NOTES ON GOLDEN EAGLE PRODUCTIVITY AND NEST SITE CHARACTERISTICS, PORCUPINE RIVER, ALASKA, 1979-1982

by
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Abstract

Nesting Golden Eagles were observed along the Porcupine River, Alaska between 1979 and 1982. Thirty-seven nests were described in relation to exposure, height, substrate, and productivity. Nest sites were generally oriented S or SE (57%) and except for one tree nest, occurred on large cliff faces. The number of active nests ranged from 3 in 1980 to 9 in 1982. Active nests in 1982 were spaced an average of 15.3 km apart. Productivity for all three years averaged 1.5 young per successful nest. Incubation probably occurs as early as mid April. Prey at nests varied and included hare, ground squirrel, and muskrat. Comparisons with other Golden Eagle populations in North America are presented.

Introduction

The Golden Eagle, *Aquila chrysaetos*, is a locally common raptor in mountainous regions of Alaska. Nest sites in northern and interior Alaska have been inventoried during petroleum industry investigations, Peregrine Falcon surveys, and other raptor censuses (i.e., Ritchie 1977; White *et al.* 1977). Aspects of the species breeding biology are scattered in these survey reports and miscellaneous published notes (Hobbie and Cade 1962; Campbell 1960; Hatler 1974; Bailey 1979).

Nesting activities of Golden Eagles were observed along the Porcupine River, Alaska, between 1979–1982. Data on productivity, nest site characteristics, food habits and estimated phenology were gathered. This paper summarizes these data previously reported in 4 unpublished reports to the U.S. Fish and Wildlife Service (Curatolo and Ritchie 1979; Ritchie and Curatolo 1980, 1981; Ritchie 1982).

Study Area

The study area consisted of the Porcupine River and adjacent cliffs, bluffs, and lowlands between the Alaska-Yukon Territory border and John Herbert Village, a distance of approximately 145 km. The river crosses the Porcupine Plateau region of the Northern Plateau Province (Wahrhaftig 1965) creating numerous riparian cliffs. Elevations range from 200 m to 600 m.

Vegetation has been markedly influenced by fire. Nearly the entire study area has been burned within the past 25 years. Fires have created a mosaic of aspen, *Populus tremuloides*, birch, *Betula papyrifera*, and spruce, *Picea* spp. South slopes also contain large tracts of grass and sagebrush, *Artemisia* spp. Gravel bars, islands, and north-facing slopes are covered with willow, *Salix* spp. and alder, *Alnus rubra*.

The Porcupine River has had a history of use as a transportation corridor for aboriginal settlements and trade. Human use today is predominantly low density recreation and trapping.

Methods

Surveys were made by boat on the Porcupine River between late June and mid-July in all study years. In 1979 all cliff habitat was checked for eagle nests with binoculars and/or spotting scopes. Nest sites were mapped on U.S. Geological Survey 1:63,360 topographic maps and surveyed for occupancy and productivity dur-

ing all 4 years. Nest sites were described in relation to their exposure, substrate, activity, and productivity. Productivity was described as the number of large nestling (3 to 6 weeks old) per nest. Seven nestlings were banded in 1981; eleven young were banded in 1982. Estimates of nesting phenology were made assuming that incubation and nestling stages were roughly 40+ and 65+ days, repectively (Brown 1976). Prey remains were collected and identified at 4 nests in 1981, and 8 nests in 1982.

Results and Discussion

Thirty-seven nests were located between 1979–1982. During 1980 1 nest was destroyed and 2 were constructed. Thirty-six nests were located on sheer cliffs and pinnacles, accessible only by rope. They ranged from approximately 20 m–125 m above the river. One additional nest was located in a white spruce, *Picea glauca*. Although Golden Eagles regularly nest in trees in other parts of their North American range (Dixon 1937; McGahan 1968; Beecham and Kochert 1975), records of nests in trees are limited in Alaska (White 1974, unpubl. notes). All but two nests were large and obvious masses of branches; these were inconspicuous and situated on broad rock ledges, similar to a site described by Campbell (1960) in the Brooks Range.

