Bald Eagles Wintering Along the Des Moines River, Iowa

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DISTRIBUTION, habitat use, and foraging behavior of Bald Eagles (Haliaeetus leucocephalus) wintering in southeast Iowa were studied in January - March 1990 and November 1990 - March 1991. Eagles were seen from November through March with the highest numbers in January and February. Adults had shorter winter residence times than immatures and they appeared to be less active during the day. Eagles concentrated their foraging efforts along certain river segments where they fed exclusively on fish. Timber harvesting along the river reduced eagle use and is considered to be the most serious threat to sustaining eagle use of the area. A roost site was believed to be used because of its proximity to foraging areas.

INDEX DESCRIPTORS: Bald Eagle, behavior, habitat loss, habitat use, Haliaeetus leucocephalus, Iowa, wintering population

The Midwest hosts approximately half of the wintering population of Bald Eagles (Haliaeetus leucocephalus) in the lower 48 states (Gerrand 1986). Most of these eagles congregate along the Mississippi, Missouri, and Illinois rivers (Millsap 1986) where ice-bluffs were dominated by oaks (Carya ovata). Bald Eagles wintering along the Mississippi River in Iowa have been extensively investigated (Southern 1963, 1964; Ingram 1965; Jonen 1973; Fischer 1982; Ross and Schall 1982; Southern et al. 1985; Haverland and Kruse 1988). However, few wintering sites have been identified within the state's interior (Fawks 1961, Spencer 1976) and no wintering studies have been conducted there. This study documents population levels, food habits, habitat use, and feeding behavior of a previously unreported concentration of Bald Eagles wintering along a section of the Des Moines River.

METHODS

The study area was located along a 23 km section of the Des Moines River in southcentral Iowa between Ottumwa and Eldon (Fig. 1). Lowland areas along this section of the river have been mostly cleared of trees and leveled for agriculture. Shoreline stands were typically narrow strips (< 75 m wide) dominated by cottonwoods (Populus deltoides) and willows (Salix spp.); silver maple (Acer saccharinum), hackberry (Celtis occidentalis), and slippery elm (Ulmus rubra) were also common along riverbanks. Upland sites on the eastern bluffs were dominated by oaks (Quercus spp.) and shagbark hickory (Carya ovata). Logging removed shoreline stands along 5 river miles (8 km) during the study.

Weekly censuses were conducted from January through March 1990 (N=10) and from October 1990 through March 1991 (N=24). Eagle distribution, abundance, and behavior were determined by one observer driving (24 - 32 km/hr) a 36-km census route on all-weather roads bordering the river (Fig. 1). The roads were generally within 200 m of the river and about 85% of the shoreline along the route could easily be seen. Brief stops were made at 4 vantage points that permitted censusing roughly another 10% of the river's shoreline. In both years, these surveys ended 2 weeks after the last eagles were seen.

Censuses were conducted between 0800-1600 hr under various weather conditions, excluding days of limited visibility. Census time was limited to 2 hours to minimize duplicate sightings. If the movement of eagles offered the possibility of duplicate counts, eagles of the same age classes next seen along the route were not recorded.

A variable power (15-60x) spotting scope and binoculars (7x35) facilitated observations. Eagles with white heads and tails were considered adults (Southern 1964). Bald eagles whose ages could not be determined were classified as unknowns.

Behavior and location of Bald Eagles along the river were also recorded. Eagle behavior was divided into flying and perching. Perches were classified by height (below 4, 4 - 8, above 8 m). Perch locations were used to determine feeding areas and annual changes in foraging distributions. Comparison of foraging distributions between years included only those eagles seen on or after 18 January 1991 since censuses began on 19 January 1990.

Observations of eagle flight patterns at sunrise and sunset were used to locate a roost (Lish and Lewis 1975). Fecal material and feathers beneath trees were used to identify favored roost trees. A blind, constructed about 200 m from the principal roosting area, was used to determine the age class and time of eagles entering or leaving the roost. Roost counts were made from January through March 1990 and were within 24 hours of diurnal counts. Observations were made either from 1 hour before sunset until dark or from 1 hour before sunrise until all eagles had left the roost.

