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BEHAVIOR OF COLONIAL COMMON KESTRELS (*Falco tinnunculus*) DURING THE POST-FLEDGING DEPENDENCE PERIOD IN SOUTHWESTERN SPAIN

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ABSTRACT.—Common kestrel (*Falco tinnunculus*) chicks from a small breeding colony in southwestern Spain fledged an average of 31 d after hatching and remained at the colony, depending on their parents for food, an average of 16 more days. Fledglings perched close to and socialized with their siblings and unrelated fledglings. Fledglings started to use hovering flights a mean of 9.7 d after fledging. Social play, in the form of chases among fledglings, manipulative play with objects, and the capture of insects by the fledglings were observed before fledglings became independent.

KEY WORDS: *fledging; post-fledging dependence period; play; common kestrel;* Falco tinnunculus.

Comportamiento del cernícalo vulgar (*Falco tinnunculus*) durante el periodo de emancipación en suroeste de España

RESUMEN.—En una pequeña colonia de cernícalos vulgares (*Falco tinnunculus*) en el suroeste de España, los pollos volaron por primera vez una media de 31 días despues de la eclosión y permanecieron en la colonia una media de 16 días más dependiendo de sus padres. Los jóvenes tenían un comportamiento social y se posaban junto a sus hermanos y junto a otros jóvenes no emparentados. Los jóvenes empezaron a cernirse una media de 9.7 días después del primer vuelo. Antes de que los jóvenes se independizaran se observaron juegos sociales, bajo la forma de persecuciones entre jóvenes, juegos de manipulación de objetos y capturas de insectos.

[Traducción Autor]

The post-fledging dependence period, defined as the period after the first flight during which young birds continue to depend on their parents for food, has received little attention in raptors. The common kestrel (*Falco tinnunculus*) is a well-studied species, and its breeding cycle has been relatively well documented (e.g., Newton 1979, Cramp and Simmons 1980, Cade 1982, Village 1990). However, information about the duration of the post-fledging dependence period and behavior of parents and offspring during this period is scarce. From casual observations, it is estimated that the young remain near the nest for at least 2–3 wk after fledging (Village 1990). Tinbergen (1940) provided some observations of the behavior of a wild brood during 20–25 d of post-fledging dependency. Komen and Myer (1989) described the behavior of nine fledglings held in captivity and released at the time of fledging. These fledglings continued to return for food for an average of 42 d. Komen and Myer (1989) estimated the duration of the post-fledging dependence period of a wild brood of three fledglings to be 37 d.

This study gives the estimated duration of post-fledging dependency in common kestrels from a small colony in southwestern Spain, and describes the adult and fledgling behavior during this part of the breeding cycle.

STUDY AREA AND METHODS

Observations were carried out in the spring and summer of 1989 in a mixed colony of common kestrel and lesser kestrel (*Falco naumanni*) in an abandoned sandstone quarry (37°29′N, 5°38′W) near Carmona, Seville, southwestern Spain. Common kestrels (12–15 pairs started breeding) nested on ledges and in holes of a cliff approximately 20 m high and 200 m long. The minimum distance between neighboring nests was 6 m. The area surrounding the quarry was a flat and open agricultural plain with small fields of cereals (wheat and barley), sunflowers, olive and fruit trees.

We banded 22 common kestrel chicks from five nests when they were 19–30 d old with laminated plastic bands with an alphanumeric code that could be read with a telescope. Brood sizes at the time of banding were three, four, four, five, and five chicks. One of the chicks had already fledged when banded and it was not known from which nest it came. At least one other nest produced two

fledglings that were not banded. Four chicks, each from a different nest, were equipped with radiotransmitters attached with a backpack harness (Beske 1978; weight with harness 9 g, 4% of body mass). The eight chicks without radiotransmitters from both of the nests with five chicks, were marked with a 2.5 cm strip of colored SAFLAG pierced on the upper part of the wing (Young and Kochert 1987), which allowed individual recognition also in flight. Adult common kestrels were not marked, and they could not be identified once they started feeding the fledglings out of the nest.

