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PARENTAL CARE, NESTLING BEHAVIORS AND NESTLING INTERACTIONS IN A MISSISSIPPI KITE (*Ictinia mississippiensis*) NEST

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ABSTRACT.—We conducted an in-depth study from hatching to fledging of one Mississippi Kite (*Ictinia mississippiensis*) nest with two nestlings. Both parents cared for the young throughout the nestling period. The male delivered food directly to the nestlings and fed more pieces of food to the nestlings than did the female. The total number of pieces of food eaten by each nestling was similar across the nestling period. Of the many nestling behaviors observed six are discussed here, including allopreening, biting nest material, setting the nest, working the nest, and preening. Aggression occurred between the nestlings, with the younger nestling (B) initiating close to as many aggressive encounters as the older nestling (A). These data suggest that the Mississippi Kite's patterns of parental care and nestling behavior may be quite different from that of other raptors.

Cuidados paternales, conducta e interacción de las crías en el nido del Milano Migratorio (*Ictinia mississippiensis*)

EXTRACTO.—Hemos conducido un exhaustivo estudio de un nido de Milano Migratorio con dos crías, desde la incubación hasta que los pollos dejaron el nido. Ambos padres dieron sus cuidados durante todo el período en que las crías estaban en el nido. El macho les trajo la comida directamente y les dio más porciones de lo que proporcionó la hembra. Los totales de las porciones que comió cada uno de estos milanos jóvenes, durante el período de su permanencia en el nido, fueron similares. De los muchos aspectos de conducta observados en éstos, seis se discuten en este estudio: Limpieza y arreglo de las plumas tanto mutuo como individual; agresión del uno al otro; picoteo al material del nido; arreglo del material del nido; ajuste y construcción del nido. Agresiones ocurrieron entre ellos: siendo el pollo más joven (B) el iniciador de casi tantos encuentros agresivos como los del pollo mayor (A). Estos datos sugieren que en milanos de la especie *I. mississippiensis*, los patrones tanto de los cuidados paternales como los de la conducta de las crías pueden ser muy diferentes a los de otras raptoras.

[Traducción de Eudoxio Paredes-Ruiz]

Mississippi Kites (*Ictinia mississippiensis*) breed in North America from North Carolina west to Arizona and New Mexico. They winter as far south as Paraguay (Blake 1949) and Argentina (Eisenmann 1963) and have been observed migrating through Guatemala (Parker 1977). Individuals arrive on the breeding grounds already mated in early May and depart for the wintering grounds in late August or early September (Bent 1937).

We observed nestling and adult behaviors at one Mississippi Kite nest during the 1988 breeding season (Botelho 1989). In this paper we 1) quantify adult patterns of nestling care, 2) quantify and compare the behaviors of the two nestlings, and 3) compare these data to that from other raptors.

STUDY AREA AND METHODS

The nest was on a 45-ha golf course in a residential area of Clovis, Curry Co., New Mexico. The course was sparsely wooded, with the dominant trees (and nest tree) being Siberian elm (*Ulmus pumila*). The nest was 5 m above the ground in a fork of two branches about 2 m from the main trunk. Observations were made from a platform blind 6 m from and level with the nest.

The parental behaviors quantified included the amount of time each parent spent on the nest feeding young and the number of pieces of food each parent delivered to each nestling. Each time a parent delivered and fed a portion of prey to the young this was scored as a piece of food.

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Because the adults of this species are sexually dimorphic, the male was easily distinguished from the female by his smaller size and lighter head. Also, the female had white feathers on her breast which formed streaks not present on the male. The sex of the nestlings could not be determined, but their difference in age was apparent throughout the nestling period.

