

uniform, high-volume flow on the Rio Yaqui below the El Novillo reservoir. Above the reservoir, and particularly above the Aros/Bavispe confluence, flow is highly seasonal with a peak from August to October and a low from December to June. Although a smaller dam on the Rio Bavispe at Angostura may stabilize the flow above El Novillo to some extent, portions of the upper river are sometimes dry during winter and spring.

The authors made five censuses by boat on various stretches of the Rio Yaqui and its tributaries from December 1981 to December 1983 (Fig. 1). Three censuses were in winter, and two were in summer. Two winter censuses (31 Dec. 1981 to 7 Jan. 1982; 31 Dec. 1982 to 8 Jan. 1983) were conducted along the 160-km stretch from the El Novillo reservoir to the Alvaro Obregon reservoir near Obregon. The third winter census, from 12 to 19 Dec. 1983, was made from Huasabas on the Rio Bavispe to its confluence with the Rio Aros, and from there to the head of the El Novillo reservoir, a distance of 145 km. Summer censuses were made along a 70-km route from the El Novillo dam to Tonichi on 10–15 Sept. 1982 and 31 Aug. to 5 Sept. 1983. The location, date of observation, and number of all eagles sighted were recorded. Approximately 20 km of river were censused each day by two to six experienced observers. The relatively long length of the census periods, up to eight days, meant that some eagles may have been counted on more than one day.

Seven Bald Eagles were seen during the 1981–82 census: three adults near Soyopa on 2 Jan. 1982 below the El Novillo Reservoir; two immature eagles (individuals with white mottling and lacking a white head) and an adult below Soyopa on 3 Jan.; and one adult above Tonichi on 3 Jan. At least four adults were seen during the 1982–83 census: one adult was seen 16 km below the dam on 1 January 1983; another adult observed at the same locality a few hours later could have been the same individual; two adults were seen on 2 Jan. near Soyopa; and one immature was seen on 3 Jan. below Soyopa. The early winter trip of 1983 produced a single sighting of an adult on 14 Dec. at the mouth of the Arroyo Bacadehuachi, approximately 120 river-km above the El Novillo reservoir. No Bald Eagles were seen on either summer trip.

In addition to our observations, we spoke with local residents along the river near El Novillo. They were familiar with *Aguilas de Cabeza Blanca* (Bald Eagles) and had observed them fishing in the reservoir in prior years.

The distribution of Bald Eagles along the Rio Yaqui prior to construction of the dam is unknown. Based on our observations and local interviews it is evident that Bald Eagles now are regular winter residents in small numbers along the Rio Yaqui drainage, especially below the El Novillo dam. The Rio Yaqui locality represents the only area of inland Sonora where Bald Eagles are known to occur regularly in winter, and it is the southern-most known wintering location west of the continental divide in North America.

*Acknowledgments.*—S. Anderson, D. Gori, C. Carey, N. Henderson, S. Jones, W. Leibfried, W. Ranney, and C. Schwalbe shared their observations with us. S. A. Nesbitt, M. W. Collopy, G. Monson, and S. M. Russell reviewed the manuscript and made valuable comments.—BRYAN T. BROWN, *Cooperative Park Resources Studies Unit, Univ. Arizona, Tucson, Arizona 85721*; AND PETER L. WARREN, *Office of Arid Lands Studies, Univ. Arizona, Tucson, Arizona 85721. Accepted 16 Dec. 1984.*

*Wilson Bull.*, 97(2), 1985, pp. 226–230

**Food habits of Richardson's Merlins in southeastern Montana.**—Early information on food habits of Merlins (*Falco columbarius*) in North America was derived primarily from examination of stomach and crop contents (Fisher, U.S.D.A. Bull. No. 3., 1893; Bent, U.S. Natl. Mus. Bull. 170, 1938), observation of hunting and feeding activities (Craighead and

Craighead, Wilson Bull. 52:241–248, 1940; Lawrence, Wilson Bull. 61:12–25, 1949), and examination of regurgitated pellets (Breckenridge and Errington, Auk 55:668–670, 1938; Johnson and Coble, Jack-Pine Warbler 45:97–98, 1967). Food habits of breeding Merlins have also been examined and quantified by analyses of prey remains gathered at or near active nests, both in Canada (Fox, Blue Jay 12:140–147, 1964; Oliphant and McTaggart, Can. Field-Nat. 91:190–192, 1977; Hodson, Can. Field-Nat. 92:76–77, 1978) and in Europe (Sperber and Sperber, Zoologiska Bidrag Fran Uppsala 35:263–268, 1963; Newton et al., Br. Birds 71:376–398, 1978; Watson, Bird Study 26:253–258, 1979). To date, little is known about the food habits of Merlins breeding in the western United States. This paper reports food habits of Richardson's Merlins (*F. c. richardsonii*) breeding in southeastern Montana during 1980 and 1981.

