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Postfledging behavior of American Kestrels in southwestern Quebec.—Postfledging dependency in the American Kestrel (*Falco sparverius*) lasts a minimum of 2-4 weeks, during which time the young gradually develop hunting skills and agility in flight (Balgooyen 1976). Anecdotal reports by Sherman (1913), Wheeler (1979), and Sherrod (1983) suggest that

TABLE 1
NUMBER OF 10-MIN SEGMENTS DURING WHICH FLEDGLING AMERICAN KESTRELS ENGAGED
IN SOCIAL AND NONSOCIAL BEHAVIOR

	Days postfledging			
	1-5	6-10	11-15	16-20
Social behavior	10 (14.7) ^{ab}	25 (19.6) ^b	8 (15.3) ^b	14 (7.5) ^b
Nonsocial behavior	41 (36.3)	43 (48.4)	45 (37.7) ^c	12 (18.5) ^b

^a Observed (expected, if no change occurred over time).

^b $P < 0.001$, analysis of standard residuals.

^c $P < 0.01$, analysis of standard residuals.

some family groups may remain intact for months after leaving their territory, possibly even migrating together. Balgooyen (1976) reported that young kestrels disperse singly, possibly in order of age. Cade (1955) observed hunting bands of 10–20 juveniles and speculated that siblings leave the natal territory as a group and merge with other groups of siblings. Wheeler (1979) sighted postbreeding hunting groups of up to 14 adults and juveniles. Wilmers (1982) observed postbreeding groups of unknown age composition frequenting areas that had not been included in breeding territories that season. Here we examine the behavior of adult and recently fledged young kestrels, in particular the social behavior of the young.

Study area and methods.—The study area, 20 km west of Montreal, Quebec, is characterized by agricultural fields interspersed with small stands of northern hardwoods. Kestrels nest in natural cavities and artificial nest boxes throughout the area.

The 3 kestrel families we studied during the 1984 breeding season nested in boxes. Four young apiece fledged from Nests I and III. Three young fledged from Nest II; the adult male was removed from the latter nest 5 days before the first egg hatched as part of another study (Bowman 1985).

We color-marked all young at approximately 22 days after hatching by treating the tips of their primaries or rectrices with a paste of 30% hydrogen peroxide and Germaine Monteil Creme D'lite® bleach for human hair. The marking method was tested on captive-bred fledgling kestrels prior to use in the field. Bleaching was not associated with feather breakage, loss of barbule function, behavioral aberrations, or mortality in either captive or wild birds.

Lett observed each nest for 1 h daily from 100 m with 8× binoculars and a 45× telescope. Observations began one week before the expected fledging date and ended when no young had been observed within sight of the nest for 5 consecutive days. One third of the observations at each nest took place in the morning, 1/3 in the afternoon, and 1/3 in the evening. Due to between-nest differences in the timing of fledging and dispersal, we performed statistical tests on 15 h (= 5 days) of prefledging and 60 h (= 20 days) of postfledging observations out of a total 102 h. We subdivided each hour of observation into 6 10-min segments. We grouped the observations into 5-day blocks arranged so that day 1 is the first day on which any of the nestlings left a given nest box.

Results.—The behavior of fledgling and adult kestrels differed in several respects. Fledglings perched in thick, concealing foliage for 68% (N = 90) of the time segments during the first 5 days postfledging. During the same 5-day period, adults spent 76% (N = 90) of the time segments flying near the nest or perched on high, exposed snag tops, dead branches, and utility wires. In the first 5 days postfledging, 92% (N = 25) of flights made by young birds were direct flights from one perch to another (<35 m apart). Fledglings occasionally caught their wings in branches when landing or missed the perch altogether. Fledglings

attempted to hover (cf. Balgooyen 1976) only on windy days, but were unable to maintain their position. In general, fledgling flight lacked the smooth, controlled appearance of adult flight. Fledglings gave the food-begging call, which resembles the adult "whine" vocalization (Willoughby and Cade 1964), for up to 10 min at a time, either when perched or when flying towards a parent. No adult "whine" calls were heard during the postfledging period.

We defined any behavior that brought two or more fledglings within 2 m of one another as social. Aggressive social behaviors included pecking, footing, vigorous billing, flying at and flushing, and snatching (or attempting to snatch) food from siblings. Nonaggressive social behavior included perching close together, simultaneous preening, and flying to join one or more perched siblings. Sibling chases were considered social behavior, but were not classified with regard to aggression. Nonsocial behavior was defined as any activity performed at a distance >2 m from the siblings (e.g., hunting). The proportion of time spent on social and nonsocial behavior varied over the postfledging period ($\chi^2 = 17.02$, $df = 3$, $P < 0.001$) (Table 1). Nonsocial behavior occupied the bulk (71%, $N = 198$) of the time segments in which fledglings were present and active. Social behavior was usually nonaggressive (81%, $N = 57$), although aggression (16%, $N = 57$) and sibling chases (7%, $N = 57$) also occurred. Aggression was more likely to occur during time segments when food was present (binomial test, $P < 0.05$) and during segments with nonaggressive behavior between siblings (binomial test, $P < 0.01$). Aggressive interactions typically followed prey delivery to one of two fledglings that were perched close to each other.