Observations were performed by one observer from a variable point 130 m from the cliff, with 10× binoculars and a 60–80× field scope. The whole colony was observed for approximately 4-hr periods, between 0630–2000 GMT, every 1–3 d (47 hr in 13 d). Observations started 17 June, when some of the chicks were starting to fledge, and ended 14 July when all but five banded kestrels (one radiotagged) had left the vicinity of the colony. Fledglings still at the colony on the last observation day spent most of the time away from the cliff and were observed infrequently. The quarry was again visited on 18, 22, and 27 July, for 30 min each day, to check if any fledglings were present or any radiotransmitter signal could be detected. No fledglings were seen and no radiotransmitter signal was detected after 18 July.

Behavioral observations were dictated on a tape. Every 30 min the perching location of every fledgling on the cliff was recorded. Distances between each fledgling and its nest, nearest sibling, and nearest unrelated fledgling were estimated later on an enlarged photo of the cliff with 0.5 m precision. I considered that fledglings were perched in groups when distance between fledglings was <2 m.

The age of 15 of the chicks at the time of banding was estimated from the equation: Age (d) = 8.14 + 0.17 × 8th primary length (mm), obtained from growth data of common kestrel chicks in central Spain (Veiga 1985). Fledging age was the first day a chick was seen flying or on a perch it had to reach flying. I considered the date of independence of a fledgling to be the mean between the last day the fledgling was seen at the colony and the first day the fledgling was no longer seen. Radio-tagged fledglings showed that not all fledglings present at the colony were observed on every 4-hr period, indicating that the duration of the post-fledging dependence period of fledglings without radiotransmitters could have been underestimated. Fledglings with radiotransmitters, even if they were not seen, were considered still dependent if their signals could be located at the colony. None of the fledglings with radiotransmitters were observed or located by telemetry after leaving the colony cliff for the first time.

I believe no radiotransmitters were lost, but some fledglings could have died before independence. I found remains of at least one unidentified fledgling eaten by a predator.

RESULTS

Common kestrel chicks fledged at a mean age of 31 d (range 27–36 d, SD = 2.8, N = 15). There were no significant differences in fledging age between fledglings with radiotransmitters ($\bar{x}$ = 33 d, N = 4) and those without ($\bar{x}$ = 30.5 d; t = 1.46, df = 13, P = 0.17). Fledglings became independent on average 16 d after fledging (range 8–25 d, SD = 5.2, N = 20), and there were no differences between fledglings with radiotransmitters ($\bar{x}$ = 15.5 d, N = 5) and those without ($\bar{x}$ = 16.1 d; t = −0.21, P = 0.83). Neither fledging date (F = 1.02, df = 1,18, P = 0.31), fledging age (F = 0.085, df = 1,13, P = 0.78), brood-size (F = 0.446, df = 2,17, P = 0.65) nor order within the brood (F = 1.683, df = 4,9, P = 0.24) had any significant effect on the duration of the post-fledging dependence period. Fledglings of the same brood did not become independent on the same day and the maximum difference in independence dates within a brood averaged 11.6 d (SD = 5.6, N = 5). Two banded chicks without radiotransmitters were never observed at the colony after fledging and probably died before independence (9% mortality, N = 22).

Fledgling Behavior. Common kestrel fledglings returned infrequently to their nests after fledging (only 4% of the observations were at <2 m from the nest). They perched on the ledges and on top of the cliff, alone (54% of observations) or in groups (46% of observations, N = 307). Groups ranged from 2–5 fledglings ($\bar{x}$ = 3.6 fledglings, SD = 1.4, N = 76) and most of them, 84%, included fledglings from different broods. Of 20 marked fledglings observed, 19 were seen at least once in a group with unrelated fledglings. Fledglings perched closer to unrelated fledglings than to their nest (paired t-test for median distances, t = 2.11, df = 14, P = 0.049), or to their siblings (t = 2, df = 14, P = 0.06), although the last difference was not significant. Median distance to the nearest sibling was not significantly different from median distance to the nest (t = −0.99, df = 18, P = 0.34; Fig. 1).

Fledglings frequently begged for food, perched or in flight, from any adult kestrel coming to the colony. On at least six instances they begged for food unsuccessfully from lesser kestrels. I also observed four juveniles eating insects 4–13 d after fledging. Although the capture was not witnessed, adults were never observed delivering insects to the fledglings.

