A WINTER POPULATION STUDY OF THE AMERICAN KESTREL IN CENTRAL OHIO

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Although considerable literature on the American Kestrel (*Falco sparverius*) exists, few studies on the dynamics of populations have been done. Raptor population studies are usually of a census nature, and data on movements and activities of individual birds are often limited. Enderson (1960) marked individual kestrels and monitored the dynamics of an Illinois population in spring and summer months. I followed a sizeable winter population from late October to early April with a high proportion of the population individually marked.

This study was conducted in an area of about 52 km^2 in south-central Ohio in the vicinity of the Ross-Pickaway County-line Road approximately 11 km south of Circleville. The area is north of the edge of glaciation in Ohio and is characterized by gently rolling hills and intensive agricultural use. Little woodland is present although scattered trees, especially in fencerows, are numerous.

METHODS AND MATERIALS

Kestrels were observed and marked during the winters from January 1970 to April 1972. A 72 km circuit was driven on most visits to the study area but was not always completed. Variations also occurred in time of day, time taken to complete the trip and number of observers. Five birds were trapped, transported, and released in the territories of others.

Trapping was done using the bal-chatri trap similar to that described by Berger and Mueller (1959) and birds were marked with wing tags similar to those used on gulls by Southern (1971). Modifications of Southern's technique included the use of strips that extended beyond the secondaries for better visibility and the attachment of an oval to the strip. By using ovals and strips in various color combinations, alternating wings, and taking advantage of the sexual dimorphism of kestrels, a large number of individuals could be uniquely marked.

Tags were both visible and durable. No tags were known to have been lost. Other than an initial period of attempting to rid themselves of the tags, kestrels showed no marked changes in behavior. Tags appeared not to interfere with normal activities, as tagged birds were seen hovering, capturing prey, and nesting.

RESULTS

Territoriality.—I observed territorial behavior when 4 of 5 kestrels were immediately chased when experimentally released within sight of other kestrels. Two females were released in male territories, one female was released in another female's territory, and a male was released in a female's

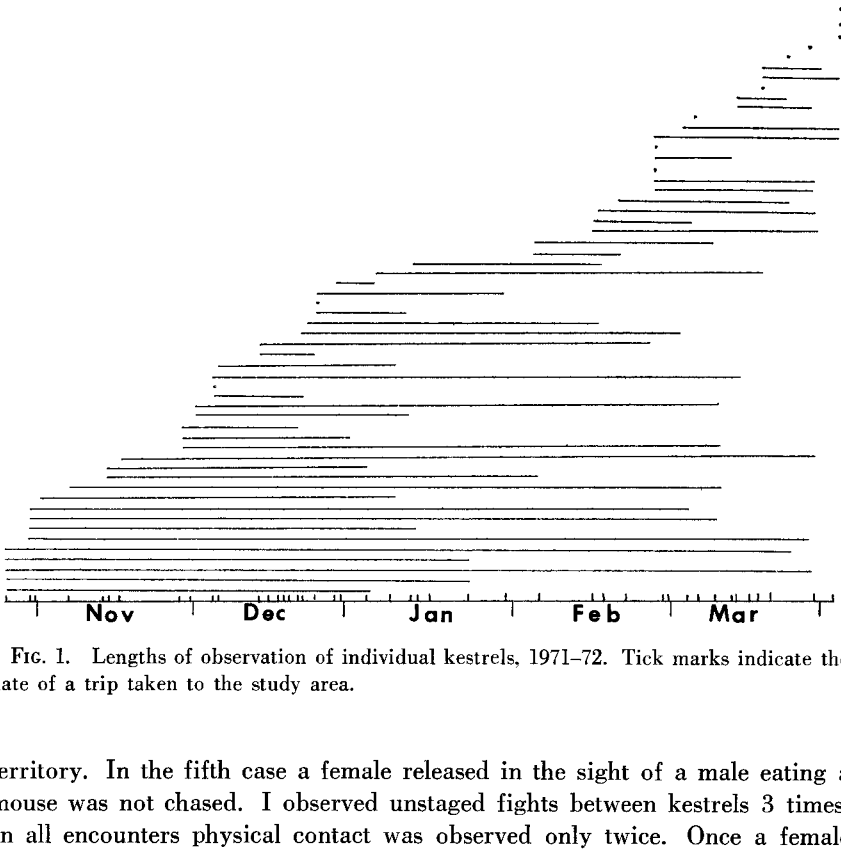

FIG. 1. Lengths of observation of individual kestrels, 1971–72. Tick marks indicate the date of a trip taken to the study area.

territory. In the fifth case a female released in the sight of a male eating a mouse was not chased. I observed unstaged fights between kestrels 3 times. In all encounters physical contact was observed only twice. Once a female drove a released male to the ground and pounced on it with outstretched talons several times. In the other case, involving 2 females at the edges of their territories, both birds fell to the ground several times while grappling. In all cases, it appeared that movement of the intruding bird was necessary to release aggressive behavior. Cade (1955) has also reported intraspecific winter territoriality in kestrels. In my study, territories were apparently defended against other raptors. Seven times kestrels were seen chasing Red-tailed Hawks (*Buteo jamaicensis*), once a Sharp-shinned Hawk (*Accipter striatus*) and once a Merlin (*Falco columbarius*).

