

# Home Range and Habitat Utilization of Breeding Male Merlins, *Falco columbarius*, in Southeastern Montana

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Home range size and habitat utilization of three breeding male Richardson's Merlins (*Falco columbarius richardsonii*) in southeastern Montana were studied using radio telemetry. Home ranges of these birds encompassed 13, 23, and 28 km<sup>2</sup>. Each bird traveled up to 9 km from its nest. Each home range encompassed five habitats; sagebrush/grassland, riparian, and Ponderosa Pine (*Pinus ponderosa*) communities were used significantly ( $p \leq 0.05$ ) more, and grasslands and agricultural fields less ( $p \leq 0.05$ ), than expected, based on the proportions in the combined home ranges. Four sites regularly used by hunting male Merlins indicated preferences for patchy shrub/grasslands as hunting habitats.

Key Words: Merlin, *Falco columbarius*, home range, habitat, southeastern Montana.

Richardson's Merlin (*Falco columbarius richardsonii*) is an inhabitant of sparsely treed grasslands in the northern Great Plains. Breeding pairs in Canada nest in small groves of deciduous trees along rivers (Bent 1938) and shelterbelts adjacent to grasslands (Hodson 1976). In the western United States, Richardson's Merlins nest in deciduous riparian communities (Call 1978) and in coniferous stands in close proximity to grasslands (Ellis 1976; Becker 1984).

Previous food studies in these areas suggest that Richardson's Merlins hunt in grassland habitats (Bent 1938; Fox 1964; Hodson 1976); however, detailed information on habitat utilization and home ranges of these birds is lacking in the literature. The objectives of this study were to determine the size of home ranges of male Merlins and to identify preferred hunting habitats. Males were selected for study because they do most of the hunting for the breeding pair and nestlings.

## Study Area

The 39 448-ha study area in southeastern Montana consisted largely of sagebrush/ grassland shrub-steppe and agricultural fields interspersed with buttes and rolling hills dominated by stands of Ponderosa Pine (*Pinus ponderosa*). Maximum elevation is 1282 m above sea level. The climate is characterized by hot summers, cold winters, and a semi-arid moisture regime. Annual precipitation averages 39 cm, of which 70% falls from May through

September. Monthly mean temperatures during the Merlin breeding season range from -8°C in March to 33°C in July.

## Methods

Adult male Merlins were captured near their nest sites in late May and early June of 1980. To minimize disturbance of breeding adults near their nests, capture was attempted only after young had hatched. A dho-gazza trapping device was modified from that described by Beebe and Webster (1964), and a permanently crippled Great Horned Owl (*Bubo virginianus*) was used to lure the Merlins into mist nets. After capture, the Merlins were restrained in a stocking while the transmitters were being attached.

Each of the three male Merlins captured was fitted with an SM-1 transmitter manufactured by the AVM Instrument Company<sup>1</sup>. The transmitter package weighed approximately 7 g, or approximately 10% of the bird's weight. It was attached ventrally to the proximal end of the shaft of a central tail feather by two strands of monofilament embedded in the dental acrylic covering of the transmitter package. Antennas

<sup>1</sup>The use of the SM-1 transmitter (AVM Instrument Company) name is for the benefit of the reader; such use does not constitute an official endorsement or approval of any service or product by the U. S. Department of Agriculture and the U.S. Department of Interior to the exclusion of others that may be suitable.

