OBSERVATIONS OF WINTERING GOLDEN EAGLES

IN NOBLE COUNTY, OKLAHOMA

By

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PREFACE

I wish to express my sincere appreciation to my major adviser, L. Herbert Bruneau, Professor, School of Biological Sciences, for his guidance, suggestions, and assistance in the preparation of this report.

I express my gratitude to the members of my graduate committee, Becky B. Johnson and Helen Miller, Associate Professors, School of Biological Sciences, for their assistance in preparing this report. I also wish to thank James Lish for his suggestions, helpful comments, and confirming golden eagle age classes in the field.

Special thanks is extended to the many landowners who provided access to the study areas, to Ann Redelfs who helped in the preparation of the manuscript, and to my wife, Lynne, for her patience and support during this study.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Each winter, from 1976 to 1978, I observed a small population of golden eagles (*Aquila chrysaetos*) in Noble County, Oklahoma. Apparently, golden eagle activity in this county is not well documented (Sutton 1967). Baumgartner and Powell (1948) considered the golden eagle a "Rare winter visitant" in Payne County (just south of Noble County) after sighting only one eagle between March 1939 and September 1946. Sutton (1967) considered eagles "Abundant winter residents" at Salt Plains Wildlife Refuge, 90 miles east of the study area, and the nearest area cited by Sutton having numerous wintering eagles.

A general survey conducted during the winter of 1976-77 provided me an opportunity to become adept in identifying the various age classes and locating areas most frequented by eagles. During the winters of 1977-78 and 1978-79, most of my time was spent observing the activities of what appeared to be a mated pair of adult eagles wintering together.

The study area is part of a large geomorphic province known as the Central Redbed Plains, an area described in detail by Duck and Fletcher (1943). Sandstone outcroppings are the most divergent physiographic feature and are common on the hilltops of this area. The principle flora includes the dominant tall grass prairie and open flood plain woodland species. The study area covers approximately 80 km square. Observations were made using a 20X60 spotting scope and 10X50

binoculars. All observations were recorded in a field notebook.

CHAPTER II

RESULTS

Age Structure of the Population

The observed age classes in golden eagles were similar to those golden eagles described by Jollie (1947). These age classes were confirmed by an alternate experienced observer and by comparing them to captive eagles of known age. I placed eagles into three groups: adult, immature, and juvenal. Eagles having a completely dark tail without white basal areas on the rectrices were classed as adults. Those having the characteristic first year plumage with a white tail and black terminal band were classed as juvenals. All intermediate plumages were classed as immatures. The adult and immature eagles were observed during the last two winters. Total population of eagles on the study area was four birds in 1976-77 and six birds in 1977-78 and 1978-79 (Table I).

A summary of daily sightings is shown in Table II. Eighty-four days were spent recording eagle activities during this study. A total of 106 eagle sightings were recorded during this time period. Sixty-eight percent of the eagles observed were adults, 17% immatures, and 14% juvenals. An average of 1.24 birds per day were observed during the three winters. The average number of eagles per day is somewhat biased because eagles were not observed on several census days before they arrived and after they departed. The high percentage of adults recorded is probably also biased because a more concentrated effort was made to

record their activities compared to the other age classes.

TABLE I

AGE CLASSIFICATION AND TOTAL NUMBER OF GOLDEN EAGLES OBSERVED ON THE STUDY AREA DURING THREE SUCCESSIVE WINTERS

Year	Adult	Immature	Juvenal	Total
1976-1977	3	1	0	4
1977-1978	3	1	2	6
1978-1979	2	2	2	6

TABLE II

SUMMARY OF GOLDEN EAGLE SIGHTINGS

Year	Number of census days	Number sighted	Average per day	Number of adults	Number of immatures	Number of juvenals
1976-77	16	21	1.31	11	10	0
1977-78	38	56	1.47	42	3	11
1978-79	30	29	0.96	20	5	4
Totals	84	106	1.24	73	18	15
Percentages				68%	17%	14%