RESULTS

Distribution and Abundance

Bald Eagles were seen from November through March with population peaks in mid-January and late February (Fig. 2). The first eagles seen were 4 immatures and 4 adults on 9 November 1990. Numbers of eagles increased erratically through early December and then stabilized through mid-January. In both years, eagle numbers fluctuated during February and were then followed by rapid declines in March. Eagles were last seen on 23 March 1990 (3 adults) and 22 March 1991 (1 adult, 3 immatures).

Figure 1. Study area along the Des Moines River between Ottumwa and Eldon, Iowa.
No difference was seen in the numbers of adults and immatures between January and March 1990 ($\chi^2 = 16.0$, $df = 9$, $p > 0.05$). In 1990-1991, population levels of immatures fluctuated differently than those of adults ($\chi^2 = 62.3$, $df = 12$, $p < 0.001$); however, the only notable difference in age classes was restricted to November when the population was composed mostly of immatures (Fig. 2).

Diurnal Behavior

Diurnal perches were exclusively along riverbanks, and eagles typically used branches above 8 m ($\chi^2 = 67.3$, $df = 2$, $p < 0.001$). No difference in perch-height use was found between adults and immatures ($\chi^2 = 3.81$, $df = 2$, $p > 0.05$).

Eagles perched or flying along the river were not randomly distributed ($\chi^2 = 256.7$, $df = 14$, $p < 0.001$; $\chi^2 = 37$, $df = 14$, $p < 0.001$, respectively). More eagles than expected were seen in both years along river miles 2, 7, 8, and 12 (Fig. 4). In 1990, disproportionately high numbers of eagles were seen in both river miles 2, 3, 10, and 12 than expected; high numbers were seen flying above river mile 4.

Perch distributions of eagles along this section of the Des Moines River differed between 1990 and 1991 ($\chi^2 = 27.33$, $df = 14$, $p < 0.05$). Differences were principally due to seeing more eagles along river miles 1 and 10 in 1990 and river miles 3 and 8 in 1991; this was reflected in marked differences between years in the proportions of eagles seen along these river miles (Fig. 4).

I compared eagle perch use before and after shoreline timber harvesting along 5 river miles within the study area. Fewer eagles were seen in areas where timber harvesting had recently occurred (Wilcoxon signed rank, $w = 15$, $p < 0.05$). Shorelines of river miles 2 and 3 were logged during the fall of 1989 and only 17 eagles were seen perched there in 1990; in 1991, 37 eagles were seen perched along these river miles. River miles 4 and 5, logged during the summer of 1990, experienced marked declines (40 and 55%, respectively) in eagles seen perched there in 1991. Over 15% ($N=104$) of the eagles seen along river mile 10 perched in a grove of large cottonwoods. This stand was logged during the first week of February 1991 and no eagles were seen perched there again.

Where the road was within 50 m of the riverbank, most (80%, $N=226$) eagles were seen perched on the opposite side of the river. No difference in the distribution of observations was seen between years ($\chi^2 = 0.06$, $df = 1$, $p > 0.05$) or between age classes ($\chi^2 = 1.17$, $df = 1$, $p > 0.05$).

Food Habits

Eagles were only seen feeding on fish. Feeding observations ($N=17$) and examination of prey remains under feeding sites ($N=6$) indicated that gizzard shad ($Dorosoma cepedianum$) was the principal food source. A strictly piscivorous diet was further suggested by the lack of pellets beneath roost trees. Only one attempt by an eagle to cap-
ture waterfowl was seen. An immature made two passes over a flock of 15-20 Greater Scaup (Aythya marila) on 3 March 1990; the ducks evaded both attacks by diving.

**Roosting Behavior**

A roost was found on 20 January 1990 along the eastern bluffs in a stand of mixed hardwoods (Fig. 1) at the head of a ravine 2 km from the river. Fecal material and feathers were found beneath five large oaks and two unidentified snags. Eagles also were sporadically seen roosting in large oaks several hundred meters from the principal roost area.

Nine roost counts were conducted in 1990 (Table 1). A high of 22 eagles was recorded on 3 February with most other counts being between 6-10 birds. No eagles were seen in the roost area after 8 March. Adults were the most common age class (69%, N=77) but limited visibility from the blind led to a high percentage (18%) being classified as unknowns. Vocalizations and movements during counts suggested that up to 25% of the eagles roosting in the area could not be seen from the blind. Therefore the estimated numbers of eagles using the roost are conservative.

