

ECOLOGY OF NESTING BALD EAGLES
ON THE
KENAI NATIONAL WILDLIFE REFUGE, ALASKA

Edward E. Bangs

U.S. Fish & Wildlife Service, Kenai National Wildlife Refuge, Soldotna, AK
Theodore N. Bailey

U.S. Fish & Wildlife Service, Kenai National Wildlife Refuge, Soldotna, AK
Vernon D. Berns

U.S. Fish & Wildlife Service, Kenai National Wildlife Refuge, Soldotna, AK

Abstract: Bald eagles (Haliaeetus leucocephalus) were censused in a boreal forest region on and near the 688,000 ha Kenai National Wildlife Refuge for the first time in 1979. Although only four active nests were observed in 10 randomly selected 10.4 km² quadrats, a total of 22 active nests were observed by checking locations where eagle nests were reported in the past. Twenty-three active nests were observed in 1980. An average of 1.0 and 1.4 eaglets per nesting pair were recorded in 1979 and 1980, respectively. The majority of bald eagle nests were in cottonwood (Populus trichocarpa) or aspen (Populus tremuloides) trees. Eagles preferred nest sites near clear streams where ice break-up occurred early in the spring and where spawning rainbow trout (Salmo gairdneri) and longnose suckers (Catostomus catostomus) utilized streams or lakes. A high concentration of nests were located in the Moose River drainage, but few nests were located in the Swanson River and Chickaloon River drainages. Causes of nest loss, abandonment, and utilization are discussed.

Most of the information on bald eagles (Haliaeetus leucocephalus) in Alaska has been gathered in remote coastal areas such as Kodiak Island (Hensel and Troyer 1964), southeast Alaska (Robards and King 1966), and the Aleutian Island Chain (Murie 1940). Few studies have been conducted on more inland populations of bald eagles near areas of rapid human development which has resulted in a gap in our knowledge of this nationally significant bird. Recent surveys conducted on the Kenai National Wildlife Refuge in southcentral Alaska have indicated both the eagles' adaptiveness and their vulnerability to human disturbance. Bald eagle nest tree selection, productivity, and food habits are examined as well as the affect of increasing human activity on the Kenai Peninsula.

STUDY SITES

The 688,000 ha Kenai National Wildlife Refuge is located in south-central Alaska and encompasses much of the lowland boreal forest on the Kenai Peninsula. The peninsula has been repeatedly burned since the early 1900's and the resulting vegetation types form a mosaic pattern of unevenly aged stands of mature and regrowth timber (Spencer and Hakala 1964). The refuge contains over 1,200 fresh water lakes larger than 2 ha and has over 2,100 km of streams. Four species of salmon (Onchorhynchus spp.) spawn on the refuge and other species such as rainbow trout (Salmo gairdneri), Dolly Varden (Salvelinus malma), and longnose suckers (Catostomus catostomus) are common in many of the lakes and streams. Typically the summers are cool with light to moderate rain while the winters are cold with complete snow cover from November through April. Lakes and rivers on the refuge freeze over in early November and are open by May.

METHODS

Bald Eagles were first censused on the refuge in 1979 by utilizing a modification of the quadrant sampling method suggested by Grier (1977). An intense aerial survey of 10 randomly selected 10.4 km² quadrants produced only four active nests. Based on these results a population of 40 active breeding pairs were estimated for the 1040 km² of assumed prime bald eagle nesting habitat on the refuge north of the Kenai River. However, because of the observed distribution of nesting sites, few nests located, and amount of time and cost of the survey, that technique was abandoned. Instead, locations where nests had been reported in the past were intensively surveyed. While only 4 nests were located using the quadrant method, 32 nests were found by surveying suspected locations. Extensive aerial surveys for other wildlife on the refuge during the past 25 years made locating bald eagle nests easier than could have otherwise been accomplished since a majority of nests had previously been observed and recorded by the refuge staff.

