THE SUMMER BIRDS OF THE FORESTS OF THE MOGOLLON MOUNTAINS, NEW MEXICO

By JOHN P. HUBBARD

The Mogollon Mountains are one of the largest and most ecologically varied ranges in southwestern New Mexico. Aside from F. M. Bailey's summary (1928) of the work done here, mainly by the Biological Survey in October, 1906 and 1908, and occasional mention of this area by Ligon (1961), very little has been published on the birdlife of these mountains, especially in regard to breeding birds. In the summer of 1964 I was able to undertake a study of the avifauna and other elements of the biota of the higher elevations of this range of mountains, the results of which are presented here.

ACKNOWLEDGMENTS

I am very grateful to Michael Baad, of the University of Michigan, for serving so capably as botanist and field companion over the course of much of this study. I wish to thank Robert W. Storer, Dale A. Zimmerman, Bruce J. Hayward, Bruce K. Harris, the members of the New Mexico Department of Game and Fish, and many others for their interest and aid in carrying out this work. Appreciated financial support was provided in part by grants from the University of Michigan Graduate Student Research Fund and the National Science Foundation.

THE STUDY AREA

Extending from west-central New Mexico to north-central Arizona is the Mogollon Plateau, here defined as that portion of the Colorado Plateau lying south of the Little Colorado River in Arizona and south of the Rio Salado and west of the Rio Grande in New Mexico (fig. 1). The Mogollon Mountains are one of several rather prominent ranges, including the San Francisco Peaks and White Mountains of Arizona, which rise from the Mogollon Plateau. For the most part such ranges are interconnected by forests of ponderosa pine (*Pinus ponderosa*), either in pure stands or mixed with oaks (*Quercus* sp.), although there are areas in New Mexico where these forests are replaced by grassland or woodland, or interrupted by river valleys.

The rugged Mogollon Mountains are located on the southern rim of the 7000-foot or higher Mogollon Plateau, falling away steeply to the southwest to elevations of less than 5000 feet. At the 8000-foot contour, the range has a maximum length of 25 miles, a width of 18 miles, and an area of approximately 235 square miles, all lying in southern Catron County (fig. 2). Above the 9000-foot contour the range is divided into a smaller, northern massif and a larger southern, or main, massif. The latter is centered some 12 miles east of the town of Glenwood (elevation approximately 4800 feet), or 20 miles east of the Arizona state line, and 135 miles north of the Mexican border. The highest point in the northern massif is Bearwallow Mountain, which is 9920 feet above sea level. In the main massif there are several peaks in excess of 10,000 feet, including the 10,892-foot-high Whitewater Baldy, the highest point in the range. In all, from eight to nine square miles are above the 10,000-foot contour in the main massif. The entire mountain range lies within the Gila National Forest and the bulk of the main massif lies within the Gila Wilderness area.

Numerous permanent and semipermanent streams drain the Mogollon Mountains, including tributaries of the Gila River in the eastern portion and tributaries of the

