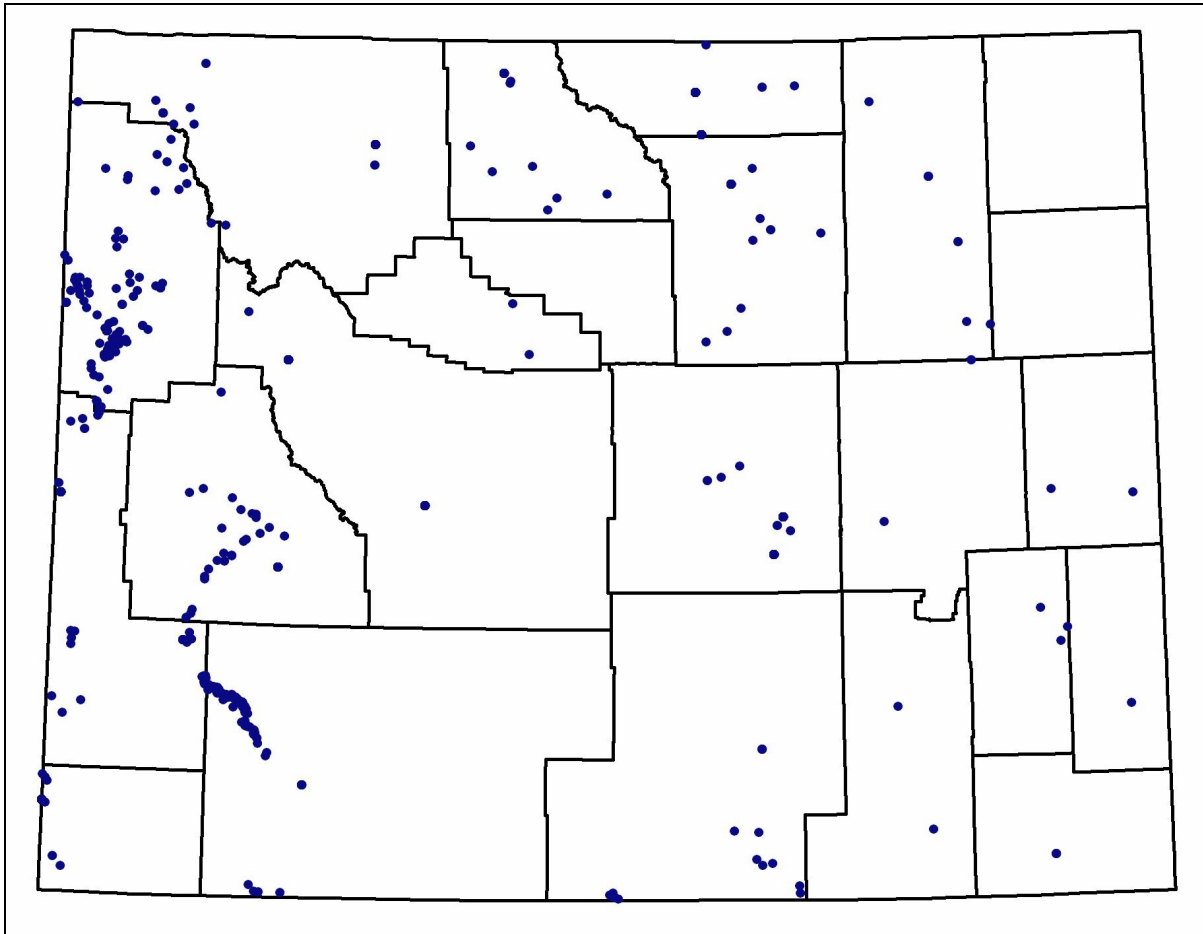
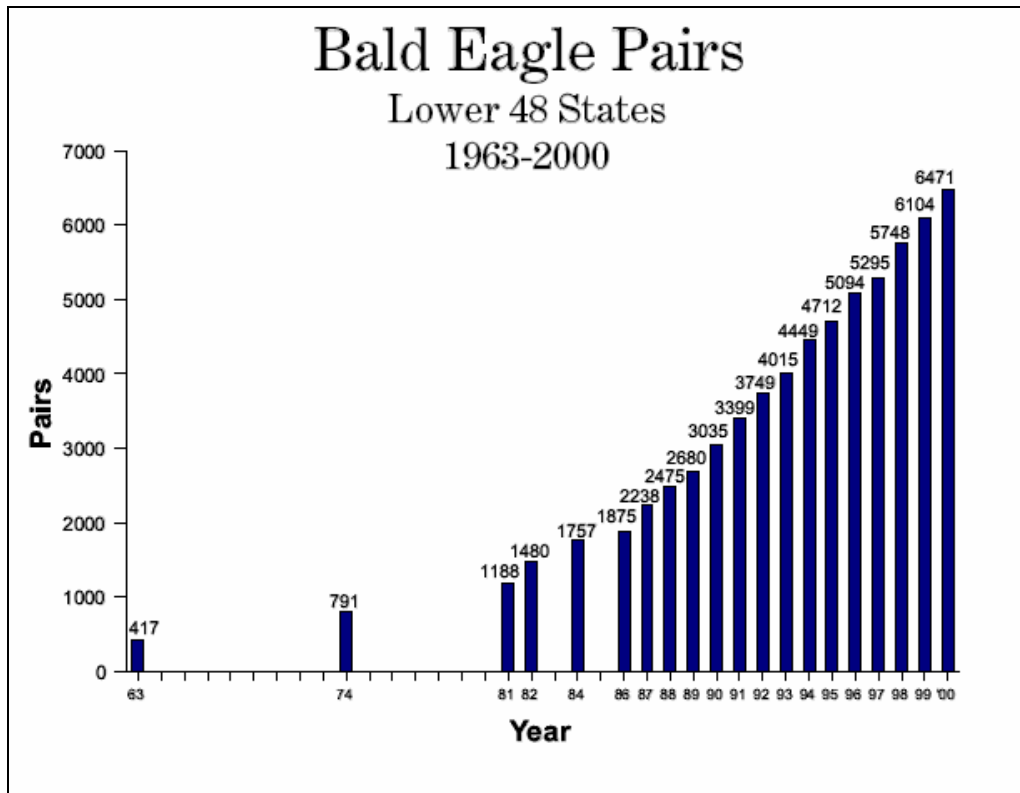


Figure 3. The Number of Bald Eagle Nesting Pairs in North America (USFWS 2004).



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