Aerial surveys of bald eagle nests are now accomplished by flying to known nests and circling at low speed and altitude (100 m) until necessary data is recorded. Each nest is surveyed twice, once in late May to determine nest activity and once in early August to record eaglet production (Troyer and Hensel 1965). All areas with suspected, reported, or potential nesting sites are surveyed intensively to locate new nests. Six nests not located in 1979 were discovered in 1980 during other types of aerial surveys and from reports from the general public.

In the spring of 1980, 8 nests were examined from the ground. Tree height was estimated, the diameter DBH was measured, and the nest tree and several adjacent trees were aged using an increment borer. The distance from water, as well as tree height, were estimated for all nests during aerial surveys.

RESULTS AND DISCUSSION

Nest Selection

The type of trees selected by bald eagles as nesting sites on the Kenai National Wildlife Refuge are typical of nesting trees selected by bald eagles throughout North America (Troyer and Hensel 1965, Corr 1974, Lehman 1978). Although the preferred species of nesting tree varies with location, the general attributes of a nest tree do not (Lehman 1978). Typically, nest trees are close to water, have a clear view to water, are usually the oldest and largest living members of the dominate overstory, and often provide some type of vegetative cover above the nest (Hensel and Troyer 1964, Robards and King 1966, Lehman 1978). This general description of nest trees accurately identifies the type of tree that is used by bald eagles on the refuge. Nest trees on the refuge are typically cottonwoods (Populus trichocarpa) (77 percent) although aspen (Populus tremuloides) (19 percent) is also commonly used. One eagle pair (3 percent) nested in a white spruce (Picea glauca), but certain characteristics of this nest suggested it was probably originally constructed by an osprey (Pandion haliaetus) and later used by eagles. The average distance from nest trees to water is less than 0.2 km and more nests are closer to streams (60 percent) than to lakes (40 percent). Trees selected for nesting by bald eagles averaged about 13 m tall with the nest built about 8-10 m above ground with sparse branches above the nest as commonly reported in other areas (Hensel and Troyer 1964, Lehman 1978). Nests on the Kenai Peninsula appear to be constructed from cottonwood and aspen sticks with a grass lining which is consistent with what Hensel and Troyer (1964) reported on Kodiak Island. The average age of 23 trees in stands at 8 measured nest sites was approximately 133 years which is slightly older than the approximate 100 year-old average for the mature forest in the same region (J. Lewandoski, personal communication*). The fire history of the Kenai Peninsula (Spencer and Hakala 1964) which resulted in large areas of regrowth vegetation has undoubtedly influenced nest tree selection by the resident bald eagle population. Approximately 160,000 ha, 35 percent of the refuge's boreal forest, has burned in the past 40 years and has resulted in the loss of bald eagle nesting trees. The absence of eagle nests along most of the Swanson River and portions of the Moose River system can most likely be attributed to loss of old age trees by fire. Eagle nests in the burn areas are found in mature stands that escaped extensive fire damage.

The distribution of eagle nests on the refuge shows a pattern which suggests that nesting bald eagles prefer areas near streams that are clear, slow moving, relatively shallow, are used by spring spawning fish, and have fall salmon runs. The Moose River drainage contains the highest concentration of nests (25 percent) of any single river system on the refuge. One factor that sets the Moose River system apart from other river systems on the refuge is the concentration of nearby lakes. These lakes are clear, with a majority having abundant fish populations. Few nests are located near silty lakes since fishing success is lower with any factor that affects fish visibility (Grubb 1977). Lakes near the Moose River are often

*Jim Lewandoski, Forester, Kenai National Wildlife Refuge, P. O. Box 2139, Soldotna, Alaska, 99669

surrounded by strips of mature trees and small knolls. This protection probably adds to the lakes' attractiveness to eagles since the effect of wind on the water is cut down, which increases fishing success (Grubb 1977), and there are numerous perching trees from which eagles can sit and hunt without expending energy flying. It is possible that these types of lakes may provide fish for eagles where there are no spawning fish in the streams. This hypothesis is supported by the fact that 60 percent of all known eagle nests are within 1 km of a lake and about 90 percent of all known nests on the Kenai are located in areas with numerous clear fish producing lakes. Lehman (1978) reported that 77 percent of all nest sites in California were associated with reservoirs while 18 percent were located on natural lakes and only 12 percent were on rivers or creeks. It was unclear whether eagles selected to nest by reservoirs or if they had previously selected creeks and remained after reservoirs were built. However, his data does indicate that eagles nested successfully, utilizing lake habitat almost exclusively.