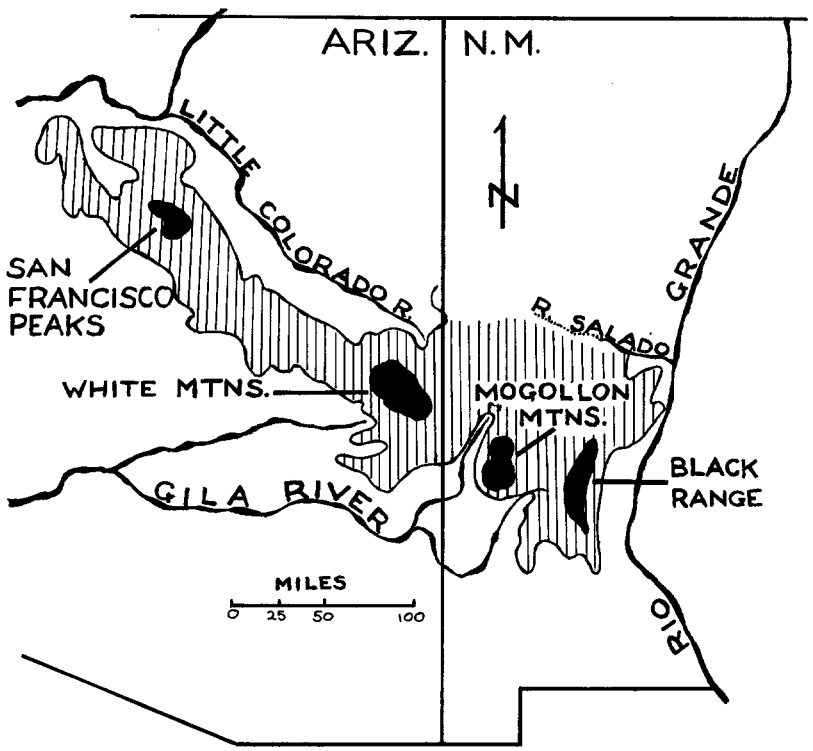

Fig. 1. Map showing the Mogollon Plateau of New Mexico and Arizona (vertical lines) with its major mountain ranges. Adapted from United States Geological Survey maps.

San Francisco River in the western portion. All of the drainage lies west of the North American continental divide.

The only main road to traverse these mountains, New Mexico Route 78, passes in an easterly direction from the town of Mogollon (elevation 7000 feet) between the northern and main massifs to the Willow Creek Ranger Station. In addition, numerous trails penetrate the Gila Wilderness Area, permitting easy access to the high country of the main massif. In order to study the array of habitat types in this range most effectively, study sites were set up along or near this road or these trails as follows (fig. 2):

Silver Creek Divide (9000 feet).—Located seven road miles east-southeast (or five miles east and two miles south) of the town of Mogollon in fir forest. Dates: June 6, 7, 19, and 20.

Bursum Camp (9100 feet).—Located nine road miles east-southeast (or seven miles east and two miles south) of Mogollon in fir forest mixed with considerable aspen (*Populus tremuloides*). Included here is the Bead Spring Tract (10,000 feet) located nine road and trail miles east-southeast (or seven miles east and three miles south) of Mogollon in spruce–fir forest. This site is one mile south of Bursum Camp on the north slope of Willow Mountain (maximum elevation 10,840 feet). Dates: May 16, 25–29; June 3, 4, 10–16, 24–27; and July 2, 3, 7, 8, and 29.

Ben Lilly Camp (8000 feet).—Located 16 road miles east (or 11 miles east and one-half mile south) of Mogollon in riparian spruce woodland along Willow Creek. Included here is Indian Creek Camp (8200 feet) three-fourths of a mile north of Ben Lilly Camp in pine forest. Dates: May 14, 15; June 4–6, 17–19, 28–30; July 1, 8–14, 30, 31; and August 1.

