# ACTIVITY PATTERNS OF BALD EAGLES WINTERING IN SOUTH DAKOTA[1]

by
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*Abstract*

Observations of Bald Eagles (*Haliaeetus leucocephalus*) wintering along the Missouri River floodplain in South Dakota showed that weather strongly influenced eagle activity patterns. Feeding activity peaked at $-5°$ to $0°$ C and dropped significantly when wind speeds exceeded 20 km/h. Reduced feeding activity during unfavorable weather conditions apparently provided energy savings for eagles. Findings are consistent with theories of optimal time and energy allocation.

## *Introduction*

The influence of weather on avian foraging activity is an important component of avian energetics (Schoener 1971). Rough-legged Hawk (*Buteo lagopus*) activity, for example, is strongly linked to weather conditions (Schnell 1967). Under certain weather conditions, both the success and frequency of Osprey (*Pandion haliaetus*) fishing efforts decline (Grubb 1977), and American Kestrel (*Falco sparverius*) activity apparently decreases with high winds and low temperatures (Enderson 1960). Similar effects would be expected for the Bald Eagle, and the impact should be especially critical during cold winter months when shorter days decrease the amount of foraging time available. Energetic considerations are important in the ecology of wintering Bald Eagles. Stalmaster (1981) has argued that eagles are "time minimizers" (Schoener 1971), restricting their flight and feeding time to optimize fitness. This paper examines the proportion of a wintering population engaged in feeding and foraging under different weather conditions and provides additional evidence that Bald Eagle foraging strategies minimize energy expenditure during winter.

## *Methods*

Daily activity patterns of Bald Eagles were observed from November to March in 1974-75 and 1975-76 from three observation points on a 30 km$^2$ section of the Missouri River floodplain below Fort Randall Dam, South Dakota. In all, 8848 eagle sightings were recorded and categorized by activity. Weather conditions within 3 h of each observation were obtained from the Pickstown, South Dakota weather station, 1 km from the Fort Randall Dam. Eagles were considered "feeding" if they were observed consuming food or actively foraging from a

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perch. I defined "food-searching" eagles as those that were not actively feeding or foraging but were associated with a feeding situation or a potential food source that was being used by other eagles. This category included eagles that were apparently "waiting" for a feeding opportunity (Stalmaster 1981). Eagles on the floodplain fed primarily on gizzard shad (*Dorosoma cepedianum*), goldeye (*Hiodon alosoides*), white bass (*Roccus chrysops*), and carp (*Cyprinus carpio*) (Steenhof 1976). Based on population counts throughout both winters, I estimated that at least 500 different individuals were observed during the study. I was unable to observe roosting activity of eagles in the floodplain communal roost, but on 20 days, I watched eagles departing from a communa roost near Lake Andes, approximately 10 km from the floodplain.

## *Results*

Most eagles left the communal night roost in the half hour immediately before sunrise, although some stayed in the vicinity of the roost during the day. Times of earliest observed departures from the roost ranged from 13 to 38 minutes before sunrise ($\overline{x}$ = 27 minutes before sunrise, s.d. = 5.2). In general, eagles moved directly from the roost to feeding areas.

The percent of birds observed feeding and food-searching was significantly higher ($X^2$ = 239, $P < .05$) in the first 6 h after sunrise than later in the day (Figure 1). As in Stalmaster's