Productivity

Two years of data on the productivity of bald eagles on the refuge suggests eagle production was comparable to other areas in Alaska and above that reported from other areas in North America (Sprunt et al. 1973). In 1979 the average active nest produced one eaglet while in 1980 each active nest produced 1.4 eaglets. The average eaglet production per active nest was between 0.6 and 1.4 for Kodiak Island (Hensel and Troyer 1964), and 1.4 to 1.6 eaglets per active nest in southeast Alaska (Robards and King 1966, Corr 1974). These data indicate eaglet production per active nest on the Kenai may be comparable or slightly below that found in other Alaskan populations. Nesting success in other areas of North America was often lower than one eaglet per active nest (Sprunt et al. 1973) while nests on the Kenai have been producing an average of over one eaglet per active nest.

Other indices of eagle nesting success on the Kenai are similar to those found on Kodiak Island (Hensel and Troyer 1964) and in southeast Alaska (Corr 1974). Seventy-eight percent of known eagle nests were active in 1980 while 77 percent were active in 1979. In 1979, 72 percent of the active nests produced eaglets with 66 percent, 26 percent, and 6 percent of the successful nests fledging one, two, and three eaglets respectively. In 1980, 78 percent of the active nests produced eaglets with 27 percent, 66 percent, and 5 percent of the nests having one, two, and three eaglets respectively. Apparently 1980 was a better year for eagle production than 1979 since there was a higher number of eaglets produced and a greater number of nests with 2 eaglets. Higher production among various raptor populations is usually associated with increased summer food and the higher reproductive rate in 1980 is assumed to be due to higher food availability in 1980. Apparently food availability effects the number of eaglets surviving to fledge in each nest rather than the number of adult pairs nesting or the percentage of active nests that are successful.

One hypothesis to explain differences in yearly eagle food availability as suggested in 1979 and 1980 may be linked to winter severity. Since breakup in the spring of 1980 was earlier than in 1979, it may have made

both lake and stream fish populations vulnerable to eagle predation earlier in the spring. Postupalsky (1967) commented that he believed winter severity had an impact on the reproductive success of eagles and the comparison between 1979 and 1980 on the Kenai Peninsula could be interpreted as supporting that theory.

By arbitrarily separating bald eagle nests into two categories, those probably experiencing some human disturbance and those probably having little human disturbance, the impact of human activity on bald eagle nest use and productivity was examined. Of 13 nests in locations probably experiencing disturbance, only 3 (23 percent) produced eaglets in either 1979 or 1980, while 16 (88 percent) out of 18 nests probably experiencing little disturbance produced eaglets in either 1979 or 1980. One (8 percent) potentially disturbed nest produced eaglets in both 1979 and 1980 while 9 (50 percent) nests in undisturbed sites produced eaglets in both 1979 and 1980. This information suggests that bald eagles on the Kenai Peninsula are susceptible to human disturbance and that eagles will not reproduce as successfully in areas of high human activity as they will in more remote sites. Hensel and Troyer (1964) reported that nest abandonment was a major factor in influencing nesting success on Kodiak Island and Robards and King (1966) suggested that human harassment is a factor influencing nest location in southeast Alaska. Corr (1978) also commented on bald eagle nest abandonment and suggested that disturbance during egg laying and incubation may have been important reasons for nest abandonment. Most of the human activity classified as disturbance in this paper is occasional recreational use such as boating, canoeing, and camping rather than development-oriented. A majority of the human activity on the refuge occurs from the end of May to late September and coincides with bald eagle incubation and rearing activities.