Thirty-one (84%) nests were within 100 m of the river. The remaining 6 (16%) were on cliffs fronted by wooded terraces but still within 400 m of the river. Twenty-one (57%) nests were oriented in a south or southeastern direction (Figure 1). These orientation data are similar to those of Mosher and White (1976) who found that Alaskan nest sites generally faced southeast. They hypothesized that this exposure was explainable on the basis of temperature-dependent nest site selection by cliff-nesting Golden Eagles.

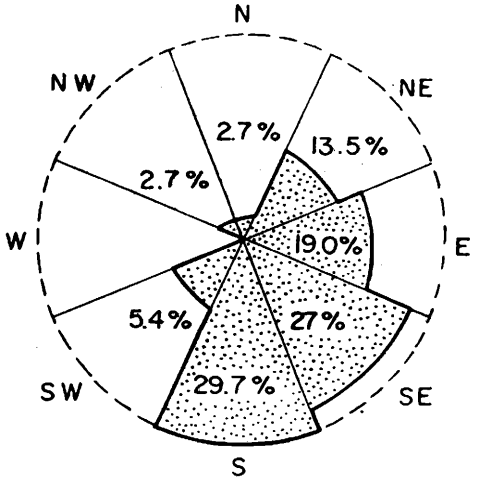

Figure 1. Compass orientation of Golden Eagle nest sites, Porcupine River, Alaska, 1979–1981.

Productivity in the study area ranged from 1.3 young per successful nest to 1.6 young per successful nest between 1979 and 1982. Productivity averaged 1.5 young per successful nest, (Table 1). Golden Eagle productivity data for other regions in Alaska are limited: 1.8 yg per successful nest for an area adjacent to the Trans-Alaska Pipeline (n=10) (White 1974); 1.7 yg per successful nest in the northwestern foothills of the

Table 1. Productivity of Golden Eagles, Porcupine River, Alaska, 1972-1982.

Year	Number of Young	Number of Successful Nests	Number of Young per Successful Nests	Number of Nests With 1 yg	2 yg	3 yg
1979	7	5	1.40	3	2	0
1980	4	3	1.33	2	1	0
1981	12	8	1.50	5	2	1
1982	14	9	1.60	5	3	1

Brooks Range (n = 10) (Ritchie 1977); and 1.6 yg per successful nest in the Mt. McKinley area (n = 8) (Murie 1944).

The timing of our surveys precluded a determination of early nestling loss characteristic of eagles. Instead, nestling numbers may more closely approach the number of young fledged. In other North American studies mean brood size per successful nest decreased from 1.8 to 1.6 between hatching and fledging in Idaho (Beecham and Kochert 1975) and Montana (McGahan 1968).

Seven nestlings were banded in 1981. There was as much as 4 or 5 weeks difference in nestling ages. The breeding phenology in 1981, based on all nestlings observed, was estimated as follows: onset of laying (10 April to 15 May); hatching (25 May to 25 June); and, fledging (25 July to 1 September). In 1982 all hatching had probably occurred by mid-June. Most pairs were probably incubating by late April in 1981 and 1982. Dixon (1938) recorded eagles on eggs as early as 8 April and Campbell (1960) estimated that eagles in the central Brooks Range must incubate as early as the end of April or early May, and that hatching probably occurs in early June.

Golden Eagles are early spring migrants in interior Alaska and have been observed in mid-March in the Brooks Range (Irving 1960, unpubl. notes). Bent (1961) recorded them as occasionally wintering in western Alaska and late winter records elsewhere in the state support this premise (D. Gibson, pers. comm.). A local trapper observed them in late February in the study area in 1981 (R. Carrol, pers. comm.).

Successful nests ranged from 2–59 m apart in 1982, a mean linear density of one pair per 15.3 km of river. Beecham and Kochert (1975) located pairs at 5 and 8 km intervals on an Idaho river in two different years. Nests on the Tanana River, Alaska averaged one pair per 13.5 km (unpubl. notes). The lower density in our study is partly due to one section of river which does not have suitable cliff habitat (ca. 40 km) as well as lower eagle numbers.