Six of the most common nestling behaviors are described here (see Botelho 1989 for a discussion of 11 other nestling behaviors recorded), including allopreening between nestlings, aggression (one nestling bites at the other), biting nest material (biting the twigs of nest rim), preening, setting nest material (placing and manipulating delivered material into the nest), and working nest material (adjusting nest material). Parental feeding duration was timed with a digital stopwatch; for all other behaviors the number of times these were exhibited was recorded. All activities at the nest were also recorded on VHS tape and later analyzed to supplement the data collected on site. Observations and video taping typically began at 0500 H and ended at 1800 H daily from the day of first hatch (3 July) to the last day either of the young was present in the nest (12 August). Observations sometimes ended early in the afternoon because of lightning storms. A total of 41 d in whole or part were spent observing the nest, for a direct observation duration of 420 hr over the course of the nestling period.

RESULTS AND DISCUSSION

The nestlings hatched 2 d apart. Data collection for each nestling began with its first day of life. The older nestling (A) left the nest during the fifth week after hatching while the younger (B) did so in its sixth week. Nestling A, however, returned to the nest periodically, especially when the parents brought food to nestling B still at the nest.

Prey consisted primarily of Apache Cicada (*Tibicen sayi*); a few other insects of similar size were also fed. Parents fed nestlings pieces of food of relatively equal size which were torn from the prey. During the first two weeks, parents chewed pieces of food before presenting them to the nestlings; strings of saliva were often visible as parents fed these chewed pieces to the young. Nestlings were, on occasion, fed pieces of toads (*Bufo* sp.).

Parental care was exhibited by both adults throughout the nestling period. The duration of time parents spent feeding nestlings increased for both nestlings from week 1 to week 2, with a decrease thereafter (Fig. 1). The decrease seemed to be due to the reduced need for parents to tear up and chew food before presenting it to the nestlings.

Prey was seldom transferred from the male to the female, and each parent fed the nestlings separately when both were at the nest. The number of pieces of food presented to each nestling by each parent is summarized in Table 1. The male provided more pieces of food to both nestlings than did the female. Each parent presented a similar weekly average number of pieces of food to each nestling. The differences that did exist were generally less than the weekly averages between the male and female. Nestling A received more pieces of food from the male during its first 3 weeks of the 6-week nestling period, whereas nestling B received more pieces from the male during its last 3 weeks of the nestling period. The number of pieces of food delivered to each of the young was most similar between adults during the first week of each nestling's life. The male greatly exceeded the female in the number of pieces of food delivered to each nestling during weeks 3 and 4. Thereafter (weeks 5 and 6), less of a difference was apparent, although the number of pieces of food fed by the male and female to nestling B differed more than to nestling A.

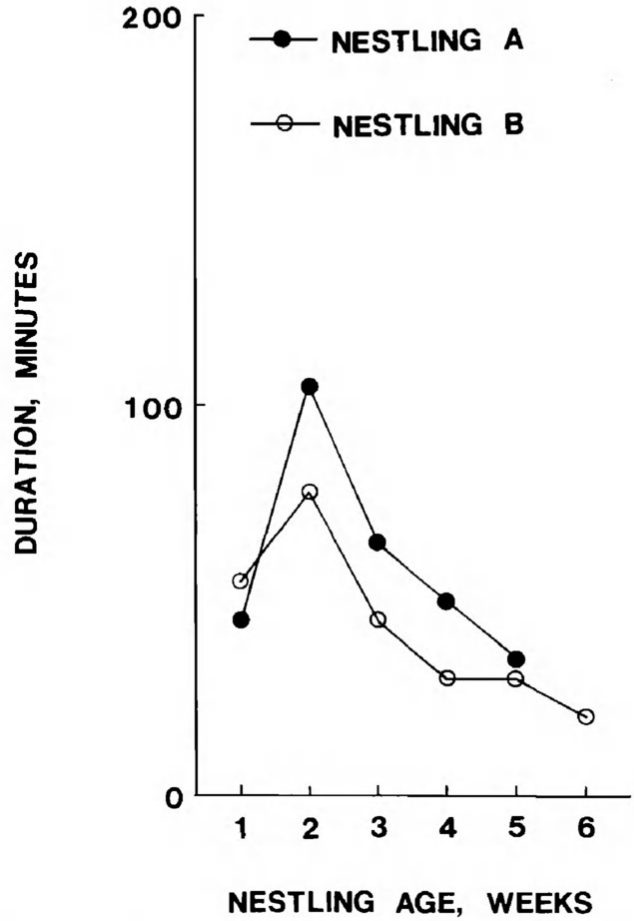

Figure 1. Parental feeding duration at a nest of Mississippi Kites according to nestling age.