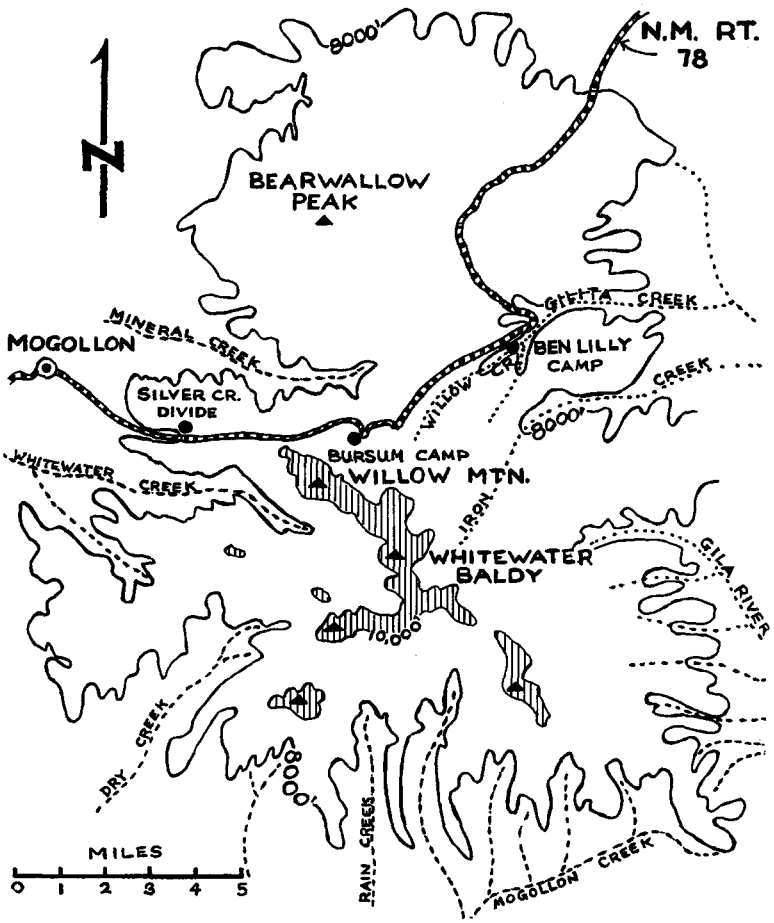

Fig. 2. Map of the Mogollon Mountains showing topographical features and localities mentioned in the text.

Other localities in these mountains were visited at less frequent intervals, including a trip of approximately eight trail miles from Bursum Camp to Black Mountain (elevation 10,637 feet) via Whitewater Baldy. However, no trips were made into the northern massif.

At least parts of 46 different days, between May 14 and August 1, 1964, were spent in the Mogollon Mountains (plus a short visit in July, 1959). On 26 of the days between May 25 and July 13, temperature extremes were measured, the mean maximum being 75° F. and the mean minimum 45° F. The lowest temperature recorded was 37° F. (on May 28) and the highest was 82° F. (on July 1). The last of the snowbanks disappeared in early June, and the summer rains began on June 28, being recorded on each of the 14 days spent in the area from then until August 1.

VEGETATION

With the exception of the arctic-alpine, all of the montane climax vegetation types recognized by Harrington (1954:vii–ix) in the southern Rocky Mountains

are present in the Mogollon Mountains. Although true timberline is not reached in these mountains, there are rocky or grassy balds fringed with stunted trees and shrubs on some of the higher ridges and peaks.

For the purposes of this study, the following vegetation types, characterized by structure and floral dominants, have been recognized:

Pine forest (Transition Zone).—Open forests of ponderosa pine with a ground cover predominantly of grasses, with little or no understory, characterize much of the plateau from which this range rises. Tongues of this forest type penetrating the Mogollons near Willow Creek were studied during the course of this work. At higher elevations this pine, and often Gambel oak (*Quercus gambelii*), form an ecotone with fir forest. At lower elevations it mingles with various live oaks to form a pine–oak woodland. Habitats below pine forest were not investigated during the course of this study, but previous work indicates a strong avifaunistic relationship to the birds of Marshall's (1957) pine–oak woodland in southeastern Arizona.

Fir forest (Canadian Zone).—Above elevations of about 8500 feet there are forests dominated by Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*) with small amounts of limber pine (*Pinus flexilis*). Shrubs and small trees are more in evidence here than in any other forest type and include maple (*Acer glabrum*), locust (*Robinia neomexicana*), gooseberry (*Ribes pinetorum*), willow (*Salix scouleriana*), ninebark (*Physocarpus monogynus*), oceanspray (*Holodiscus dumosus*), and others. The ground cover consists of an abundance of forbs with some sedges and grasses. Aspen is a common subclimax species, and where it is numerous it is an important avian habitat.

Riparian spruce woodland (Hudsonian Zone).—Often occurring on floodplains or the sides of permanent or semipermanent streams above about 7500 feet are rather openly spaced individuals or stands of blue spruce (*Picea pungens*). Interspersed with these trees are copses of alder (*Alnus tenuifolia*) and willows (including *Salix bebbiana, S. irrorata,* and *S.* cf. *geyeriana*) and thickets of gooseberry and red-osier (*Cornus stolonifera*). Ground cover consists of abundant forbs, grasses, and sedges which form meadows and swales where the floodplain broadens. Intrusion of adjacent forest types, generally pine and fir forests, also occurs in these floodplains. This type of habitat is well developed along Willow Creek and was studied in the area of Ben Lilly Camp.