Phenology

Dates of earliest and latest observations of both adults and non-

adult eagles are shown in Table III. Latest dates of adults observed on the study area are February 25, 1977, March 4, 1978, and February 3, 1979. Edwards (1969) studied the nesting and mating behavior of eagles inhabiting the Western United States and reported that mating behavior occurred in late January and early February, nest site selection in February, and egg laying in late February and late March. The laying of eggs by temperate zone golden eagles in early March has also been documented by Brown and Amadon (1968) and Olendorff (1975). These authors agree that adult temperate zone eagles usually do not migrate and that eagles from more northern areas (above the line of 55 N latitude) do migrate. It may be that the birds wintering in Noble County are not from a temperate zone, because if they were they would not have been observed on the study area at such late dates. That is, they would have to leave much earlier in order to establish a nesting territory by late January (Edwards 1969).

TABLE III

EARLIEST AND LATEST OBSERVATION DATES FOR WINTERING GOLDEN EAGLES IN NOBLE COUNTY, OKLAHOMA

Year	Earliest dates observed		Latest dates observed	
	Adults	Non-adults	Adults	Non-adults
1976-77	X	X	25 February	31 March
1977-78	25 November	27 November	4 March	17 April
1978-79	25 December	2 December	3 February	2 April

Sutton (1967) stated that the golden eagle is a year round resident species in Cimmaron County. He also states that fall and winter visitants occur throughout the rest of the state from September 8 to March 9. My observations show that an immature eagle was a visitant as late as April 17.

Food Habits

Food habits were determined by analyzing the contents of regurgitated pellets (Stains 1958) and by direct observation of hunting and feeding behavior. A list of food items is shown in Table IV. Five pellets were identified as those of golden eagles. Two pellets contained hair from eastern cottontail rabbits (*Sylvilagus floridanus*), two others contained hair from blacktailed jackrabbits (*Lepus californianus*), and one contained hair from a striped skunk (*Mephitis mephitis*). Eagle predatory behavior was observed on two occasions. On the first occasion an immature golden eagle captured an unidentified shorebird, and on the second occasion an adult eagle captured an eastern meadowlark (*Sturnella magna*).

Other prey items that were not observed being caught but were seen being fed upon include a blacktailed jackrabbit, two eastern cottontail rabbits and a greater prairie chicken (*Tympanuchus cupido*). Inspection of these prey items after the birds fed upon them indicated that they were recently killed, because the remains were fresh and not stiff or frozen. Lagomorphs made up 57% of the food of these eagles.

Intra-Specific and Inter-Specific Behavior

Thirty-seven interactions, eagles with other eagles and eagles

with other vertebrates, were observed and recorded during this study. Sixty-five percent of the activities recorded were hunting, 22% nuptial displays, 8% feeding, and 5% vocalizations. Two adult eagles performed most (78%) of the above activities. When perched together in a tree, these two adults showed a definite size difference. Presumably, the smaller of the two was a male and the larger a female. They were assumed to be a mated pair because they performed many activities together, especially nuptial flight displays.

TABLE IV

FOOD HABITS OF GOLDEN EAGLES IN NOBLE COUNTY

Prey items eagles were observed capturing or feeding upon	Prey items identified from pellets
Mammals	Mammals
Blacktailed jackrabbit....1	Blacktailed jackrabbit...2
Eastern cottontail.....2	Eastern cottontail.....2
	Striped skunk.....1
Birds	
Greater prairie chicken...1	
Eastern meadowlark.....1	
Unknown Shorebird.....1	

Hunting Methods

Two basic types of hunting methods were observed. These are 1) birds perch on trees or tall structures and make short flights to catch prey, and 2) birds attempt to catch prey while aloft. The use of topo-

graphy to hide, approach and surprise prey was employed by eagles using both hunting methods. From a perch, the eagle would fly rapidly towards its intended prey. In the course of flight the bird would gradually descend and while in flapping flight its wing tips would almost touch the ground. The eagle would flap its wings between obstacles and glide over other obstacles in its path clearing the obstacle with a minimum of space. In the final stage of this type hunting flight, the eagle would use a terrace or embankment to conceal itself from its prey until the last few seconds. The use of topography was employed in 60% (3 of 5) of the observed perched hunting activities.