Parental prey deliveries differed significantly over time ($\chi^2 = 19.37$, $df = 4$, $P < 0.001$) (Fig. 1a), and peaked at days 6–10. The same was true for the time spent by the young in calling for food ($\chi^2 = 12.48$, $df = 3$, $P < 0.01$) (Fig. 1a). Adults responded to 15% ($N = 198$) of the fledglings' food begging calls by giving the excited, potentially aggressive "klee" vocalization (Willoughby and Cade 1964). The only clear instance of adult aggression toward offspring occurred when an adult female rose vertically off a perch to bump a begging fledgling. Young kestrels occasionally flew toward their parents and briefly hovered above them or flushed them from perches and chased them. This aggressive begging behavior (cf. Sherrod 1983:126) was largely limited to Nest II (91%, $N = 11$ incidents). Most of the aggressive begging (55%, $N = 11$) (Fig. 1a) occurred at 11–15 days, just as the frequency of parental prey deliveries began to decline. Fledgling-parent aggression, however, was no more frequent in time segments when food was absent than when present (binomial test, $P = 0.25$). Parents began to leave the nest area on the approach of their young at days 6–10, and most instances of parental avoidance of the young (83%, $N = 12$) (Fig. 1a) took place between days 11 and 20.

Seventy-one percent ($N = 14$) of the attacks by adult kestrels on other birds were directed at Northern Harriers (*Circus cyaneus*), which are reported to prey on kestrels (Bent 1937). Attacks peaked at days 1–5 (Fig. 1b). The amount of time adults were observed within sight of the nest varied significantly ($\chi^2 = 39.98$, $df = 4$, $P < 0.001$) (Fig. 1b) over the late nestling and postfledging periods, with a parent in attendance during 71% ($N = 270$) of the time segments between 5 days pre-fledging and 10 days postfledging and during 31% ($N = 180$) of the segments between days 11 and 20.

An unmarked juvenile female first appeared at Nest II on day 10. She elicited no observable response from the resident birds, although she flew within 50 m of the adult female. At Nest I on day 14, an unrelated juvenile female and the resident adult male briefly flew around each other with the fluttering wingbeat characteristic of courtship flights (cf. Balgooyen 1976) as the male gave the "chitter" call commonly used in interactions between mates (Willoughby and Cade 1964). At Nest II on day 24, an unrelated juvenile male flew, perched, and preened with two of the female fledglings. He also approached the adult female and displaced her from her perch. On day 28, a young male from Nest I was seen flying side by side with an