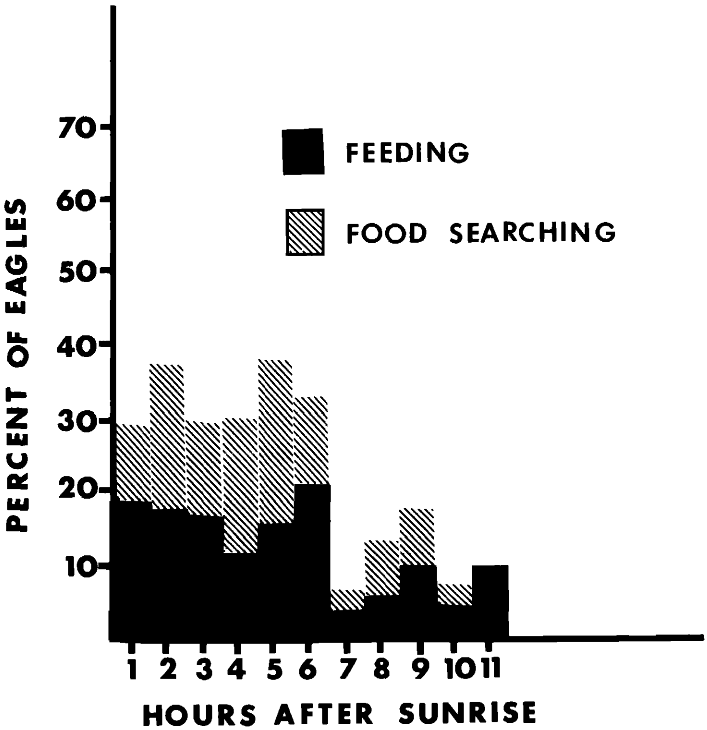


Figure 1. Percent of observed Bald Eagles feeding and food-searching in South Dakota in relation to time of day, 1974-76.

(1981) study, the bimodal pattern in feeding schedules described by Grewe (1966) and Servheen (1975) was not apparent. Increased morning feeding was probably due to daily variations in food availability (Steenhof 1976) as well as increased hunger in the morning (Stalmaster 1981).

The proportion of feeding and food-searching eagles peaked when temperatures were −5° to 0° C. and decreased with both higher and lower temperatures (Figure 2). Although this relationship was confounded by typically cold temperatures at preferred morning feeding times, the pattern persisted when morning and afternoon periods were considered separately (Figure 2). Warner and Rudd (1975) observed that hunting by Black-shouldered Kites (*Elanus caeruleus*) increased with decreasing ambient temperatures, and Fevold and Craighead (1958) showed that food consumption by a captive Golden Eagle (*Aquila chrysaetos*) increased with decreasing air temperatures. The ambient temperatures during this study, however, were colder than during the Golden Eagle and kite studies. Foraging at extremely cold temperatures may yield a net energy loss. Hayes and Gessaman (1980) calculated that American Kestrels could conserve up to 15% of their winter daily energy requirement by restricting activity at cold temperatures. Although this savings would be much less in the larger eagle, it may explain the observed foraging patterns.

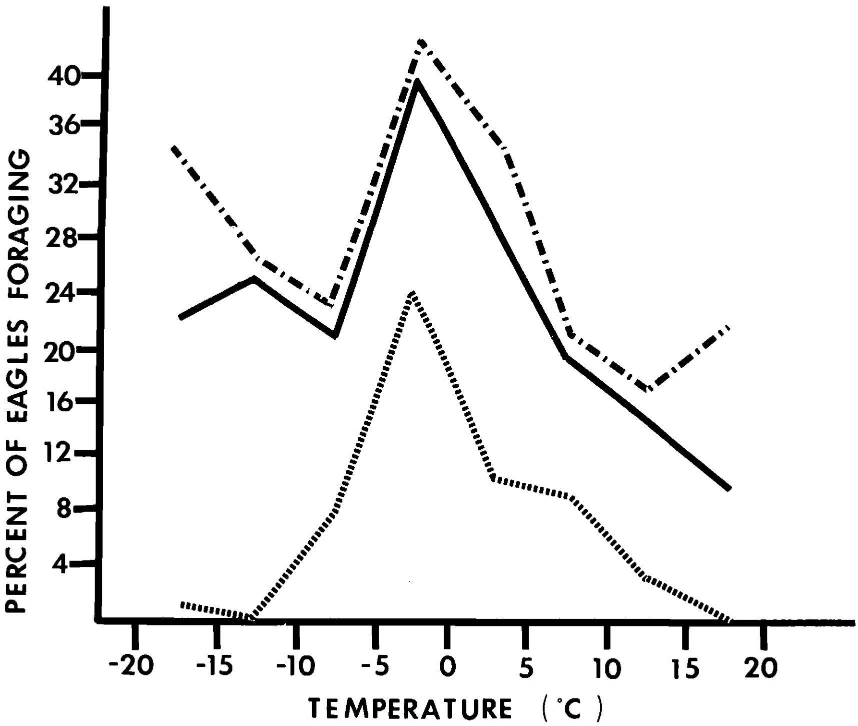


Figure 2. Percent of observed Bald Eagles feeding and food-searching in South Dakota in relation to temperature and time of day, 1974-76. The top line represents eagles observed less than 6 h after sunrise; the middle line represents all eagles observed; and the bottom line shows eagles seen more than 6 h after sunrise.