Aerial attempts by eagles to capture or harass prey were initiated when aloft, while soaring, gliding or flapping their wings. Vertically dropping from aloft with tightly folded wings and gradually descending (Ca. 45° angle) with partially folded or open wings were the two modes of descent I observed eagles employ in aerial hunting. Once the descent began, flapping of the wings ceased. Eagles were observed utilizing the aerial hunting method on six occasions. On one occasion topography was used by an eagle to conceal itself from its prey and on another occasion a pair of adult eagles hunted this way together.

Hunting was observed on 10 other occasions, but on these occasions it appeared that the eagles were not attempting to catch prey but were harassing the animals.

Twenty-four observations were made of eagles interacting with prey animals on the study area. Sixteen of these interactions involved prairie chickens. Five included marsh hawks (*Circus cyaneus*), one each involved a striped skunk, a group of mallard ducks (*Anas platyrhynchos*), and an eastern meadowlark. These interactions were mostly prey capture

attempts and two were successful (meadowlark and shorebird). The interactions between eagles and marsh hawks may have been attempts by the eagles to pirate prey from the hawks or to capture the marsh hawk itself. Adults were observed attempting to capture prey more often than other age groups.

Nuptial Displays

Nuptial displays such as undulating, mutual soaring and undulating, and rolling and foot touching were observed on eight different occasions. These displays have been described in detail by Brown (1976), Brown and Amadon (1968), and Grossman and Hamlet (1964). Nuptial displays are performed most often during the breeding season but also occur outside it, and they are performed by adults and immatures (Brown and Amadon 1968). These behaviors were frequently observed and mostly performed by the eagles presumed to be a mated pair. I made extensive detailed recordings of them when possible.

Undulating flight displays, the rise and falling of an eagle in flight that presents a wavy appearence, are performed by either sex (Brown and Amadon 1968). However, on the two occasions I observed, only the male performed this manuever. An unusual variation of this display was observed on January 27, 1978. During this performance, the male eagle raised its tail and head a second, remained motionless, dropped them back down, and vigorously flapped his wings twice just before reaching the peak of each of the apexes. This occurred at the apex of four undulations.

The unusual behavior of the eagle closely resembles the behavior of the European snake eagle (*Circaetus gallicus*) in its threat flight,

but the snake eagle does not undulate (Brown 1967). Perhaps this is also a threat behavior in golden eagles.

Mutual soaring and undulating was also seen twice. On the first occasion, a single adult undulated several times and when it finished the display two other eagles appeared. The group then consisted of two adults and one immature. They soared a few minutes and flew out of sight. Presumably, the mated pair performed this type flight display on the second occasion. While the female was soaring, the male joined her and began undulating. When he reached the top of the third apex, he performed the pendulum display that Brown and Amadon (1968) described in the verreaux's eagle (Aquila verreauxi).

Rolling and foot touching occurs when a bird dives towards another, but instead of swinging up, the bird positions itself just above the lower bird. In response, the lower bird rolls over on its back and presents its talons. I observed golden eagles engage in five of these flight displays. The immature age class participated in two of these aerials and a juvenal presented talons to an adult in a third. Foot touching did not take place during any of these observations.

The remaining two observations included what appeared to be the same group of two juvenals and one immature eagle. Both encounters had an additional flight behavior, tail chasing, that seemed to play an intricate part in rolling and foot touching. The term tail chasing was used and defined by Lish (1973) as a segment of the flight display in bald eagles (Haliaeetus leucocephalus). He also reported that bald eagles rolled and presented talons but noted that these behaviors did not occur simultaneously with tail chasing, as they did in the golden eagles I observed.

The first incident involving tail chasing began with three eagles perched in the same tree. An immature individual departed from the tree and two juvenals followed, one behind the other. While flying in this fashion, the trailing bird tail chased the bird in the center, which rolled and presented 11 times. While not rolling and presenting talons, the second eagle tail chased the immature bird in the lead. The immature bird rolled and presented twice during this activity. This flight behavior continued until they flew out of my sight.