I observed four fledglings engaged in play behavior with objects 16, 16, and 18 d after fledging. The age of the fourth bird was unknown. On separate occasions two fledglings flew low over the cliff performing prey catching and plucking movements on small roots hanging from the cliff. A similar behavior

was performed on a small twig, a stone, and an airborne feather in quick succession by another fledgling. The fourth fledgling performed prey plucking movements on an object carried with its talons. The most frequent play behavior were fast flight chases by two or more fledglings. Fledglings chased each other and dove toward other fledglings perched on the cliffs making them fly. The roles between chaser and chased changed frequently, suggesting some kind of social play. Chases among fledglings—from the same and different broods—were observed on 15 occasions, 5–13 d after fledging.

Beaking, a behavior in which one individual nibbles at the beak and lore area of another (Sherrod 1983), was observed in one instance between two fledglings from different broods. Fledglings were observed hovering for the first time a mean of 9.7 d after fledging (SD = 6.5, N = 10).

Adult Behavior. Adult common kestrels were only seen at the colony when delivering prey to the fledglings. Both male and female adults fed the fledglings during the post-fledging dependence period. Of 22 prey deliveries in which the sex of the adult was recorded, nine were performed by males and 13 by females. Twice a male was seen transferring the prey to the female before she fed the fledglings. No aerial prey transfers to fledglings were observed, and all prey transfers took place on cliff perches or on the ground. After all chicks had fledged, 85.3% of the prey transfers took place on perches different from the nest (N = 34). All prey delivered were birds and small mammals. The average prey delivery rate by adult common kestrels at the colony was 0.9 prey/hr. Correcting for the number of fledglings present, each fledgling received an average of 1.1 prey/d. After young fledged, adults frequently transferred prey to groups of fledglings from more than one nest. Adults did not seem to select the fledgling in the group to which they transferred the prey. As adults were not marked, it was not clear if adults were feeding only their offspring or occasionally feeding other fledglings.

Aggression. I never observed aggressive behavior among common kestrel fledglings. Most of the aggressive behavior observed was allospecific. A lesser kestrel adult female took 0.5 hr to expel a common kestrel fledgling from her nest that had accidentally landed there. An adult common kestrel attacked a lesser kestrel female who had previously attacked a common kestrel fledgling. An adult male common kestrel dove four times toward a fledgling who was

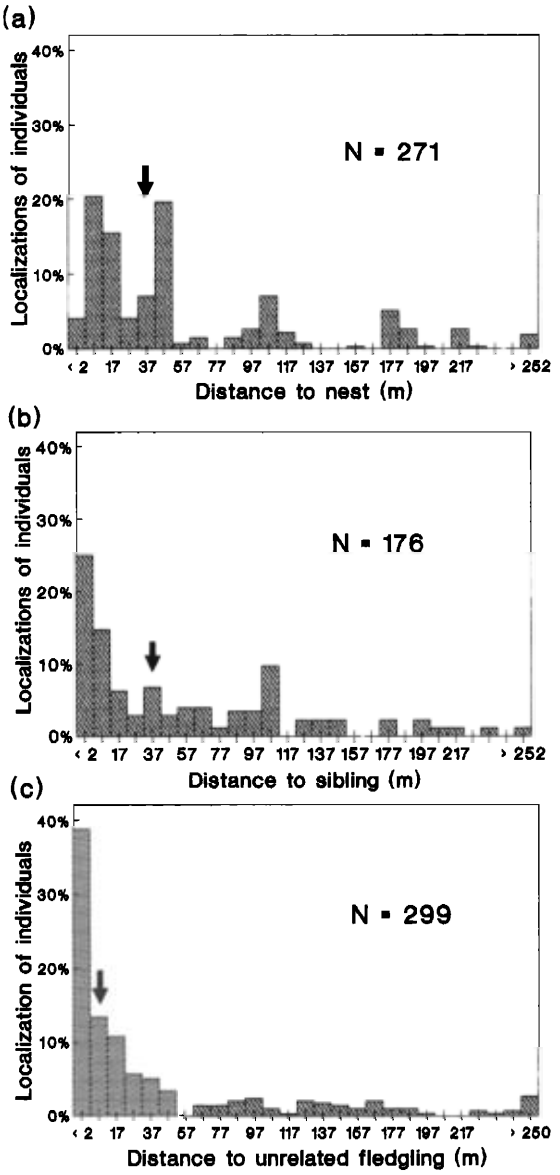

Figure 1. Frequency distribution of the observations of perched common kestrel fledglings in relation to distance to their nest (a), distance to the nearest sibling (b), and distance to the nearest unrelated fledgling (c), during the post-fledging dependence period. Data on all fledglings were pooled. The values are given in 5 m intervals, except the first interval, <2 m, and the last interval, >252 m. Arrows indicate the medians. Distances were measured every 30 min with 0.5 m precision.

begging in a fluttering flight after him and forced the fledgling to perch on the cliff.