Wind velocity also influenced eagle feeding activity (Figure 3). The proportion of feeding and food-searching eagles was highest when wind speeds were 15-20 km/h, and the proportion dropped significantly ($X^2 = 45.2$, $P < 0.05$) when winds exceeded 20 km/h. Ueoka (1974) suggested that wind speeds of 8 to 15 km/h are optimal for Osprey maneuverability, and Grubb (1977) noted decreased fishing efficiency by Ospreys above 15 km/h. Wind speeds probably affect Bald Eagles similarly, and eagles apparently can save energy by not foraging when wind conditions reduce fishing efficiency. Kites apparently use this strategy, because Bammann (1975) noted that they did not hunt when winds exceeded 40 km/h. On the South Dakota study area, Bald Eagles did not leave the communal roost during a severe 2-day windstorm when winds gusted to 80 km/h. The roost was protected from the wind and afforded shelter to the eagles (Steenhof et al. 1980).

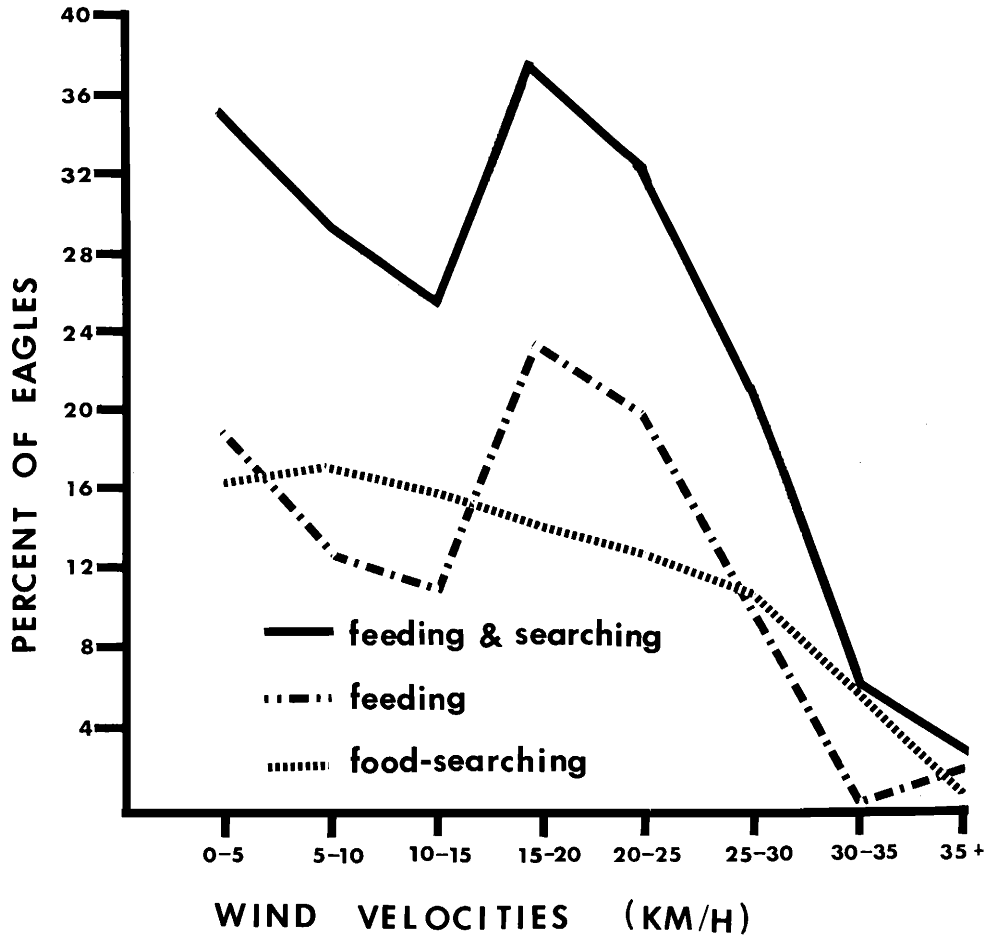


Figure 3. Percent of observed Bald Eagles feeding and food-searching in South Dakota in relation to wind velocity, 1974-76.