The second incident began with two juvenals, one chasing the other. After rolling and presenting, tail chasing ensued until an immature vertically passed between the juvenals just before they were about to present talons. The juvenals, after the interruption, began tail chasing the immature which led them behind a sandstone outcropping. I regained sight of the two juvenals 2.4 km due east of the outcrop and they were still tail chasing. A few moments later, one rolled and presented talons and touching occurred for a second. The immature then reappeared and the juvenals dove at it, one after the other. Again, they all flew out of view, tail chasing, with the immature in the lead.

Feeding Behavior

I had two opportunities to witness behavior between adult eagles which were feeding on prey. One feeding bout was without conflict and occurred between the male and female assumed to be a mated pair. While the male was feeding on an eastern meadowlark, he was joined by the female, who landed several meters away from him and walked to within 50 cm of him. She began performing comfort movements, such as preening and rousing (ruffling) her feathers, and once assumed a submissive feeding

posture (Ellis 1973). During this time, the male continued feeding without reacting to the female. After he finished and flew away, the female began picking at what few remians were left. This feeding bout lasted 57 minutes.

In the other feeding bout, agonistic behavior occurred between the female of the mated pair and another larger eagle, presumed to be another female. The larger bird caught a jackrabbit and while pulling hair with her beak and tossing it side to side, the intruder made three attempts to pirate the prey remains. In the first two attempts, the interloper was diverted from the prey by one foot stabs (described by Ellis, 1973) executed by the rabbits captor. On the third attempt, she was successful. She ran in very quickly with open wings, foot stabbed the head of the rabbit, and moved approximately 5 meters away. This attempt occurred while the larger bird was bent over the prey, and was sudden enough that she did not have time to respond to the intruder's actions. They fed simultaneously until the larger bird left, and the remaining female continued feeding on the leftovers. The feeding bout with agonistic behavior lasted 37 minutes, and the intruder fed alone for an additional 18 minutes.

Another interaction between an adult and a juvenal occurred, but actual feeding was not observed because the prey animal was not in view. Their behavior was different from the others because the food item appeared to be shared. From a perch in a tree, an adult and juvenal alternately flew to the ground, remained several minutes, and returned to the perch. On one occasion, they both remained on the ground together and then returned to the perch one after the other. After her last descent, the adult returned to the tree and began rubbing her beak on a limb. A

moment later the juvenal joined the adult and copied her behavior. The next 20 minutes were spent preening. After they left, I checked underneath the tree and found fresh remains of a greater prairie chicken.

Apparently, the greater prairie chicken had been recently killed because the bases of the plucked feathers were clean; that is, there was not any tissue sticking to the bases (Hamerstrom, 1972). Rubbing of the beak on a hard surface is a behavior most often observed after a bird of prey has eaten. This behavior and freshly killed prey support the thought that the prairie chicken was caught and shared by an adult and juvenal eagle.

Vocalization

I heard vocalizations on two occasions. On the first occasion, a female golden eagle was perched in a tall cottonwood tree (*Populus deltoides*) and a hunter with dogs approached the tree from the southeast. The female vocalized seven times, and a male dropped vertically out of the sky and perched next to her. After he landed, they both produced a barking call six times in unison. The male departed, with the female following 30 meters behind. The sounds emitted by the birds have been described by Ellis (1973) as the "skonk call", an expression of excitement in golden eagles. On the second occasion, both adults vocalized while perched in separate trees. However, no physical response to the "skonk calls" occurred, as on the first occasion.

Adult and Juvenal Intra-specific Interactions

Earliest observations of the presumed mated pair occurred on 27 November 1977 and 25 December 1978. Accompanying the adults during the

first days of both of these winters were two juvenal golden eagles. The young eagles were repeatedly seen with the adults, soaring, perching, roosting together, displacing each other from perch sites, and tail chasing. Rolling and presenting of talons and food sharing were observed once each. The first winter, the juvenals were no longer seen with the adults after seven days, and the following winter after 13 days.