*Study area and methods.*—Merlins were studied in southeastern Montana in an area dominated by hills and sandstone buttes ranging to approximately 300 m above adjacent prairies and farmlands. Grassland comprised approximately 67% of the 39,448 ha study area, while 27% was covered by forest. The remaining 6% was composed of rough, broken badlands habitat. Forested habitat was dominated by ponderosa pine (*Pinus ponderosa*) associated with aspen (*Populus tremuloides*), box elder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*). Grasslands were composed largely of blue grama (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), and needle-and-thread grass (*Stipa comata*). Dominant shrubs were big sagebrush (*Artemisia tridentata*), silver sagebrush (*A. cana*), and snowberry (*Symphoricarpos albus*).

From May through July 1980 and 1981, prey remains (contour feathers, wings, legs, beaks, etc.) and regurgitated pellets were collected at and near 20 active Richardson's Merlin nests. Each nest was visited three to five times, and all prey remains at the nest-site and at nearby perches were collected. Prey remains were identified to species when possible. Primary feathers were counted individually. Based upon comparisons with museum specimens, if fewer than the expected number of primaries of a left or a right wing were present, it was assumed that one individual bird had been consumed. When more than the expected number of primaries from a left or a right wing were located, these were counted, divided by the number of primaries for that species, and rounded to the next highest number to provide the number of individual prey involved (Page and Whitacre, Condor 77:73–83, 1975).

Pellets were examined under a variable power dissecting microscope. Bird and reptile remains were compared with museum specimens in the University of Montana Zoology Museum. Skulls of mammals were identified using a skull key (Hoffman and Pattie, Univ. Montana Printing, 1968). Hair samples were identified by dorsal guard hair characteristics (Moore et al., Wyoming Game and Fish Dept. Bull. 14, 1974). Insect remains were compared with specimens collected in the field. Weights of bird and mammal prey were obtained from information recorded for museum specimens in the University of Montana Zoology Museum. Weights for insects were obtained from specimens collected in the field.

*Food habits.*—A total of 1951 individual prey items (flight feathers, wings, legs, beaks, etc.) and 110 pellets were collected from nests and perches during 88 visits. These items represented at least 173 prey in 1980 and 254 in 1981.

Birds comprised 393 (92%) of the prey items and 93% of the total biomass of prey (Table 1). Seventeen (61%) of 28 species of birds identified as prey were species typically associated with grasslands or predominantly open prairie habitats. These species represented 83% of the total number of individual prey and 83% of the total biomass. Horned Larks (*Eremophila alpestris*) and Lark Buntings (*Calamospiza melanocorys*) each comprised 21% of the total biomass, and Vesper Sparrows (*Pooecetes gramineus*) were approximately 10%. Western Meadowlarks (*Sturnella neglecta*) comprised only about 4% of the total prey, but accounted for 12% of the biomass. Seven prey species were associated with forested habitat. These species represented 7% of the total prey and 10% of the total biomass.

