

# DIFFERENTIAL HABITAT USE BY SEXES OF AMERICAN KESTRELS WINTERING IN NORTHERN CALIFORNIA\*

by

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**ABSTRACT.** Differential habitat use by sexes of American Kestrels (*Falco sparverius*) wintering in Humboldt, Mendocino, Lake, Colusa and Yolo Counties, California, was discovered and quantified by roadside counts conducted during the winters of 1970-71 through 1972-73. A prevalence of females was discovered in expansive pastures and fields devoid of or with few trees, and a prevalence of males was discovered in orchards and small pastures and fields surrounded by trees. However, Chi-square tests of homogeneity and frequency indicated a complex transition in habitat use. Relative abundance of Kestrels, measured by linear distance between 340 successive observations, differed significantly only between the Central Valley and the other areas sampled. Kestrels averaged 115 individuals per 100 miles (161 km; 135 observations) in the Central Valley and 34 birds per 100 miles (161 km; 205 observations) elsewhere. The differential use of habitats by wintering Kestrels is interpreted as character displacement. Its relevance to the principle of competitive exclusion is discussed.

Population studies of raptors wintering in the Arcata Bottoms near Arcata, Humboldt County, California, in the fall of 1970 revealed an unexpectedly high proportion of female Kestrels (*Falco sparverius*) in censuses. Six to twenty times as many females as males were counted through the winter. Roadside counts of Kestrels wintering in other areas in coastal Humboldt County also revealed high numbers of females. Since these findings were contrary to those reported by Roest (1957), who found that males constituted approximately 60% of late summer, fall and winter populations of Kestrels over a wide geographic area in the United States, I extended the study to include other geographic areas in northern California.

## *Methods*

I conducted roadside counts of Kestrels between late November and mid-February in Humboldt, Mendocino, Lake, Colusa and Yolo Counties. Habitats censused included open areas relatively devoid of trees, areas vegetated predominantly by trees, and areas transitional between these two major habitats.

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Open habitats included pastures in the vicinity of Humboldt Bay and agricultural fields in the Central Valley. Wooded areas censused were in the Coast Range. Transitional habitats censused were immediately east of Humboldt Bay and riparian habitats along the Sacramento River in the Central Valley.

Kestrels were observed mainly in agricultural areas in the Coast Range. So few were observed in redwood (*Sequoia sempervirens*) and Douglas fir (*Pseudotsuga menziesii*) forests on the west slope and in pine-oak-chapparral woodlands on the east slope that they were not counted in these habitats. Thus, surveys in the Coast Range were restricted to agricultural areas along the Mad, Elk, Van Duzen, Eel and Mattole Rivers, and Jacoby and Salmon Creeks on the west slope; and to agricultural areas along Cache Creek and Clear Lake on the east slope.

Each Kestrel observed was examined carefully with the aid of 10-power binoculars or a 15-power spotting scope to determine its sex. Only those birds in which sex was positively identified were recorded. Attempts to age Kestrels in the field were unsuccessful.

Distance between successive observations of 340 birds was recorded to the nearest 0.1 mile (0.16 km) on automobile odometers as a means of measuring density.

### *Results and Discussion*

A total of 670 Kestrels was sexed in all habitats surveyed during the winters 1970-71 through 1972-73 (Table 1). Chi-square tests of homogeneity and fre-

**Table 1.** Sex ratios of Kestrels wintering in open, wooded, and transitional habitats in northern California.

Geographic area and habitat	No. females	No. males	Sex ratios* females:males
Coastal Humboldt County			
open pasturelands	151	16	9.4:1 <sup>a</sup>
transitional habitats	192	55	3.5:1 <sup>b</sup>
Central Valley			
open farmlands	73	19	3.8:1 <sup>b</sup>
transitional habitats	26	21	1.2:1 <sup>c**</sup>
Coast Range			
wooded pastures and orchards	35	85	1:2.3 <sup>d</sup>

\*Ratios followed by different letters are significantly different from each other ( $p \leq 0.05$ ); ratios followed by the same letter are insignificantly different from each other ( $p = 0.75$ ).

\*\*Insignificantly different from a 1:1 sex ratio ( $0.75 < p < 0.50$ ); all others are significantly different from a 1:1 sex ratio ( $p \leq 0.05$ ).

quency indicated significant differences in sex ratios among Kestrels in pastures on the coast, riparian habitats in the Central Valley, and wooded habitats in the Coast Range. Sex ratios in transitional habitats on the coast and in agricultural fields in the Central Valley were statistically similar, but differed significantly from the other three habitat types.

The null hypothesis that sex ratios were 1:1 was rejected for all but Kestrels in riparian habitat in the Central Valley.

Analysis of variance of distance between successive observations showed only two differences: average densities of 34 Kestrels per 100 miles (161 km; 95% confidence estimate of mean =  $34 \pm 11$  Kestrels per 100 miles—161 km) in coastal and Coast Range habitats, and 115 Kestrels per 100 miles (161 km; 95% confidence estimate of mean =  $115 \pm 25$  Kestrels per 100 miles—161 km) in Central Valley habitats. This indicated a difference in relative suitability of these areas for Kestrels, including differences in suitability of coast transitional and Central Valley open habitats in which there was no significant difference in sex ratios.

These results clearly indicate habitat segregation between sexes of Kestrels wintering in northern California. Males predominate in wooded, agricultural habitats and females predominate in open pastures and fields. The open and transitional habitats differed latitudinally as well as climatically. Therefore, it is not possible to interpret the decrease in the relative proportion of females in open and semi-wooded habitats between coastal Humboldt County and the Central Valley. More extensive surveys are required to determine if sexes of Kestrels are segregated latitudinally (i.e., geographically) as well as on the basis of habitat.

Habitat segregation by sexes of wintering Kestrels is interpreted here as character displacement (Brown and Wilson 1956) reducing intersexual competition for food resources. Habitat segregation by sexes is but one of several methods by which intersexual competition for food may be alleviated. In his general review of the phenomenon, Selander (1966) discussed several alternatives including one other that has been documented for Falconiformes: the selection of prey differing in size by sexes of accipiters (Höglund 1964, Storer 1966) and Peregrine Falcons (*Falco peregrinus*) (Cade 1960). Accipiters and Peregrine Falcons exhibit pronounced sexual dimorphism in body size; the size of prey selected by these birds is directly proportional to their own body size. Presumably, Kestrels also fit this pattern. However, even though the sexes of Kestrels differ in body size, they are much less dimorphic than are the sexes of accipiters and Peregrine Falcons (Selander 1966:139). Therefore, the sexes of the relatively monomorphic Kestrels would be expected to select prey of similar size in different habitats, whereas sexes of the more dimorphic accipiters and Peregrine Falcon would be expected to select prey of different sizes in the same habitat. In support of this postulate, Cade (1960:243) reported that he has unpublished data indicating that sexes of Kestrels select prey of similar size and Collopy (pers. comm.) reports no evidence of differential size selection of prey by sexes

of Kestrels. Thus, habitat segregation of Kestrels by sexes may be an adaptation necessary to alleviate intersexual competition for food.

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