Nestling behaviors are summarized in Figures 2–

Table 1. The number of pieces of food given to each nestling by each parent Mississippi Kite in New Mexico.

WEEK[a]	PARENT	NESTLING A	NESTLING B
1	Male	363	151
	Female	360	160
2	Male	400	335
	Female	442	458
3	Male	703	686
	Female	235	315
4	Male	506	692
	Female	315	290
5	Male	177	404
	Female	124	179
6	Male	12	139
	Female	34	12
	$\bar{x}$/week (±SD)		
	Male	360.2 ± 221.8	401.2 ± 224.1
	Female	251.7 ± 139.0	235.7 ± 140.0
	Total, weeks 1–6		
	Male	2161	2407
	Female	1510	1414

[a] Since an age difference of two days existed between nestlings, data are arranged for each chick's week 1, 2, etc.

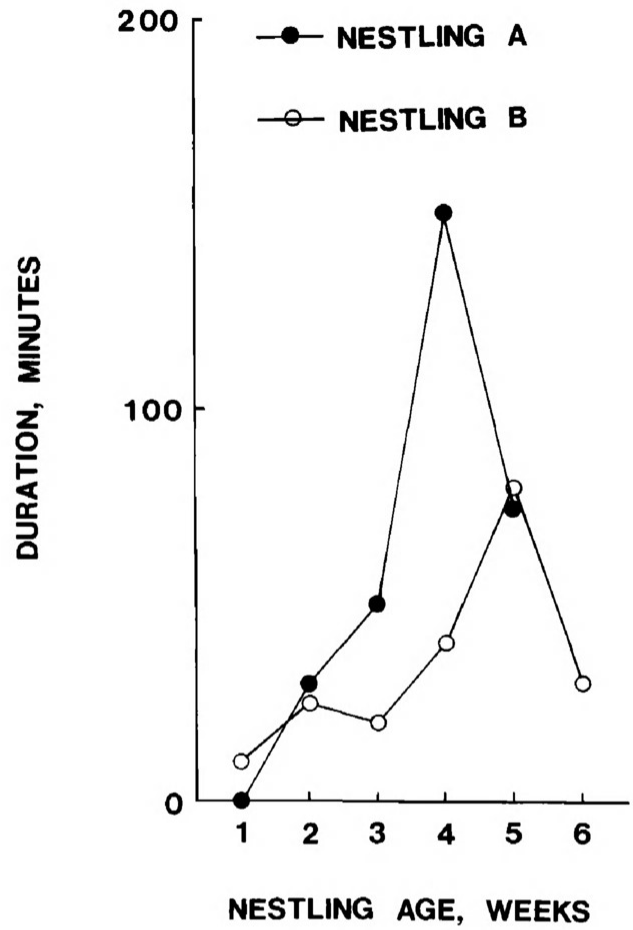

Figure 2. Preening durations by nestling Mississippi Kites according to age.

4. Preening was common. Preening duration increased with nestling age but decreased during the last 1–2 wks of the nestling period (Fig. 2). We observed allopreening between the nestlings, although it was a relatively uncommon behavior (Fig. 3). Allopreening was most often initiated by nestling A (five of seven events). Nestlings typically allopreened each other's head.

Nest setting was rarely exhibited during the initial weeks of the nestling period but increased during weeks 4 and 5 (Fig. 3). Nest setting did not occur during week 6 probably due to the fledging of nestling A and the movement of nestling B from the nest to the nearby branches.