Spruce–fir forest (Hudsonian Zone).—Above 9800 feet on north slopes and perhaps 400 feet higher on south slopes there occur forests of Engelmann spruce (*Picea engelmannii*) and alpine fir (*Abies lasiocarpa* var. *arizonica*). In the more open stands such shrubs as currant (*Ribes wolfii*), mountain-ash (*Sorbus dumosa*), and honeysuckle (*Lonicera utahensis*) are fairly common. Ground cover consists primarily of whortleberry (*Vaccinium oreophilum*), along with various forbs and sedges, and is better developed in the more open stands. Aspen is present in lesser numbers in most tracts of spruce–fir forest than it is in fir forest. This type of forest was studied mainly on Willow Mountain.

SPECIES ACCOUNTS

Sixty-seven species of birds were recorded in montane forest habitats in the course of this study; of these 60 were considered to be breeding birds (marked with an asterisk). Although breeding was established mainly on the basis of gonadal development of specimens or the discovery of eggs or young, in some cases it has been assumed on the basis of geographic probability. Comments on the abundance and ecology of the following birds are based on general impressions rather than on rigid mensural techniques. Taxonomic treatment follows the A.O.U. Check-list (1957), unless otherwise noted. A particular departure is the placement of the subfamily Carduelinae after the Emberizinae in the Fringillidae. The bulk of the birds collected during this study are now in the collections of The University of Michigan Museum of Zoology, Ann Arbor, Michigan.

**Cathartes aura*. Turkey Vulture. Flying individuals were seen occasionally throughout the study, but no specimens were secured.

**Accipiter striatus velox*. Sharp-shinned Hawk. This inconspicuous hawk was encountered four times in fir forest and once in riparian spruce woodland. An immature, unsexed, but probably a male, was shot on May 29 but not found until June 13, and an immature male (testes 4 × 7 mm.) was taken on June 11 in fir forest near Bursum Camp.

**Accipiter gentilis*. Goshawk. The only record is of a flying adult, being pursued by Brewer Blackbirds (*Euphagus cyanocephalus*), seen in riparian spruce woodland near Ben Lilly Camp on June 11. I believe the goshawk almost certainly breeds in these mountains.

**Buteo jamaicensis calurus*. Red-tailed Hawk. Adults were seen in the vicinity of Willow Creek on several occasions. An adult female (ovary regressing) collected near Ben Lilly Camp on July 13, shows an approach to the race *fuertesi* in the reduction of dark streaking on the belly and somewhat paler underparts.

**Falco sparverius sparverius*. Sparrow Hawk. This species was decidedly uncommon in pine forest near Willow Creek. None was collected.

**Dendragapus obscurus obscurus*. Blue Grouse. This grouse was uncommon in forests above 9000 feet in the main massif. Broods accompanied by single hens were seen near Bursum Camp as follows: at least two very young chicks on June 25; five to six small chicks (one collected) on July 2; and three half-grown young on July 30. These observations probably refer to two or three different family groups. Adult males were collected near Bursum Camp on June 4 (testes 5 × 10 mm.) and June 13 (testes 7 × 14 mm.), and on Center Baldy on June 16 (testes 9 × 11 mm.). The crops of all the adults contained conifer needles and small stones. The eye wattles were orange and the air sacs of the neck were pinkish-purple.

**Meleagris gallopavo*. Turkey. This species was fairly common in the vicinity of Willow Creek, ranging less commonly to elevations exceeding 10,000 feet in forests of the main massif. Broods accompanied by single hens were recorded in the study area as follows: six small poults were seen on Little Turkey Creek near Ben Lilly Camp on June 29; five small poults seen in a meadow in spruce–fir forest on Whitewater Baldy on July 8; and two groups totaling 15 to 20 young on Willow Creek west of Ben Lilly Camp in mid-July.

**Columba fasciata fasciata*. Band-tailed Pigeon. This species was common throughout the study area until early July, after which time it became rare or uncommon. An adult female (ovary enlarged, largest ova to 3 mm.) was secured on June 19 near Ben Lilly Camp.

**Otus flammeolus*. Flammulated Owl. This species was heard regularly in fir forest near Bursum Camp and also at Silver Creek Divide, but I was unable to collect any.