The first observations of the paired eagles with juvenals present occured in the exact same locale both winters. There was daily activity among the four eagles in this section of the study area while the juvenals were still with the adults. Throughout these two winters, after I no longer saw the juvenals with the adults, the adults would consistently return to this section of the study area. The adults utilized several of the same perches each year, but most frequently perched on a windmill, gate post and tall cottonwood tree. These perch sites gave the eagles a commanding view of the tall grass prairie and nearby man-made reservoir. This 16 km sq section of the wintering quarters had a high density of prairie chickens (Ca. 1,000 1978-79), while the nearby lake supported several species of waterfowl with periodic fluctuations in their densities.

This 16 km sq section of habitat appeared to be segregated. When the juvenals were no longer seen with the adults, only adult age class individuals were observed wintering in this section each of the two years. I did not see immatures in this section or juvenals return to this locale during the remainder of each winter. I did note that adults utilized the areas most frequented by immatures and juvenals. Apparently, adults could use all of the study area whereas juvenals and immature

eagles could utilize only parts of the study area.

Discussion

I believe that the male and female golden eagles that wintered in Noble County are a mated pair. This belief is supported by the following facts: in 26 of 36 sitings, the pair was observed together; they vocalized; they fed without conflict; they hunted and roosted together on more than one occasion; and they performed various nuptial flight displays, especially pendulum flight, while on their wintering grounds. Brown (1976) believes that such displays could help maintain the pair bond outside the breeding season between breeding cycles. He also believes that in the verreaux's eagle the pendulum flight is one of the more intensive behaviors that prepares the pair for mating. The two adults consistently utilized and returned to the same areas and perch sites each year. This suggests they were the same pair.

Newton (1979) reports that for most raptors, there is no evidence that the young migrate with their parents and more evidence to the contrary. However, in two winters (1977-78, 1978-79) I observed two juvenals with paired adults for short periods of time (7 and 13 days) during the earliest days on their wintering quarters. During this time, several interactions between the adults and juvenals were observed. This, plus tail chasing, rolling and presenting, and an apparent sharing of a food item between an adult and juvenal suggests that these young far northern migrant golden eagles followed adults during migration, and this in turn suggests that their routes are learned.

CHAPTER III

SUMMARY AND CONCLUSIONS

Golden eagles wintered in Noble County, Oklahoma, from 1976-1978. The total population in the described study area ranged from 4-6 eagles. Eighty-four daily sitings of these birds were recorded, and of these 68% were adults, 17% immatures and 14% juvenals. The earliest and latest observation dates were 15 November and 17 April.

Blacktailed jackrabbits and eastern cottontail rabbits were the prey most often consumed but these eagles were capable of catching both birds and other mammals. Two hunting methods (perched and aerial) were employed by eagles to catch prey and on several of these occasions the topography was utilized to conceal themselves from their prey.

Nuptial displays were observed during the study period. Two adult eagles were observed performing the mutual soaring and undulating flight display. On one of these occasions, the pendulum flight was executed by a male. This, plus several other activities, suggests that the two adults were a mated pair.

Apparently, the wintering quarters were segregated. Adult eagles were observed using the entire study area while the juvenals (except for the first two weeks of the wintering period) and immatures were excluded from one area in particular. This area had a high density of greater prairie chickens.

During approximately the first two weeks of the wintering periods

from 1977-1979, juvenal and adult eagles interacted consistantly. This, plus a sighting of the two different age classes rolling and presenting talons, and alternate feeding of a food item, strongly suggests that far northern experienced migrants are followed by young and that these routes are learned.

Migrating family units of far northern eagles, learned migration routes, and parental care of young by paired adult eagles extending during and shortly after migration are behaviors that need to be better documented. Tail chasing and rolling and presenting talons between juvenal and immature eagles appeared to be playing behavior and activities between these two age classes (young following immatures) seemed to indicate that perhaps immature eagles take up parental care of juvenals when the adults behavior subsides. These aspects of behavior warrant further study.

Hopefully, this report will generate a greater interest in the wintering behavior and ecology of far northern eagles, which have not been as thoroughly studied as the temperate zone eagles of the western United States. Lack of knowledge about the natural history of these eagles in their wintering quarters and what constitutes suitable habitat to support them can definitely be detrimental to their populations.

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