Nest working consisted of nestlings biting and manipulating green nest material already present in the nest cup. Nestlings were typically crouched, or preparing to crouch, in the nest while exhibiting this behavior. Nest working was observed during weeks 3–5 but did not occur in weeks 1 and 6 (Fig. 3). Nestlings were too young to exhibit this behavior during week 1 and in week 6 spent most of their time either away from the nest tree (nestling A) or in branches (nestling B).

Nest biting consisted of nestlings biting nest twigs which made up the nest rim. Nest biting was the most frequently exhibited behavior. It occurred with increasing frequency up to week 4 after which the frequency sharply decreased (Fig. 3).

Aggressive acts consisted of nestlings lunging at each other with open beaks. Nestlings struck each other in the head region only; no other body areas were struck. Aggression was exhibited sporadically throughout the nestling period, but occurred most frequently during week 1 (Fig. 4). The incidence subsided during week 2; this was also the week with the greatest duration of parental feeding (Fig. 1). Aggression was low in week 3, but increased again during weeks 4 and 5. Nestling A behaved aggressively toward nestling B 20 times while nestling B behaved aggressively toward nestling A 16 times.

The number of pieces of food delivered to both nestlings was the highest during the middle (week 3) of the nestling period, although the parental feeding duration was greatest for both chicks in their

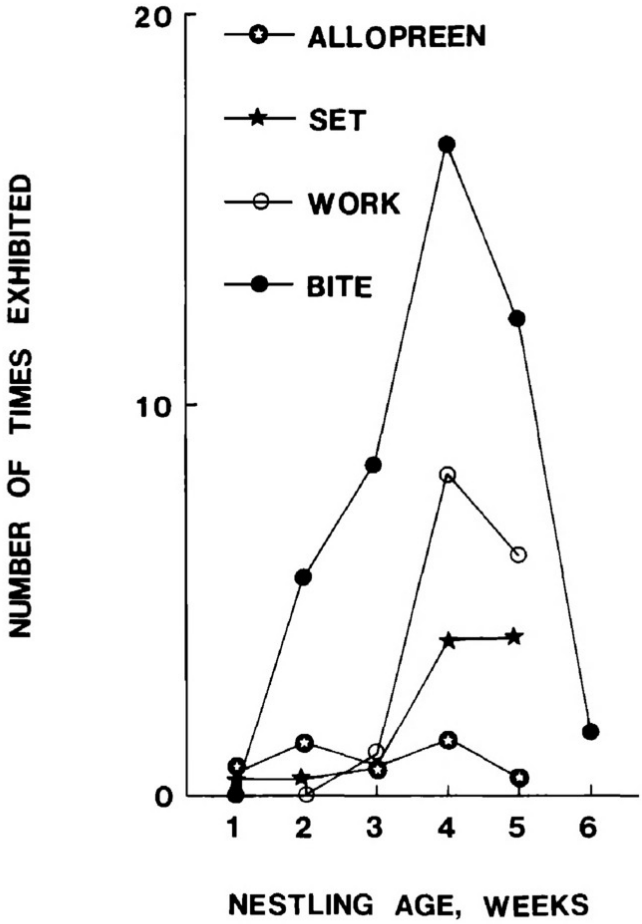

Figure 3. Number of times allopreening, nest setting, nest working, and nest biting were observed according to age of nestling Mississippi Kites (points represent average values for both nestlings).