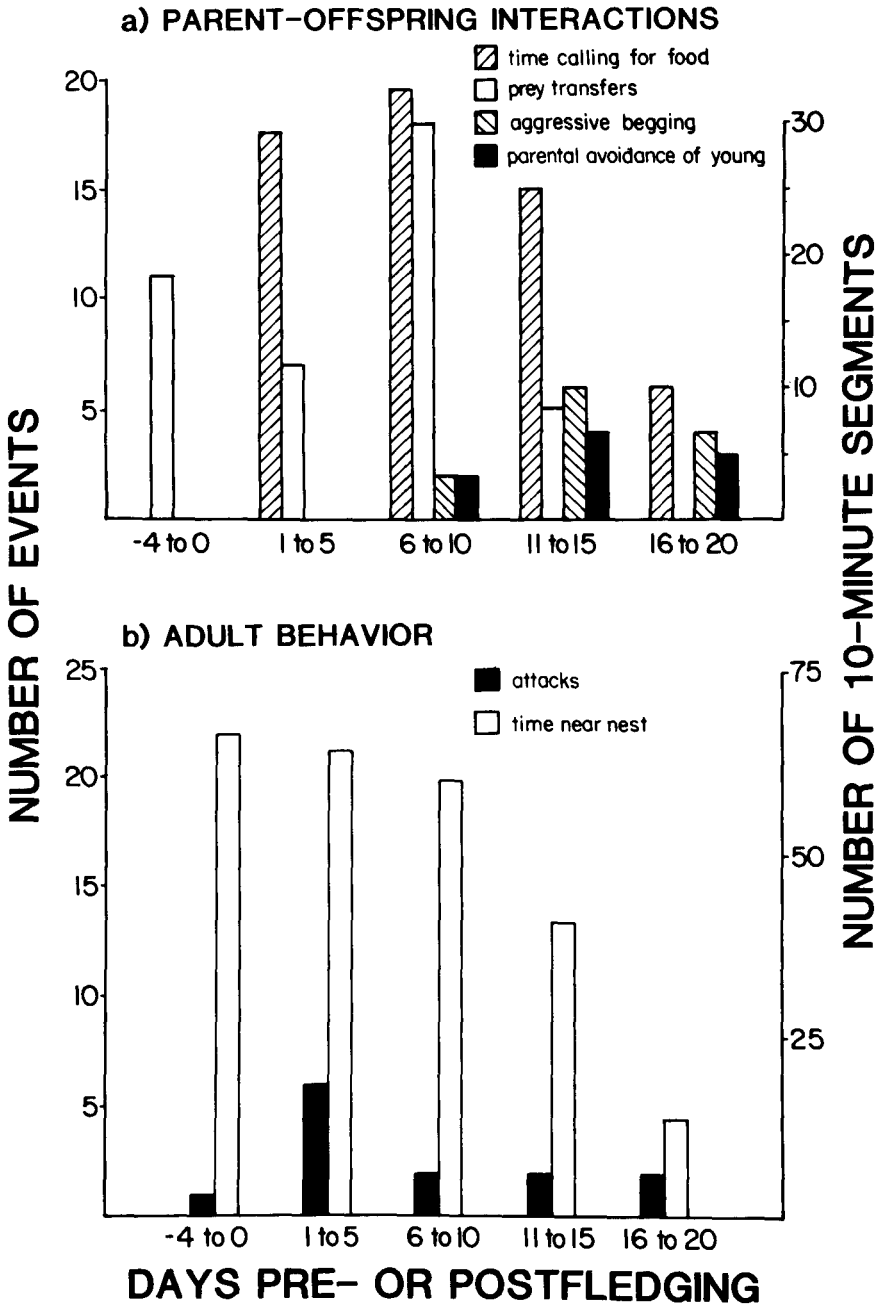


FIG. 1. a. Parent-offspring interactions and days pre- or postfledging. b. Anti-predator behavior of adults and days pre- or postfledging. Behavioral patterns are defined in the text.

unmarked juvenile female over a territory from which neither had fledged. In all cases where adults were present, they refrained from the behavior Cade (1955) associated with territorial defense against conspecific individuals, i.e., klee-ing, stooping, striking, and chasing. When fledglings interacted with unrelated juveniles, their behavior was indistinguishable from the nonaggressive interactions among siblings.

Discussion.—Although Newton (1979) contended that most fledgling raptors perch apart from their sibs, young American Kestrels follow and perch near their sibs and engage in social behavior. Fledglings of several other raptorial birds also follow siblings from perch to perch (Southern et al. 1954, Johnson 1973, Parker 1975, Sherrod 1983). Nestlings and fledglings of birds of prey have been observed joining in activities initiated by siblings (Herrick 1924, Bond 1942, Johnson 1973, Parker 1975, Kussman 1977, Sherrod 1983), similar to the socially facilitated preening bouts we observed in kestrels.

Many young raptors behave aggressively toward both siblings and parents in the presence of food (Rowe 1947, Schnell 1958, Meinertzhagen 1964, Johnson 1973, Kussman 1977, Jenkins 1978, Sherrod 1983). Fledgling kestrels, however, are rarely aggressive toward either siblings or parents, and the only aggression that we saw among siblings was associated with the presence of food.

Our observations of interactions between known individuals and unrelated juveniles support Balgooyen's (1976) finding that adult kestrels tolerate intrusions by dispersing juveniles into their territories. The presence of only one unrelated juvenile at a time suggests that young kestrels need not disperse in the company of their siblings (cf. Cade 1955). We suspect that families with fledged young may be attractive to dispersing juveniles, and that fledglings may disperse in the company of a juvenile which has intruded on their natal territory. Further observations of dispersing juveniles are necessary to clarify the process by which unrelated kestrels form the large postbreeding aggregations described by other workers.

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Abundance, habitat use, and perch use of Loggerhead Shrikes in north-central Florida.—Although populations of Loggerhead Shrikes (*Lanius ludovicianus*) have declined severely in numbers in many parts of their range in the United States (Morrison 1981, Fraser and Luukkonen 1986), they remain common in Florida. I studied relative abundance, habitat use, and perch use of Loggerhead Shrikes in north-central Florida. These data should provide useful comparative information not only for future studies in this area, but for other regions where shrike populations are low.

I randomly established 24 16-km roadside transects on paved secondary roads in parts of nine counties surrounding Gainesville, Florida (see Bohall 1984 for details). Two observers censused each transect once every 2 weeks from 18 October 1981 to 30 October 1982, by driving 32 km/h and scanning both sides of the road for perched and flying shrikes. I recorded the habitat for each shrike observed, whether the bird was on the roadside or actually in the habitat, and the perch type.

I combined 26 recognized vegetation types on the basis of vegetation structure into 5 habitat types for data analyses: completely open areas (low herbaceous vegetation without trees), midsuccessional (overgrown areas with tall shrubs or small trees), woods, wetlands (marsh or lake edge), and pastures with scattered trees. The completely open areas included settled areas (suburbs, lawns, homes), improved pasture, overgrown pasture (herbaceous