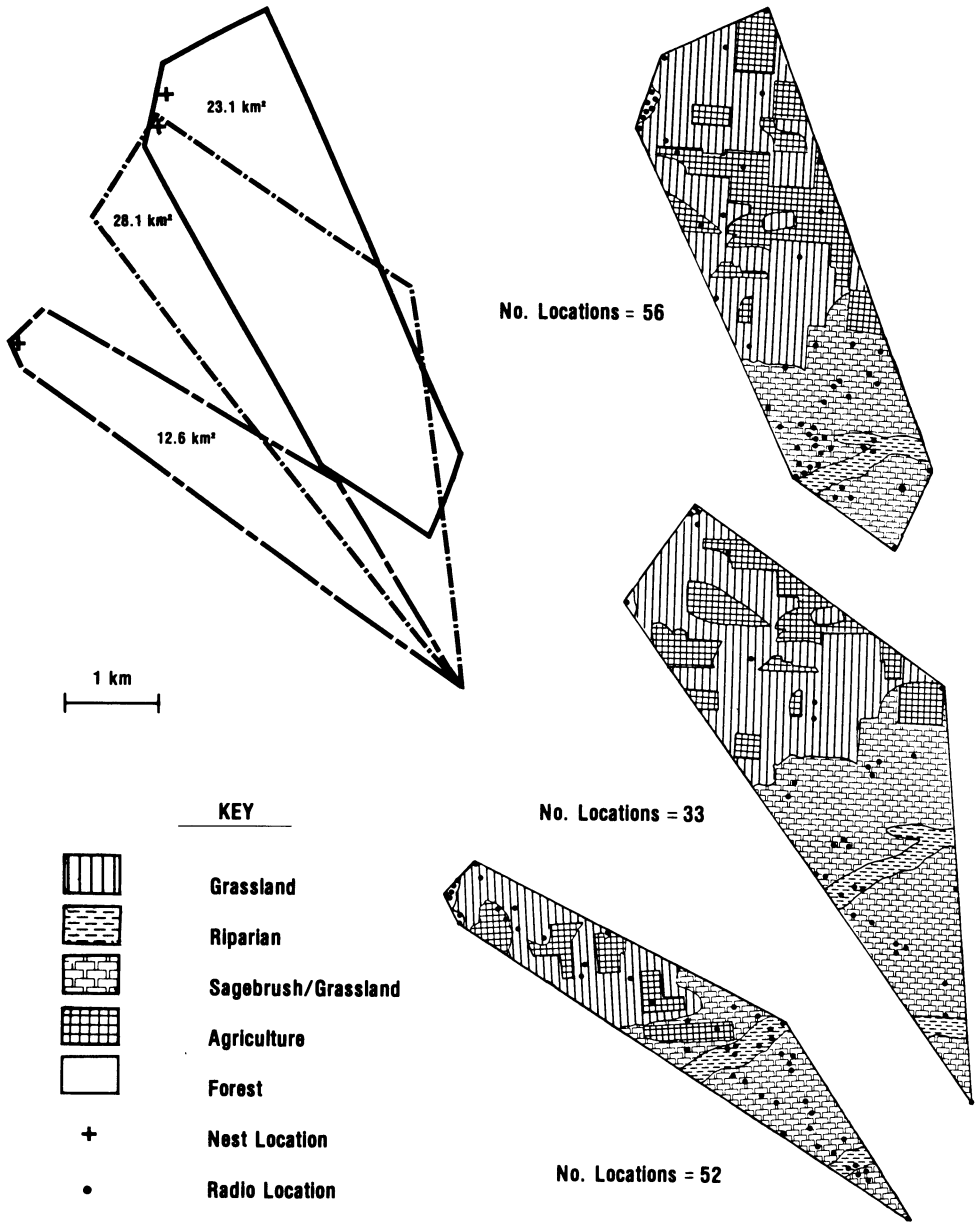


FIGURE 1. Home ranges, habitat types, and radio locations of three breeding male Richardson's Merlins in southeastern Montana.

on each transmitter were approximately 14 cm in length. Two additional monofilament strands stabilized the antenna on the feather at intervals of approximately 4 and 8 cm from the transmitter package. All monofilament strands were secured by two square knots and epoxy glue.

Movements of the three male Merlins fitted with transmitters were simultaneously monitored for five days (eight consecutive hours) and during portions (a minimum of four consecutive hours) of 12 subsequent days during June and July of 1980. One fixed monitoring station and a mobile unit were used to

track the birds. Triangulation was necessary due to the extreme difficulty of visually locating the birds. Locations of each bird were recorded at 15-minute intervals, and time, location of the investigator, and azimuth were recorded for each monitoring effort. Bearings were later plotted on USGS topographic maps (scale 67.4 mm = 1.61 km). Home range size of each male Merlin was calculated by use of a planimeter and delineated by the minimum home range method (Mohr 1947).