TABLE 1  
 MAJOR PREY SPECIES OF RICHARDSON'S MERLINS IN SOUTHEASTERN MONTANA, 1980-1981

	No. of individuals	% total	Biomass (g)	% biomass
<b>Birds</b>				
Horned Lark ( <i>Eremophila alpestris</i> )	116	27.2	3062	21.2
Lark Bunting ( <i>Calamospiza melanacorys</i> )	75	17.6	3023	21.0
Vesper Sparrow ( <i>Pooecetes gramineus</i> )	54	12.6	1366	9.5
Mountain Bluebird ( <i>Sialia currocooides</i> )	28	6.6	644	4.5
Western Meadowlark ( <i>Sturnella neglecta</i> )	18	4.2	1728	12.0
Chestnut-collared Longspur ( <i>Calcarius ornatus</i> )	16	3.7	272	1.9
Red Crossbill ( <i>Loxia curvirostra</i> )	13	3.0	419	2.9
American Goldfinch ( <i>Carduelis tristis</i> )	9	2.1	132	0.9
Chipping Sparrow ( <i>Spizella passerina</i> )	7	1.6	84	0.6
Killdeer ( <i>Charadrius vociferus</i> )	7	1.6	728	5.0
Unidentified birds	6	1.4	229	1.6
Bobolink ( <i>Dolichonyx oryzivorus</i> )	5	1.2	165	1.1
Brown-headed Cowbird ( <i>Molothrus ater</i> )	5	1.2	220	1.5
Brewer's Sparrow ( <i>Spizella breweri</i> )	5	1.2	60	0.4
Brewer's Blackbird ( <i>Euphagus cyanocephalus</i> )	5	1.2	340	2.4
Lark Sparrow ( <i>Chondestes grammacus</i> )	4	0.9	92	0.6
Townsend's Solitaire ( <i>Myadestes townsendi</i> )	4	0.9	130	0.9
Other birds <sup>a</sup>	16	3.7	725	5.0
Subtotals	393	91.9	13,419	93.1
<b>Other</b>				
Grasshopper (Acrididae)	17	4.0	17	0.1
Thirteen-lined ground squirrel ( <i>Spermophilus tridecemlineatus</i> )	8	1.9	920	6.4

TABLE 1  
CONTINUED

	No. of individuals	% total	Biomass (g)	% biomass
Moth (Noctuidae)	5	1.2	7	<0.1
Other mammals and reptiles <sup>b</sup>	4	0.9	62	0.4
Subtotals	34	8.0	1006	7.0
Totals	427	100.0	14,425	100.0

<sup>a</sup> Including one or two individuals of the following: House Sparrow (*Passer domesticus*), Common Poorwill (*Phalaenoptilus nuttallii*), Red-winged Blackbird (*Agelaius phoeniceus*), American Robin (*Turdus migratorius*), Cliff Swallow (*Petrochelidon phyrhonota*), Eastern Kingbird (*Tyrannus tyrannus*), Savannah Sparrow (*Passerculus sandwichensis*), Dark-eyed Junco (*Junco hyemalis*), Northern Oriole (*Icterus galbula*), Mourning Dove (*Zenaida macroura*), and Yellow-rumped Warbler (*Dendroica coronata*).

<sup>b</sup> Including one or two individuals of the following: myotis (*Myotis* spp.), least chipmunk (*Eutamias minimus*), and northern short-horned lizard (*Phrynosoma douglassi brevirostre*).

The only insects recorded as prey were grasshoppers (Acrididae) and moths (Noctuidae), which comprised 5% of the prey (Table 1). Mammals, mostly thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*), accounted for approximately 3% of the prey. The only reptile recorded was one northern short-horned lizard (*Phrynosoma douglassi brevirostre*). A comparison of individual prey species consumed by Merlins in 1980 (33) and in 1981 (23) indicated that the relative composition of prey species was similar ( $r_s = 0.62$ ,  $P \leq 0.05$ ) between years.

This study illustrates the importance of grassland/prairie avifauna as a major prey component of breeding Richardson's Merlins in southeastern Montana. Similar results have been recorded in studies of food habits of Merlins breeding in the Canadian prairies. Fox (Blue Jay 12:140-147, 1964) observed that about 54% of the prey items noted in his study area in Saskatchewan were Horned Larks. Hodson (Can. Field-Nat. 92:76-77, 1978) found that 50% of prey items collected in Alberta consisted of the remains of Horned Larks.

A radio-telemetry study of breeding male Richardson's Merlins on the Montana study area indicated that the birds hunted most often in open sagebrush/grassland habitats (Becker, M.S. thesis, Univ. Montana, Missoula, Montana, 1984). Horned Larks, Lark Buntings, and Vesper Sparrows were the most conspicuous species and possibly the most abundant in these habitats. Hodson (1978) hypothesized that breeding Richardson's Merlins in Alberta preyed heavily on Horned Larks and Chestnut-collared Longspurs (*Calcarius ornatus*) because the feeding methods of these passerines made them more noticeable than other grassland birds. Oliphant and McTaggart (1977) suggested that Merlins breeding in urban Saskatoon, Saskatchewan, were taking a large number of House Sparrows (*Passer domesticus*) (64% of 176 identified prey items) because this species was abundant at the time.