DISCUSSION

Common kestrel chicks fledged in southwestern Spain at an average age of 31 d, similar to that reported by other authors in Europe (27–32 d; Cramp and Simmons 1980) and in Africa (34 d; Steyn 1982). The average duration of the post-fledging dependence period I observed, 16 d, was shorter than those reported both in Europe (20–25 d, Tinbergen 1940; 1 mo, Cramp and Simmons 1980; 30 d, Masman 1980 in Komen and Myer 1989), and in Africa (1 mo, Steyn 1982; 41.5 d, Komen and Myer 1989).

I do not think that the kestrel family groups I observed continued together somewhere else after leaving the colony. Siblings would have disappeared on the same day, but they did not. It is still possible that I underestimated the post-fledging dependence period of the fledglings without radiotransmitters, because on average only 66% of the dependent fledglings were observed on each 4-hr period. Also, the death of some fledglings before independence could have remained unnoticed, but the mean duration of the post-fledging period of the five fledglings with radiotransmitters was not significantly different from that of the fledglings without. This supports the idea that I did not underestimate the duration of the post-fledging dependence period.

Some species of raptors have shorter post-fledging dependence periods in populations breeding at higher latitudes (Bustamante 1993, unpubl. data). The high variability among individuals in the duration of the post-fledging dependence period, small sample sizes in all studies, and this latitudinal effect probably explain the high variability among estimates from different authors. Also, the short post-fledging dependence period I observed could be related to the conditions (possibly, high abundance of prey) that permit that common kestrels nest colonially in this area.

My observations also confirm that the nest is rarely used by common kestrels after fledging (Tinbergen 1940), and that fledglings play with objects during the post-fledging period (Komen and Myer 1989), possibly as a way to develop and train their hunting skills. Also, the first prey caught were insects as observed by Komen and Myer (1989), and this has been observed in many other species of raptors (e.g., Baker-Gabb 1978, Mueller et al. 1981, Sherrod 1983, Oliphant and Tessaro 1985, Varland et al. 1991, Lawrence and Gay 1991, Varland and Loughin 1992).

Although Newton (1979) contended that most fledgling raptors perch apart from their siblings, common kestrel fledglings perched close to each other, were never aggressive toward other fledglings, and engaged in social behavior (beaking) and social play (chases) with their siblings and with other fledglings. Siblings of other species of falcons also socialize during the post-fledging dependence period. Allopreening and beaking have also been observed (Sherrod 1983, Lett and Bird 1987, Varland et al. 1991, Varland and Loughin 1992).

Fledglings from different broods intermingled during the post-fledging dependence period because nests were close and fledglings did not avoid perching close to fledglings from other broods. Groups of fledglings were not caused by fledglings trying to stay close to their own nests, where it could be expected that parents came with prey, or by fledglings trying to maintain a close group with their siblings at some point on the cliff, where they could be easily found and fed by their parents.

Adults provided prey to fledglings that were usually in groups and did not seem to be able to select who finally obtained the prey. They never behaved aggressively toward fledglings and never chased fledglings from other broods away from the vicinity of their nests, in contrast to what has been observed in the colonial lesser kestrel (Bustamante and Negro in press). Also fledglings were not selective to whom they directed their begging. All this suggests that adults could have accidentally provided food to fledglings that were not their own. Even lesser kestrels, which seem to be able to recognize their offspring after fledging and behave aggressively toward unrelated juveniles near their nests, have been recorded accidentally feeding fledglings from other nests (Bustamante and Negro in press) and adopting unrelated nestlings (Donázar et al. 1991, J.L. Tella pers. comm.).

The capacity to recognize its own offspring after fledging could be less developed in the common kestrel than in the lesser kestrel. The common kestrel is generally territorial and a solitary nester. Breeding colonies, like the one I studied, are uncommon (Cramp and Simmons 1980, Village 1990). It is probably not necessary for common kestrels to discriminate between their offspring and unrelated juveniles during the post-fledging dependence period under normal circumstances, and hence the lack of

adult discrimination of offspring and lack of aggression toward unrelated fledglings I observed in this colony.

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