Habitats within each male Merlin's home range were delineated on the basis of physiognomic features and mapped. Area and percentage of each habitat were calculated within each home range. Pooled habitat use patterns for radio-tagged Merlins were evaluated with contingency tables, and numbers of observations in the various habitats were compared to expected numbers, based on proportional availability, by chi-square analysis (Neu et al. 1974).

Vegetation characteristics were sampled at four sites where at least 12 locations of one or more of the male Merlins were clustered. Percent plant canopy cover was estimated by species in 150, 0.1-m<sup>2</sup> quadrats spaced at 1-m intervals along three, 50-m transects on each site (Daubenmire 1959). Maximum vegetation height within each quadrat was also recorded. Shrub densities (numbers of individual stems of each species present) were sampled in 90-milacre (2.1-m<sup>2</sup>) quadrats spaced at 2-m intervals on alternate sides of the three, 50-m transects on each site. Beetle (1970) was used as the authority for common and scientific names.

## Results

Home ranges of the three male Merlins ranged from 13 to 28 km<sup>2</sup> and were elongated in shape (Figure 1). The home range of each bird overlapped that of at least one of the other male Merlins. The nest site of

one of the Merlins was also located within the home range of another male whose nest was located in an adjacent drainage. Maximum distances traveled from nests were 8 to 9 km.

Five physiognomic habitats were delineated within the home ranges of the three male Merlins. The sagebrush/grassland habitat was characterized by varying densities of Big Sagebrush (*Artemisia tridentata*) and mixed grasses such as Western Wheatgrass (*Agropyron smithii*), Blue Grama (*Bouteloua gracilis*), Buffalograss (*Buchloe dactyloides*), Prairie Junegrass (*Koeleria cristata*), and a variety of other species. Shrubs such as Silver Sagebrush (*A. cana*), Woods Rose (*Rosa woodsii*), and Western Snowberry (*Symphoricarpos occidentalis*), and grasses such as Western Wheatgrass and bluegrass (*Poa* spp.) characterized the vegetation along the ephemeral stream in the riparian habitat. The grassland habitat occurred on lowlands surrounding the buttes, and was dominated by Western Wheatgrass, Blue Grama, Prairie Junegrass, Needle and thread (*Stipa comata*), and bluegrass; shrub cover in this habitat was limited to stands of Western Snowberry in mesic drainages and scattered, small stands of Silver and Big sagebrush. The Ponderosa Pine habitat dominated the sideslopes of the buttes, and consisted of Ponderosa Pine of mixed ages and densities. Grain, fallow, and hayfields collectively constituted the agriculture habitat.

Sagebrush/grassland, riparian, and Ponderosa Pine habitats were used significantly ( $p \leq 0.05$ ) more by hunting Merlins than expected, based on proportionate availability (Table 1). Grassland and agriculture habitats were utilized significantly less ( $p \leq 0.05$ ) than expected.

Big Sagebrush and Blue Grama were dominant plant species at two sites (sites 2 and 3) where the hunting male Merlins were most frequently observed

TABLE 1. Combined radio locations of three breeding male Richardson's Merlins in five habitats in southeastern Montana.

Habitat	Area (ha)	Proportion of total	Observed number of locations	Expected number of locations	Habitat selection <sup>1</sup>	Proportion observed in each habitat type and 95% confidence interval
Sagebrush	2770	43.4%	76	61	+	0.54 ± 0.11
Grassland	2169	34.0%	22	48	-	0.16 ± 0.08
Agriculture	1182	18.5%	12	26	-	0.08 ± 0.06
Riparian	209	3.3%	14	5	+	0.10 ± 0.07
Pine	51	0.8%	17	1	+	0.12 ± 0.07
Total	6381		141	141		

<sup>1</sup>+denotes significantly greater ( $p < 0.05$ ) use than expected.