Although Horned Larks represented a large proportion of Merlin prey documented in this study, 32 other species were also taken by Merlins. Conspicuous, abundant grassland birds were caught most often by Richardson's Merlins, and avifauna associated with forest communities was less prevalent in the diet. The variety of foods in the diet of Richardson's Merlins in southeastern Montana is probably a reflection of the diversity of habitats on the study area.

*Acknowledgments.*—Funding was provided by the USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. D. W. Carney and R. LeVesque assisted with data collection. I. J. Ball, K. L. Bildstein, D. M. Bird, R. L. Hutto, B. R. McClelland, and C. Hull Sieg provided critical review of this manuscript.—DALE M. BECKER, *USDI Fish and Wildlife Service, Univ. Montana, Missoula, Montana 59812. Accepted 19 Oct. 1984.*

*Wilson Bull.*, 97(2), 1985, pp. 230–231

**Raptors killing raptors.**—There are few detailed accounts of diurnal raptors killing other diurnal raptors (Peyton, *Condor* 47:167, 1945; Broun, *Hawks Aloft: The Story of Hawk Mountain, Dodd, Mead Co., New York, New York, 1949:193–194*; Rudebeck, *Oikos* 2:65–88, 1950; Rudebeck, *Oikos* 3:200–231, 1951). Here we provide additional field observations of this type of killing and suggest why it occurs.

Our observations were made during a study of the individual flight patterns of migrating raptors at Lehigh Gap, a break in the Kittatiny Ridge at Palmerton, Pennsylvania.

At 13:10, 15 Oct. 1982, a Peregrine Falcon (*Falco peregrinus*) was seen flying over the northeastern edge of the gap. The size of the falcon suggested it was a female. For approximately 2 min it coursed over the edge. It then turned west and set its wings in a gliding position. Suddenly, the falcon captured a Sharp-shinned Hawk (*Accipiter striatus*) believed to be a male because of its small size. The hawk was also in a glide prior to capture. The falcon approached its quarry from below (15–30 cm) and then flew up, flared its wings, and grasped the back of the accipiter. The hawk did not struggle after being grasped, and fell limp. The Peregrine Falcon then turned and flew back to the northeastern edge of the gap using labored flapping flight.

W. S. Clark and P. Dunne (pers. comm.) witnessed a Peregrine Falcon capture a Sharp-shinned Hawk in the fall of 1976 at their Cape May Point, New Jersey, banding station. The victim was gliding into a trap area when an immature male falcon struck it from above. As the Peregrine Falcon carried off its prey, a Northern Harrier (*Circus cyaneus*) began chasing the falcon. The peregrine responded by flying swiftly and turning sharply from side to side. Both birds passed from view over grass and dunes. Within a few seconds the falcon bolted almost straight up into the air without its prey. The harrier did not reappear.

D. F. Brinker and T. C. Erdman (pers. comm.) watched a Red-tailed Hawk (*Buteo jamaicensis*) capture a Sharp-shinned Hawk at their banding station on the west shore of Green Bay, Wisconsin. They also stated that during migration the larger raptors such as Red-tailed Hawks are lured to traps by previously captured smaller raptors such as Sharp-shinned Hawks. The larger birds dropped from their passage, entered the traps, and killed the smaller birds.

While banding raptors between 9 and 22 Oct. 1974, J. Ruos (pers. comm.) observed raptors of several species hunting other species on Loggerhead Key, Dry Tortugas, Florida. The weather was unfavorable for migration, with high winds and seas, and few typical prey were available to the predators. On several occasions during 11 Oct. Sharp-shinned Hawks attacked other Sharp-shinned Hawks caught in mist nets. Between 13 and 21 Oct. observations of Peregrine Falcons chasing a Sharp-shinned Hawk, American Kestrels (*F. sparverius*), and a Merlin (*F. columbarius*) suggest that the pursuing raptor was attempting to prey on the smaller ones.

Smaller raptors have also killed larger ones. From different accounts, Forbush (*Birds of Massachusetts and Other New England States, Part II, Norwood Press, Norwood, Massachusetts, 1927:170*) describes Peregrine Falcons killing Red-shouldered Hawks (*B. lineatus*)