Soaring activity was also clearly influenced by weather. Soaring by eagles was recorded 22 times in 1975 and 1976. As in Preston's (1981) study of Red-tailed Hawks (*Buteo jamaicensis*), the incidence of soaring appeared to be related more to wind velocities than time of day, season or wind direction. Eagles soared during all months of the study, at all times of day, and during most prevailing wind directions. Wind velocities during soaring observations ranged from 7.4 to 25.9 km/h, with 82% of all soaring activity occurring in velocities between 12.9 and 22.2 km/h. Although these velocities are the same as those apparently preferred for foraging, the optimal conditions for these two activities apparently are not identical. Stalmaster (1981) noted that soaring by eagles in Washington was most common during warm periods. In this study, more than 70% of all soaring occurred when temperatures exceeded 0° C., the temperature above which foraging activity declined.

The data indicate that weather conditions strongly influence Bald Eagle feeding activity, and the findings are consistent with theories of optimal time and energy allocation (Schoener 1971). As colder temperatures raise energy demands, eagle foraging increases. At approximately −5° C., however, the benefit/cost ratio apparently does not favor foraging, and eagles begin to restrict feeding activity. Eagles also apparently reduce energy expenditures by not foraging when wind reduces foraging efficiency. Stalmaster (1981) estimated that eagles could survive for 2-3 days during winter without feeding. Thus, only unusually persistent severe storms would make this strategy of restricted feeding ineffective.

## *Acknowledgments*

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## MOUSE TRAP RECOVERED IN HARRIER NEST

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An annual vole (*Microtus* sp.) index is an important part of Hamerstrom's study of the Northern Harrier (*Circus cyaneus*) in central Wisconsin (Hamerstrom, F., Auk 96:370-374, 1979). Vole trapping on her study area began in 1964 and 28,911 trap nights have been accumulated by Hamerstrom and her coworkers through 1981. On 4 July 1981 I found evidence that a harrier had stolen a trap.

On 1 July, 120 traps were put out at about 2000 hours. When they were picked up at about 1200 hours 2 July, 1 trap was missing. Tufts of vole hair were found within 10 cm of the missing trap. On 4 July at 0945 hours I visited a harrier nest about 2.2 km from the trap-line. The nest has been deserted within the past 2 days, and an empty sprung trap lay upside down near the center of the nest. I believe it unlikely that the harrier carried an empty trap. It seems reasonable to conclude that the harrier was attracted to the trap by the presence of a vole in it. The vole may have been dead at the time it was taken since in a few instances harriers have been known to feed on carrion (Bent, U.S. Natl. Mus. Bull. No. 167, 1937:86; Randall, Wilson Bull. 52: 165-172, 1940; and Errington and Breckenridge, Am. Midland Nat. 17: 831-848, 1936). It is also possible that the vole may have been alive when the trap was taken because a few live voles have been found in sprung traps in previous years (Hamerstrom pers. comm.).

## PRECOCIOUS NEST DEFENSE BEHAVIOR BY A SHARP-SHINNED HAWK

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On 22 July 1981 we observed 3 fledged Sharp-shinned Hawks (*Accipiter striatus*) in trees within 20 m of their nest in Door County, Wisconsin. They were food-calling (for a description of calls, see Beebe, F.L., Occas. Pap. B.C. Prov. Mus. 17. 163 pp., 1974) and we anticipated the return of an adult with prey for them. To capture adults, we placed a mist net within 3 m of the nest tree and 1 m of a tethered live Great Horned Owl (*Bubo virginianus*) (Hamerstrom F., Proc. Int. Ornithol. Congr. 13: 866-869, 1963). We