-denotes significantly less ( $p \leq 0.05$ ) use than expected.

TABLE 2. Percent bare ground, litter cover, and plant canopy cover of major plant species on four sites where male Richardson's Merlins were frequently observed hunting in southeastern Montana.

Cover Type	Site number			
	1	2	3	4
BARE GROUND	42.5	18.9	18.4	9.3
LITTER	8.9	16.4	19.8	29.6
SHRUBS				
Silver Sagebrush, <i>Artemisia cana</i>				10.4
Fringed Sagebrush, <i>A. frigida</i>	0.6	0.1	1.1	
Big Sagebrush, <i>A. tridentata</i>	19.3	11.7	7.4	0.2
Plains Pricklypear, <i>Opuntia polyacantha</i>	1.1	0.7	0.6	
Woods Rose, <i>Rosa woodsii</i>				1.2
Western Snowberry, <i>Symphoricarpos occidentalis</i>				16.3
OTHERSHRUBS <sup>1</sup>	1.0	1.0	1.3	
GRASSES				
Western Wheatgrass, <i>Agropyron smithii</i>	6.4	2.6	5.3	16.1
Blue Grama, <i>Bouteloua gracilis</i>	2.1	13.7	8.2	
Buffalograss, <i>Buchloe dactyloides</i>	1.3		2.0	
Sandberg Bluegrass, <i>Poa secunda</i>	0.5			2.3
Other grasses <sup>2</sup>	1.0	1.1	1.3	
FORBS				
Common Y arrow, <i>Achillea millefolium</i>	1.0		0.5	1.0
Other forbs <sup>3</sup>			1.0	1.9
OTHER				
Lichen, <i>Parmelia chlorochrae</i>	1.9	2.2	2.5	
Club Moss, <i>Selaginella densa</i>	5.3	26.4	10.6	
Algae	2.6	2.5	0.8	

<sup>1</sup>Gardner Saltbush (*Atriplex gardneri*), Broom Snakeweed (*Gutierrezia sarothrae*).

<sup>2</sup>Tumblegrass (*Schedonnardus paniculatus*), Needle and thread (*Stipa comata*).

<sup>3</sup>Small-leaf Pussytoes (*Antennaria parvifolia*), thistle (*Cirsium* sp.), Scarlet Gaura (*Gaura coccinea*), Silky Crazyweed (*Oxytropis sericea*), Fuzzytongue Penstemon (*Penstemon eriantherus*), Scurfpea (*Psoralea* sp.), Field Pennycress (*Thlaspi arvense*), Hoods Phlox (*Phlox hoodii*).

(Table 2). Site 3 was dominated by Big Sagebrush and Western Wheatgrass. Each of these three sites were in the sagebrush/grassland habitat. Site 4 was in the riparian habitat, and was dominated by Western Snowberry and Western Wheatgrass.

Shrub densities in the three sagebrush/ grassland sites were variable, ranging from 7530 to 14740 stems/ha of Big Sagebrush and Gardner Saltbush (*Atriplex gardneri*) (Table 3). The riparian site had a total shrub density of 43350 stems/ha. Average maximum vegetation height was also variable, averaging 16.6 cm on the three sagebrush/grassland sites, and 44 cm on the riparian site.

## Discussion

Few comparative data on home range sizes or foraging distances of breeding Merlins are available. Hodson (1976) concluded from behavioral observations that breeding Merlins in Alberta hunted up to 1.6 km from their nesting sites. The home ranges of

the Montana Merlins and maximum distances they traveled from their nests were considerably larger. Richardson's Merlins have longer wings and tails and lighter wing-loading in comparison with other subspecies of Merlins inhabiting forested habitats. These physical differences may be adaptations that allow this subspecies to range over large areas (Temple 1972). Other factors involved in these differences may have included differences in habitats within home ranges, terrain, prey availability and abundance, or some combination of these factors.