I cannot concur with the inclusion of this species in the Old World *Otus scops*, as proposed by Delacour (1941), in view of the differences in size, adult (and perhaps juvenal) plumage, voice, and eye color that exist between it and the forms of Scops Owl in eastern Eurasia (*O. s. strictonotus* and *O. s. japonicus*). The sympatric occurrence of species morphologically more similar than these is well established in the genus *Otus*, for example *Otus asio* and *O. trichopsis* in southeastern Arizona (Marshall, 1957:76–77) and serves to point out potential pitfalls in the lumping of well-differentiated, allopatric forms in this group.

Strix occidentalis. Spotted Owl. Bailey (1911:220) recorded this species in the Willow Creek area in October, 1908, and I heard what may have been a pair of these owls in the same area on June 5.

**Chordeiles minor henryi*. Common Nighthawk. Small numbers were observed foraging most evenings in the area of Willow Creek. A male (testes 5 × 7 mm.) was captured in a mist net which was stretched over a small pond in pine forest near Indian Creek Camp on June 4.

**Aeronautes saxatalis*. White-throated Swift. This species was observed rather infrequently and in small numbers as it foraged over all types of habitat, but no specimens were taken.

Stellula calliope. Calliope Hummingbird. An adult male (testes less than 1 mm.) was taken on July 31 near Ben Lilly Camp. Several other small hummingbirds which may have been of this species were seen in the same area on the same day.

**Selasphorus platycercus platycercus*. Broad-tailed Hummingbird. This species was common in all habitat types except spruce–fir forest where it was rare. Flowers of such species as beard-

tongue (*Penstemon barbatus*) and gooseberry were especially attractive to this and other species of hummingbirds. An adult male (testes small) was collected at Ben Lilly Camp on July 13.

Selasphorus rufus. Rufous Hummingbird. A male was seen on Willow Mountain on July 8, and the species was seen frequently thereafter in the study area, especially along Willow Creek. A female (ovary postbreeding) was collected at Ben Lilly Camp on July 13.

**Colaptes auratus collaris*. Flicker. Flickers were especially common in the pine forest and less so in denser forests. Five specimens were taken, including a laying female (large eggs in oviduct, brood patch) at Bursum Camp on June 10, and a large juvenal male near Ben Lilly Camp on July 13.

There seems to be no reason for retaining *Colaptes cafer* as a species distinct from *C. auratus* in view of the widespread introgression between them demonstrated by Short (MS).

**Sphyrapicus varius nuchalis*. Yellow-bellied Sapsucker. This species was fairly common in all habitats in which aspens were present, especially fir forest. Nests (all in aspen) containing noisy young were located as follows: one (from which the 2 one-third grown young were secured) at Silver Creek Divide on June 20; one on Little Turkey Creek near Ben Lilly Camp on June 28; two on Indian Creek near Ben Lilly Camp on July 1; and one at Bursum Camp in mid-July. Nine other specimens were taken, including large juvenal males on July 10 and 11 at Ben Lilly Camp.

**Sphyrapicus thyroideus nataliae*. Williamson Sapsucker. This sapsucker was rather uncommon in fir forest and pine–fir ecotone in the area of Willow Creek, where two nests (in aspens) containing noisy young were found on June 29. Four specimens were collected in this area, including a female feeding young on large ants on June 29, a large juvenal female on July 10, and a large juvenal male on July 12.

**Dendrocopos villosus leucothorectis*. Hairy Woodpecker. This was probably the most abundant woodpecker in the study area, although not common in riparian spruce woodland. Ten specimens were collected, including a worn male feeding young (insects) on June 27 near Bursum Camp.

**Dendrocopos pubescens leucurus*. Downy Woodpecker. This was one of the least common woodpeckers in the study area, where it was found in fir and spruce–fir forests in which aspens occurred. Three specimens were collected near Bursum Camp: a female (ovary enlarging, ova to 3 mm.) on May 17, a male (testes 2 × 4 mm.) on June 13, and a female (old brood patch, ovary postbreeding) on June 25.