Food Habits

Although specific bald eagle food habits information was not collected on the Kenai, it is generally assumed that fish comprise a major portion of their summer diet, particularly salmon, since a majority of the nests are along salmon streams. Grubb and Hensel (1978) suggested that bald eagles are opportunistic feeders and several observations from the Kenai support that observation. Bald eagles have been known to take snowshoe hares (Lepus americanus), gulls (Larus spp.), and are commonly observed feeding on moose (Alces alces) carrion in the winter. Carrion may be an important winter food source for eagles overwintering on the refuge since eagles are often reported caught by trappers using exposed baits. Limited information obtained from refuge trapping permits from 1972 through 1976 indicated an average of 6.5 eagles were reported captured each year but 80 percent were released unharmed. The actual capture rate is probably much higher than reported here since many trappers might be hesitant to report capturing an eagle. Since fish are largely unavailable during the winter, small game hunting and scavenging probably play an important part in eagle food habits during the winter months.

CONCLUSION

Bald eagle nest location and nest tree selection on the Kenai National Wildlife Refuge is typical of the locations and type of trees selected in other areas. The nest tree is generally an older living member of the dominant overstory that is near water. Eagles tended to pick trees that were near slow moving, clear streams which are used by spawning salmon in the fall, spawning trout in the spring, and are near clear, fish-producing lakes.

Eagle productivity on the refuge appears comparable to or slightly lower than other areas in Alaska, while higher than that reported in the Continental United States. There appeared to be a large yearly variation in eaglet production which was probably food-related. The amount of human disturbance appeared to negatively influence the nesting use and reproductive success of eagles.

Bald eagles appear to be dependent on fish, particularly salmon, as an important part of their summer diet. Eagles were observed to hunt and scavenge both in the summer and the winter. The number of eagles caught by trappers indicates carrion may be an important food source during the winter. The food habits of bald eagles on the refuge could best be described as opportunistic.

LITERATURE CITED

- Corr, P. O. 1974. Bald eagle (Haliaeetus leucocephalus alaskanus) nesting related to forestry in southeastern Alaska. M.S. Thesis, Univ. Alaska, Fairbanks. 144 p.
- Grier, J. W. 1977. Quadrat sampling of a nesting population of bald eagles. J. Wildl. Manage. 41(3):438-443.
- Grubb, T. R. 1977. Why Ospreys hover. The Wilson Bulletin 89(1):149-150.
- Grubb, T. C. and R. J. Hensel 1978. Food habits of nesting bald eagles on Kodiak Island, Alaska. Murrelet. Summer:70-72.
- Hensel, R. J. and W. A. Troyer 1964. Nesting studies of the bald eagle in Alaska. Condor 66(4):282-286.
- Lehman, R. N. 1978. An analysis of habitat parameters and site selection criteria for nesting bald eagles in California. Part 1. U.S. Forest Service, Region 5, San Francisco, CA mimeo. 34 p.
- Murie, O. J. 1940. Food habits of the northern bald eagle in the Aleutian Islands, Alaska. Condor 42(4):198-202.
- Postupalsky, S. 1967. Reproductive success and population trends in the bald eagle in Michigan. Unpublished ms. Univ. of Michigan Biological Station, cited from Sprunt et al. 1973.
- Robard F. C. and J. G. King 1966. Nesting and productivity of bald eagles southeast Alaska. U.S. Bureau Sport Fisheries and Wildlife. Juneau, Alaska. 14 p.
- Spencer, D. L. and J. B. Hakala 1964. Moose and fire on the Kenai. Proc. 3rd Tall Timbers Fire Ecology Conf. 33 p.
- Sprunt, A. IV, W. B. Rovertson, Jr., S. Postupalsky, R. J. Hensel, C. E. Knoder, and F. J. Ligas 1973. Comparative productivity of 6 bald eagle populations. Trans. N. Amer. Wildl. and Nat. Res. Conf. 38:96-106.
- Troyer, W. A. and R. J. Hensel 1965. Nesting and productivity of bald eagles on the Kodiak National Wildlife Refuge, Alaska. Auk. 82(4):636-638.