Results of this study indicated a high degree of use of sagebrush/ grassland habitats by hunting male Merlins during June and July. A study of food habits of this population of Merlins indicated that Horned Larks (*Eremophila alpestris*), Lark Buntings (*Calamospiza melanocorys*), and Vesper Sparrows (*Poocetes gramineus*) constituted 27%, and 13% of 427 food items, respectively (Becker 1984). Merlin use of sagebrush/grassland may have been a

TABLE 3. Shrub densities (stems/ ha) at four sites where hunting male Richardson's Merlins were frequently observed in southeastern Montana.

Species	Shrub densities (stems/ ha)		
	Site number		
	2	3	4
Big Sagebrush	14740	7 110	4470 130
Western Snowberry	—	—	— 35 590
Silver Sagebrush			— 5 540
Woods Rose			2 090
Gardner Saltbush		420	20 —
Totals	14 740	7 530	4 490 43 350

direct result of relatively high densities of Horned Larks and Vesper Sparrows drawn to food, cover, and elevated perches provided by Big Sagebrush interspersed with grassland.

Male Merlins were observed less often in grasslands than expected, based on availability of this habitat. In contrast, food habits of breeding Merlins in southeastern Montana indicated that birds typically associated with open grassland habitat were heavily preyed upon (Becker 1984). Similar results have been reported by Fox (1964) and Hodson (1978) for Merlins in Canada. The importance of the grassland habitat in our study, as represented by the number of radio locations in it, may have been underestimated because of a lack of elevated hunting perches in the form of shrubs or because of difficulty in locating Merlins perched on the ground in broken terrain. Thus, grassland habitat may be more important to hunting Merlins than indicated by the data presented.

The limited use of agricultural habitat by adult male Merlins might have been influenced by a lack of perching sites, difficulty in locating Merlins on the ground, or by lower vegetation diversity and a corresponding lower density of potential prey species. In a study of avian habitat use in central North Dakota, Horned Larks and Vesper Sparrows were two of the most common species observed in croplands; however, of all major habitats sampled, croplands had the lowest breeding bird populations (Faanes 1982). The limited use of croplands by breeding birds was further illustrated by lower species richness, mean density, and species diversity in the North Dakota study.

Higher than expected use of riparian habitats by hunting male Merlins was attributed mainly to the presence of water and food sources that attracted prey species. Also, shrub cover in this habitat likely provided perches for both Merlins and their prey.

The Ponderosa Pine habitat probably is not an important hunting habitat for Richardson's Merlins.

Forest avifauna constituted only 7% of food items identified for this population of Merlins (Becker 1984). However, because nests of the three Merlins in this study were in Ponderosa Pine stands, the birds spent considerable time at or near nest sites between hunting forays.

The patchy shrub cover on four sites regularly used by hunting male Merlins likely provided cover, nesting sites, and perches for prey species. The variety of plant species on these sites may also have provided excellent food sources for passerines. In addition, small depressions in the ephemeral stream bed on the riparian site held water during the entire study period, and was likely important in attracting prey species.

Although shrub density was highly variable on sites where Merlins were regularly observed hunting, it appeared that the presence of some shrubs increased the use of the site by Merlins. Shrubs were probably important to resident birds for elevated singing perches, as well as for hiding and nesting cover. The high variability in shrub densities and heights likely contributed to a diverse prey base. For example, Horned Larks make greater use of sites with low shrub densities, whereas Lark Buntings and Vesper Sparrows are more apt to utilize sites with intermediate to higher shrub densities (Johnsgard 1979).

The results of this study indicated that Merlins used diverse habitat and prey; however, they relied most heavily on the abundant avifauna of sagebrush/grasslands of the shrub-steppe. Management activities that would maintain or increase the natural diversity of these habitats would be beneficial to both Merlins and their prey. Removal of shrubs or conversion of sagebrush/grassland habitat to agricultural cropland could reduce the quality of Merlin hunting habitat. The importance of the Ponderosa Pine habitat on the study area was clearly indicated by the Merlins' exclusive use of this habitat for nesting (Becker 1984). The pine community also provided important perching and roosting sites. Thus, management efforts in the area should be aimed at maintaining Ponderosa Pine and adjacent sagebrush/grassland habitats.

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