### Table 1. Numbers of bald eagles observed during roost counts in 1990.

<table>
<thead>
<tr>
<th>Date</th>
<th>Adult</th>
<th>Immature</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 20</td>
<td>16 (86)</td>
<td>0</td>
<td>1 (14)</td>
</tr>
<tr>
<td>January 26</td>
<td>6 (67)</td>
<td>0</td>
<td>3 (35)</td>
</tr>
<tr>
<td>February 3</td>
<td>17 (77)</td>
<td>0</td>
<td>5 (25)</td>
</tr>
<tr>
<td>February 10</td>
<td>4 (33)</td>
<td>4 (33)</td>
<td>4 (33)</td>
</tr>
<tr>
<td>February 16</td>
<td>4 (67)</td>
<td>1 (16)</td>
<td>1 (16)</td>
</tr>
<tr>
<td>February 25</td>
<td>0</td>
<td>5 (30)</td>
<td>5 (30)</td>
</tr>
<tr>
<td>March 3</td>
<td>2 (29)</td>
<td>0</td>
<td>5 (71)</td>
</tr>
<tr>
<td>March 8</td>
<td>4 (67)</td>
<td>0</td>
<td>2 (33)</td>
</tr>
<tr>
<td>March 16</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Comparison of the number of eagles seen along the river with those seen at the roost indicated that eagles must have been roosting elsewhere. The number of eagles at the roost was consistently lower than the number seen along the diurnal census route (paired t = 5.31, p < 0.01; roost counts averaged 10.9 (S. D. ± 5.3) while diurnal counts averaged 32.8 (S. D. ± 12.3)).

**DISCUSSION**

The results of diurnal surveys were not complete censuses of all eagles present along this section of the Des Moines River. Potential biases that could have affected count accuracy included: 1) immatures being less conspicuous than adults (Servheen 1975, Stalmaster and Newman 1978), 2) detectability of perched eagles probably decreased with increased distance from the river, 3) eagles being less likely to be concentrated along the river under certain weather conditions (e.g., high winds, mild temperatures, clear skies), and 4) only 80-90% of the river shoreline was censused.

Eagle arrival time in southeastern Iowa was similar to that of other midwestern wintering populations (Halleran 1960, Johnson 1961, Southern 1963, 1964, Jonen 1973, Steenhof 1978, Havera and Kruse 1988). Gerrard et al. (1978) found that band recoveries and sightings of marked birds supported the belief that some bald eagles return to the same wintering grounds each year. They also noted that older eagles, on average, were found farther south than first-year birds from November through March. The similarity in arrival dates between populations of bald eagles wintering in the Midwest could be due to early fall migrants returning to areas used in previous years.

The high percentage of immatures in early winter along this section of the Des Moines River is also seen in populations of eagles wintering along the Mississippi River bordering Iowa (Jonen 1973, Fischer 1982). This supports the contention that immatures arrive earlier than adults at some wintering sites (Sprunt and Ligas 1966, McCleland et al. 1981, Millspaugh 1986) in the Midwest. Since hatch-year birds tend to lag behind fall migrants (Gerrard et al. 1978), it seems likely that the first Bald Eagles to arrive at Midwest wintering areas were two or three-year-old immatures. Most immatures seen during the study were at least two years old.

Adults composed the bulk of the population in both years. This composition was similar to other wintering concentrations in northeastern Illinois (Southern 1963, 1964, Jonen 1973, Fischer 1982), Missouri (Giffin 1978), North Dakota (Steenhof 1976), and Nebraska (Lingle and Krapu 1986). Acceptable wintering habitat appeared to be limited along this section of the Des Moines River. Scarcenumber shoreline perch sites and long periods of ice cover limited foraging areas. A reliable signal of the availability of food sources nearby to foraging eagles would be the relative density of eagles along a section of river. Both ages of eagles were routinely seen perched and feeding along river miles 7, 8, 10, and 12 (Figure 5), which remained open all winter.

The high correlation between the relative numbers of adults and immatures along the river suggests the potential for competition to exist between age classes at foraging sites. Juveniles are considered to be at a competitive disadvantage with adults in many species of birds (Lack 1954, Ashmole 1963, Oriens 1969, Greig et al., 1983). Foraging efficiency of immature bald eagles is generally believed to be lower than that of adults (Erskine 1968, Giffin 1981, Stalmaster 1984) and Fischer (1982) reports that immatures may take twice as long as adults to capture fish. Ingram (1965) proposed that immatures are forced south by their inability to compete successfully with adults at more northern wintering sites; in Illinois, greater numbers of immature bald eagles are found in southern populations (Sabine 1982).