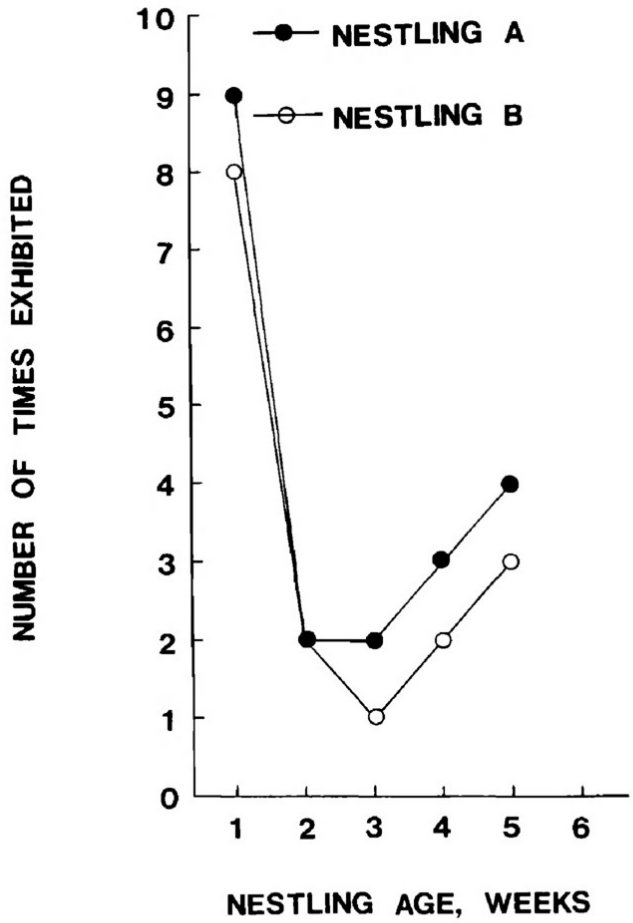

Figure 4. Number of times aggressive behavior between nestling Mississippi Kites was observed, according to nestling age.

second week. Another Mississippi Kite nest at the same study site, that contained a single nestling, showed a peak in duration of parental feeding during week 1 of a 5-week nestling period (pieces of food eaten by nestlings were not quantified in this study; Airth-Kindree 1988). The pattern of a mid-period peak in parental feeding has been noted in other raptors. Golden Eagle (*Aquila chrysaetos*) nestlings experienced an increase in feeding during weeks 7 through 9 of a 10-week nestling period (Collopy 1984). Nestling Sparrowhawks (*Accipiter nisus*) peaked in food consumption in weeks 2 and 3 of a 4-week nestling period (Newton 1978).

The behavior of the male seemed crucial to the survival of the nestlings. Prey brought to the nest and fed to the young by the male made it less necessary for the female to leave the nest to forage, at least initially. Male inattentiveness in a Golden Eagle nest forced the female to leave the nest, forage for herself and later abandon the nestlings (Collopy 1984). Heavy summer rains and wind, typical during this study, can threaten nestling survival, especially when the nestlings are unattended by parents (see also Newton 1978, Moss 1979).

The sibling aggression observed in this study did not appear to establish an absolute dominance scenario common in many other birds, including large raptors (Poole 1979, Drummond et al. 1986, Wechsler 1988). Aggressive acts delivered by nestling A to B were reciprocated during each week even though there was a size difference between nestlings. The nestlings were fed similar amounts of food during the study. Food was not aggressively taken from one nestling by the other nor did nestling A interfere with parental feeding of nestling B. Our impression was that food was readily available to the adults during this study.

Allopreening has rarely been reported between raptor nestlings or fledglings (see Varland et al. 1991). Allopreening has also been noted among American Kestrel (*Falco sparverius*) fledglings (Sherrod 1983). Although the incidence was very low among the Mississippi Kite nestlings, its occurrence demonstrates more inter-sibling affiliative behavior than is characteristic of many raptors.

Upon depositing nest material on the perimeter of the nest, parents either flew from the nest or remained but made no attempt to incorporate the material into the nest cup. Nestlings manipulated new (green) vegetation into place in the nest cup after the parent left the material. Nest working and nest setting by nestlings have not been reported in other raptors. Nestlings, thus, were not just passive inhabitants of the nest but instead actively participated in nest maintenance.

The behaviors observed in this study were made through extensive observations. A study of this nature allowed us to note important, and rarely exhibited, behaviors (i.e., aggression, allopreening, nest setting, nest working). Although only one nest was examined during this study, some of the same behaviors (including male participation in feeding and preening) have been seen also in another nest of Mississippi Kites in the same area (Airth-Kindree 1988). Some of the behaviors we observed are sufficiently different from other raptors to raise interesting questions about the reproductive biology of kites of the genus *Ictinia*.

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