I observed some overlap of territories but the only case in which I saw 2 kestrels in the overlapping portion of the territories was when 2 females were fighting. In at least 5 cases a male and female kestrel appeared to share a territory. These pairs were often seen perched near each other and it seemed that they attempted to stay together although one member of a pair was sometimes seen alone.

An important territorial requirement appeared to be the availability of a roost. I saw kestrels entering old buildings or barns 7 times and a hollow tree once at dusk. Every territory had at least one old or unoccupied building.

I estimated territory size by connecting extreme points of observation. For 16 tagged birds seen at least 5 times each, the average diameter of the territory was 1.4 km with the largest being 2.4 km. These territorial diameters are smaller than the diameters of the winter "ranges" of 1.5 miles (2.4 km) and 2.2 miles (3.5 km) reported by Enderson (1960) in Illinois and the Craigheads (1956) in Michigan, respectively.

Homing.—All 4 females, caught in late February or early March, were released 1.6 to 4.8 km from where they had been trapped and flew immediately in the direction from which they had come. Two were seen again where they had been caught; 2 were not seen again. A male brought into the area in late November from 24 km north was observed near the point of release over one month later.

Population changes.—Of interest was the inconsistent number of marked kestrels observed the winter after they had been tagged. Of 7 birds marked in early 1970, I saw 3 the following winter, but of 14 marked in the winter of 1970–71 I saw only one the next winter. In each case the birds were re-sighted where marked the previous year.

Figure 1 records the observations of individual kestrels in the winter of 1971–72. I made 44 trips to the area in 162 days. The extreme dates of observation of an individual were connected and I assumed that the bird remained in the area during the entire interval. The mean number of sightings of each kestrel was once every 2.5 trips to the area. Birds seen only once or twice on the periphery of the area were not included since an accurate sample of observations was unlikely. Of the 57 kestrels included, 39 were tagged, though not necessarily for the duration of the observation period. I feel that the consistency in location shown by tagged birds along with plumage and behavior differences allowed reliable identification of the untagged birds.

From Fig. 1 a graph of an estimate of the number of birds in the area at any particular time can be made (Fig. 2). The maximum population size was 27 on 24 December and the minimum was 17 on 30 January. Either number in 52 km^2 represents a much higher density than winter populations of 4 to 10 kestrels in 111 km^2 and 5 in 96 km^2 observed by Enderson (1960) in Illinois and the Craigheads (1956) in Michigan, respectively. Two peaks in population size occurred, resulting in 3 distinct periods which I will consider separately.

The population during the first period, 25 October to 24 December, steadily increased perhaps due to increased sampling. However, an actual

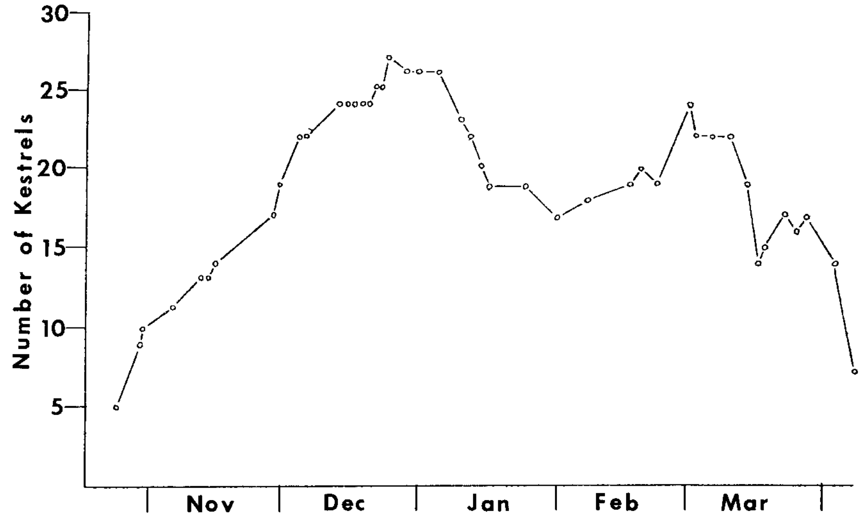

FIG. 2. Changes in population size of kestrels during the winter of 1971–72.

increase in population size is indicated. Several birds which first appeared in December were later observed regularly. For example, one female first observed 13 December after I had made 12 visits to the area was seen on 5 of the next 7 visits. The population during this period was quite stable. "New" birds appeared only in areas where none had been seen and only 3 were "lost."

The second period, 25 December to 30 January, was characterized by a rapid drop in population. Eleven of the birds from the first period were lost and only 3 were added. This period coincided with the first cold spell of the year in central Ohio with temperatures below –7°C and over a week of snow-covered ground.

The third period, 5 February to 4 April, was characterized by a population increase but losses were also high. Most new kestrels appeared in areas where others had been. The decline in March is difficult to analyze due to the termination of the study. It is interesting to note that the increase in the third period corresponds to the time of rapid population increase observed by Enderson (1960) in Illinois.