Ten prey species were identified in nests in 1981 and 1982; their frequency of occurrence is listed in Table 2. Varying hare (*Lepus americanus*) and Arctic ground squirrel (*Citellus parryi*) predominated in both years. Only the pike, *Esox lucius*, a common fish in the Porcupine River, has not been recorded in northern Golden Eagle nests. Other fish species, however, have been identified at North American Golden Eagle nests (Olendorff 1976).

Besides those species listed above, food items at nests in Alaska have included marmot, *Marmota caligata* (Murie 1944; unpubl. notes), microtines and ptarmigan, *Lagopus* spp. (Murie 1944; Hatler 1974), short-tailed weasel, *Mustela ermina*, Gray Jay, *Perisoreus canadensis*, Harlequin Duck, *Histrionicus histrionicus* (Hatler 1974), caribou, *Rangifer tarandus*, Dall sheep, *Ovis dalli* (Murie 1944), murres, *Uria* spp. (Swartz 1966;

Table 2. The occurrence of potential prey species in Golden Eagle nests, Porcupine River, Alaska, 1981 and 1982.

Prey Species	1981 Number	1981 %	1982 Number	1982 %	Combined Number	Combined %
Varying hare *Lepus americanus*	11	55.0	28	60.8	39	59.1
Arctic ground squirrel *Citellus parryi*	8	40.0	10	21.7	18	27.3
Muskrat *Ondatra zibethicus*	1	5.0	2	4.3	3	4.5
Yellow-cheeked vole *Microtus xanthognathus*			1	2.2	1	1.5
Marten *Mustela americana*			1	2.2	1	1.5
Unidentified duck *Anas* spp.			1	2.2	1	1.5
Herring Gull *Larus argenatus*			1	2.2	1	1.5
Unidentified passerine			1	2.2	1	1.5
Northern Pike *Esox lucius*			1	2.2	1	1.5
	20	100	46	100	66	100

Drury 1977, 1978; Springer and Roseneau 1978), and kittiwakes, *Rissa* spp. (Drury 1978). All of these species, with the exception of seabirds, are probably available to Golden Eagles along the Porcupine River during breeding season.

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Literature Cited

Bailey, E. 1979. Discovery of a Golden Eagle nest on the Alaska Peninsula. *Condor* 77:207–208.

Beecham, J. and M. Kochert. 1975. Breeding biology of the Golden Eagle in southwestern Idaho. *Wilson Bull.* 87:506–513.

Bent, A. C. 1961. Life histories of North American birds of prey. Part 1. Dover Publications, Inc. New York. 409 pp.

Brown, L. 1976. Eagles of the world. Douglas David and Charles Limited, Canada. 224pp.

Campbell, J. M. 1960. Nesting of the Golden Eagle in the central Brooks Range of arctic Alaska. *Condor* 62:298.

Curatolo, J. and R. J. Ritchie. 1979 Peregrine Falcon banding on the Porcupine River, Alaska, 1979. Unpubl. report to U.S. Fish and Wildl. Serv., Endangered Species Office, Anchorage, AK. 28pp.

Dixon, J. B. 1937. The Golden Eagle in San Diego County, California. *Condor* 39:49–56.

Dixon J. S. 1938. Birds and mammals of Mount McKinley National Park, Alaska. Fauna of the National Parks of the United States, Fauna Series No. 3. 236 pp.

Drury, W. H. 1977. Birds of coastal habitats on the south shore of the Seward Peninsula, Alaska, pp. 1–178. *In*: Environmental Assessment of the Alaskan Continental Shelf, annual reports of principal investigators. NOAA OCSEAP. Vol. 3.

Drury, W. H. 1978. Ecological studies in the northern Bering Sea; birds of coastal habitats on the south shore of the Seward Peninsula, Alaska, pp. 510–613. *In*: Environmental Assessment of the Alaskan Continental Shelf, annual reports of principal investigators. NOAA OCSEAP. Vol. 2.

Hatler, D. 1974. Food at a Golden Eagle nest in central Alaska. *Condor* 76:356–357.

Hobbie, J. E. and T. J. Cade. 1962. Observations on the breeding of Golden Eagles at Lake Peters in northern Alaska. *Condor* 64:235–237.

Irving, L. 1960. Birds of Anaktuvuk Pass, Kobuk, and Old Crow. U.S. Nat. Mus. Bull. 217. 409 pp.