An alternate explanation for the correlation between age classes along this section of the Des Moines River is that both age classes concentrated where food was most available. Eagles typically used sections of the river where the water was shallow and fast-moving; these areas remained ice-free throughout the winter and fish were probably most available there.

Only casual observations were made at feeding areas and it is unknown if food limited eagle numbers in either year. However, feeding sites became spatially limited during periods of heavy ice cover in January and February. Competition for food between age classes could account for higher proportions of adults seen during these periods. It is also possible that there was little intraspecific competition, and immatures simply made up a small proportion of the wintering population.

The inconspicuous plumage of perched immatures may have led to their underrepresentation in auto counts. Some support for this position was offered by seeing a higher proportion of immatures flying compared to perching. However, immatures may have to fly more often than adults on their wintering grounds because; 1) their need to become familiar with foraging and roosting areas (Harmata 1984, Sabine 1987), 2) they have lower foraging efficiencies than adults (Fischer 1982, Stalmaster and Gessaman 1984), or 3) their lower social position. Immatures could also have been forced to fly more often because access to prime feeding areas was limited by adults (Steenhof 1976). Regardless, although some immatures were probably missed during auto counts, it appears they made up only about 25% of the population.

An increase in the number of adults and immatures occurred in late February and was probably due to the movement of spring migrants through the study area (Fig. 2). Bald Eagles apparently migrate alone (Harmata 1984) and are believed to be initially responding to changes in photoperiod (Brown and Amadon 1968).
Subsequent travel is influenced by weather and food availability (Harmata 1984). The Des Moines River, therefore, appears to be an important stopover area for Bald Eagles during spring migration.

Diurnal perches were similar to perches used by eagles along portions of the Mississippi River bordering Iowa (Southern 1963, 1964, Fischer 1982) and over much of their wintering range (Steenhof 1976, Knight et al. 1979, Stalmaster and Newman 1979). Diurnal perch sites appeared to be limiting along this section of the river. Narrow woodlands bordered most of the shoreline; wider stands were interspersed with camps and homes that had few trees close to the river. The little woodland edge that remained was further reduced by logging.

Eagles typically perch along shorelines that are insulated from human activity (Steenhof 1978, Hansen et al. 1984, Knight and Knight 1984, Sidle et al. 1986), contain tall trees (Steenhof 1976, Stalmaster and Newman 1979), and have ice-free water. The two major sources of human disturbance along this section of the Des Moines River appeared to be motor vehicle traffic and pedestrians. Eagles avoided these activities by perching in insulated or inaccessible areas. However, groups of 3-7 eagles tolerated human activity opposite a group of homes along river miles 7 and 8 (Fig. 4). Eagles tend to tolerate more activity near prime foraging areas (Steenhof 1976, Skagen 1980) and they could have tolerated human activity at this site because energetic gains from feeding outweighed the energetic costs of disturbance (Stalmaster and Newman 1978).

Eagles were seen feeding only on fish even though waterfowl were present throughout the winter. Food habits of eagles along this section of the Des Moines River were similar to eagles wintering along the Mississippi River (Fawks 1961; Southern 1963, 1964, Jonen 1973; Fischer 1982; Ross and Schall 1982).

The upland roost site located during the study is similar to that described by Jonen (1973) at Cedar Glen near the mouth of the Des Moines River. Large oaks and snags were used; they offered the greatest visibility of surrounding terrain and possessed a branching pattern that permitted easy take-offs and landings.

A number of selective factors have been implicated in the evolution of communal roosting in Bald Eagles (Keister and Anthony 1983, Knight and Knight 1984, Stalmaster and Gessaman 1984), but one principal influence is habitat availability. Several studies suggest wintering eagles roost close to their feeding grounds (Southern 1963, Lish and Lewis 1975, Ross and Schall 1982, Sabine 1982, Keister and Anthony 1983). Most of the floodplain bordering this section of the Des Moines River has been developed and no large stands of trees were found there. The ravine may have been the closest area to the river with habitat acceptable to roosting eagles.

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