Another method of analyzing the population is by following segments of the population based on the month of the first sighting of each bird. The number of kestrels first seen in any one month that were also seen in subsequent months is recorded in Table 1. Of the 19 birds first seen in October or November, 9 (47%) were observed in March but of the 12 first observed in December only 2 (17%) were seen in March.

TABLE 1
LOSSES OF SEGMENTS OF THE KESTREL POPULATION BASED ON THE MONTH FIRST SEEN

First seen:	Number left in Oct	Nov	Dec	Jan	Feb	Mar
Oct	10(8–2)*	10(8–2)	10(8–2)	10(8–2)	5(4–1)	5(4–1)
Nov		9(6–3)	9(6–3)	7(4–3)	5(3–2)	4(3–1)
Dec			12(7–5)	8(5–3)	4(3–1)	2(1–1)
Jan				2(2–0)	2(2–0)	1(1–0)
Feb					12(6–6)	9(3–6)
Mar						9(6–3)
Total	10(8–2)	19(14–5)	31(21–10)	27(19–8)	29(19–10)	30(18–12)

* (female–male)

Since individuals could be identified, sex ratios could be figured 2 ways: by the individuals present at any one time (from Fig. 1) or by the total sightings during a given time period (Table 2). Thus, a bird seen 4 times in a month constituted 4 sightings but only one individual. Although no significant difference ($\chi^2 = 0.27$, $p > .5$) between the 2 methods is observed, there does seem to be a bias for sightings of females, especially in January. For the entire winter, females averaged 5.6 sightings per bird and males averaged 4.8 sightings per bird.

Regardless of the method used, the percentage of males was lowest in October and November and gradually increased. Most of the imbalance is a result of the birds seen in October and November. During most of the study females outnumbered males by more than 2 to 1. Sex ratios of kestrel populations reported by other authors have been unbalanced but with a higher percentage of males in most cases (see Heintzelman and Nagy 1968).

DISCUSSION

The American Kestrel is listed as a permanent resident in Ohio by Borror (1950). The term "permanent resident" has a double meaning, being used in many state checklists for a species with any members present throughout the year but more properly defined as a "species not undergoing a regular periodical migration and consequently staying in one area the year round" (Pettingill 1970). In many cases the confusion of these definitions does not allow an adequate description of the true nature of many populations. My study indicates a heterogenous and changing population with little "permanency."

That some of the population were true permanent residents is indicated by those birds that were seen in the area the year after they had been tagged.

TABLE 2

TWO METHODS FOR CALCULATING SEX-RATIOS OF KESTRELS, WINTER 1971–72

Month	By sightings			By individuals		
	♀	♂	♀:♂	♀	♂	♀:♂
October	8	4	2.0:1	8	2	4.0:1
November	21	7	3.0:1	14	5	2.8:1
December	66	31	2.1:1	21	10	2.1:1
January	33	6	5.5:1	19	8	2.4:1
February	35	10	3.5:1	19	10	1.9:1
March	40	28	1.4:1	18	12	1.5:1
Total year	203	86	2.4:1	36	18	2.0:1

Although almost no summer study was done, one female was known to have nested a summer between observations. Another indication of permanency was the relatively high percentage of kestrels first seen in October and November that were later observed in March.

Some birds seen were undoubtedly migrants, though few birds were seen only one time, possibly indicating a slow migration. That few kestrels first seen in December remained in March may reflect this. A major problem is that the disappearance of a bird may have been due to either migration or mortality.

The correlation of a period of cold and snow with the rapid drop in population suggests weather is an important factor influencing kestrel populations. Snow cover, especially, may reduce the hunting efficiency of kestrels preying on mice, which I observed to be the major prey during this study. Enderson (1960) reported that kestrels were less conspicuous on cold, windy days in Illinois; I noted this also. The difference in population density between this area and that of Enderson (1960) in Illinois and the Craigheads (1956) in Michigan is perhaps due, in part, to weather differences. Another factor may be differences in prey populations, although all are areas of fertile agricultural land. The smaller territory size found may reflect differences in food availability. Attempts to estimate small mammal populations were unsuccessful. Availability of roost sites may also be an important factor affecting population density. Areas that are very open with few buildings or tree hollows for roosts may not be suitable in colder climates.

The comparison of the 2 methods of calculating sex ratios indicates that sightings are an adequate way to sample sex ratios of kestrels. The sex ratio obtained in this study adds to the number of unbalanced populations of kestrels reported in the literature. Although I observed no difference in territory between males and females, the sex ratio is consistent with the differential habitat selection shown by wintering kestrels in northern California (Koplin 1973). I have other data indicating this differential habitat selection is widespread.

SUMMARY

Individually marked American Kestrels studied in central Ohio showed definite winter territoriality. Winter population density was much higher and territory size was smaller than in similar studies done in Illinois and Michigan. Presence of a roost may be an important part of a territory. The population was quite dynamic, peaking in late December, dropping to a low in late January which correlated with cold weather and snow, and peaking again in February. During most of the study females outnumbered males by more than 2 to 1.

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