McGahan, J. 1968. Ecology of the Golden Eagle. *Auk* 85:1–12.

Mosher, J. A. and C. M. White. 1976. Directional exposure of Golden Eagle nests. *Can. Field Nat.* 90:356–359.

Murie, A. 1944. The wolves of Mount McKinley. Fauna of the National Parks of the U.S., No. 5. 238 pp.

Olendorff, R. R. 1976. The food habits of North American Golden Eagles. *Amer. Midl. Nat.* 95:231–236.

Ritchie, R. 1977. Inventory and evaluation of, and recommendations for, cliff-nesting raptor habitat in Naval Petroleum Reserve–Alaska (NPR-A). Unpubl. report U.S. Fish and Wildl. Serv., Anchorage, AK. 88 pp.

Ritchie, R., and J. Curatolo. 1980. Peregrine Falcon banding on the Porcupine River, Alaska, 1980. Unpubl. report to U.S. Fish and Wildl. Serv., Endangered Species Office, Anchorage, AK. 26 pp.

Ritchie, R. and J. Curatolo. 1981. The status of Peregrine Falcons and other raptors along the Porcupine River, Alaska, 1981. Unpubl. report to U.S. Fish and Wildl. Serv., Endangered Species Office, Anchorage, AK. 36 pp.

Ritchie, R. 1982. The results of raptor surveys along the Porcupine River, Alaska, 1982. Unpubl. report to U.S. Fish and Wildl. Serv., Endangered Species Office, Anchorage, AK. 25 pp.

Springer, A. M. and D. G. Roseneau. 1978. Ecological studies of colonial seabirds at Cape Thompson andr Cape Lisburne, Alaska, pp. 839–960. *In*: Environmental Assessment of the Alaskan Continental Shelf, annual reports of principal investigators. NOAA OCSEAP. Vol. 2.

Swartz, L. G. 1966. Sea cliff birds, pp. 611–678. *In*: N.J. Wilimovsky and J.N. Wolfe (eds.). Environment of the Cape Thompson region, Alaska. U.S. Atomic Energy Commission, Springfield, Virginia.

Wahrhaftig, C. 1965. Physiographic divisions of Alaska. U.S. Geological Survey Professional Paper No. 482. 52 pp.

White, C. M. 1974. The 1974 raptor survey of the Alaska Pipeline between Franklin Bluffs and Big Delta. Unpubl. interim rep. to U.S. Fish and Wildl. Serv., Anchorage, AK. 10 pp.
White, C. M., T. D. Ray, and L. W. Sowl. 1977. The 1970–1972–1974 raptor surveys along the Trans-Alaska Oil Pipeline. pp. 199–221. *In*: Chancellor, R.D. (ed.). World Conference on Birds of Prey, Report of the Proceedings. International Council for Bird Preservation. 440 pp. + appendices.

SPATIAL RELATIONSHIPS OF NESTING GOLDEN EAGLES IN CENTRAL UTAH

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Abstract

We examined the distribution of Golden Eagle (*Aquila chrysaetos*) nest sites in the eastern Great Basin using the Clark-Evans nearest-neighbor method of analysis. Distribution values indicated uniform spacing of nest sites within the hills and ridges, which provided all of the potential nesting sites in the study area. Analysis of Golden Eagle nest site distribution with three other large raptors suggested a tendency toward uniform spacing between diurnal raptor species and aggregation with the Great Horned Owl (*Bubo virginianus*).

Introduction

Odum (1971) suggested that populations exhibit one of three distribution patterns: (1) random, where habitat is homogenous and individuals do not normally interact; (2) uniform, where habitat is homogenous and individuals compete for one or more resources; (3) aggregated, that may result from either heterogenous habitat or a tendency to aggregate socially. Newton (1979) noted that many species exhibit uniform distribution of territories and nest sites except where available sites are limited and concentrated, such as in the Snake River Birds of Prey Natural Area. Our observations of Golden Eagles in the eastern Great Basin Desert revealed a concentration of nest sites in high, north-south oriented ridges and hills but none in intervening broad, flat valleys. Herein we examine this distribution using the Clark-Evans nearest-neighbor model (1954).

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