**Picoides tridactylus dorsalis*. Northern Three-toed Woodpecker. This species was fairly common in spruce–fir forest in the main massif and was also sparingly encountered in the pine–fir ecotone near Bursum Camp and in the Willow Creek area. It is interesting that the species was found only in forest types in which trees with flakey bark occur, such as ponderosa pine and Engelmann spruce. This is correlated with characteristic feeding behavior observed in this species in which food items are exposed by chipping away the bark on tree trunks with laterally administered blows of the bill.

Five specimens were collected, including a large juvenal male, in pine–fir ecotone near Ben Lilly Camp on July 31; it was still being fed by the male parent.

**Empidonax difficilis hellmayri*. Western Flycatcher. This flycatcher was common throughout the study area except in pine forest and pine–fir ecotone where it was rare. In all, 17 specimens were collected, including four females, but no nests or young were discovered.

**Contopus pertinax pallidiventris*. Coues Flycatcher. A singing male (testes 4 × 8 mm.) in badly-worn plumage was collected in pine–fir ecotone near Ben Lilly Camp on July 2. This is the only occurrence of this species in the study area that I observed.

**Contopus sordidulus veliei*. Western Wood Pewee. This pewee was fairly common in pine forest and riparian spruce woodland in the vicinity of Willow Creek. Two specimens were taken: a male (testes 3 × 7 mm.) near Bursum Camp on May 27, and a female (brood patch, ovary postbreeding) at Ben Lilly Camp on July 9.

**Nuttallornis borealis*. Olive-sided Flycatcher. This flycatcher was locally fairly common in riparian spruce woodland along Willow Creek and its immediate tributaries. Foraging birds fed in adjacent pine and fir forests as well as in the previously mentioned habitat. A mated pair was

collected at Ben Lilly Camp on June 17, the male having enlarged testes (4 × 9 mm.) and the female with a soft-shelled egg in the oviduct.

**Tachycineta thalassina lepida.* Violet-green Swallow. This swallow was common in the pine forest near Willow Creek and foraging birds occurred as high as the spruce–fir forest. Three specimens were collected, including a large, flying juvenal female near Ben Lilly Camp on July 13.

**Progne subis.* Purple Martin. The martin was noted occasionally foraging over forests in the vicinity of Willow Creek throughout the summer but never in any numbers. No specimens were collected.

**Cyanocitta stelleri macrolopha.* Steller Jay. This jay was common in all habitats, although perhaps most abundant in fir forest. A nest with two large young (one collected) was found at Ben Lilly Camp on July 2. Twenty-four other specimens were collected, including a pair apparently feeding young on Willow Creek on June 30.

**Corvus corax.* Common Raven. This species was present in small numbers throughout the study area. A pair with three to four large young was seen near Ben Lilly Camp on July 12, 1959. No specimens were collected.

**Nucifraga columbiana.* Clark Nutcracker. The nutcracker was fairly common in forests above 9000 feet in the main massif in family groups or small flocks. The three adults collected (male on May 25, female on May 27, and male on June 11) had small gonads and were molting. In addition, two large juveniles (female on May 23, and female on June 23) were collected. On the basis of present evidence the breeding of this species in these mountains is only inferred, but it seems probable that it does breed here.

**Parus gambeli gambeli.* Mountain Chickadee. This species was common in all habitats, especially fir forest. Eight specimens were taken, including a grown juvenal male on July 11, at Ben Lilly Camp.

**Sitta carolinensis nelsoni.* White-breasted Nuthatch. This species was uncommon in pine forest near Willow Creek, ranging rarely up to spruce–fir forest on Willow Mountain where two were seen and a male (testes 3 × 4 mm.) was collected on June 27.

**Sitta canadensis.* Red-breasted Nuthatch. This nuthatch was fairly common in forests above 9000 feet. Three specimens were collected, including an incubating female (brood patch, ovary postbreeding) at Silver Creek Divide on June 20.

**Sitta pygmaea.* Pygmy Nuthatch. This species was common in pine forest and in the pine–fir ecotone and occasional in spruce–fir forest. No specimens were collected.

**Certhia familiaris montana.* Brown Creeper. This bird was fairly common in all habitats except fir forest where it was uncommon. Seven specimens were taken, including a grown juvenal male and female on July 12 at Ben Lilly Camp.

**Cinclus mexicanus unicolor.* Dipper. The only record is of a pair with two grown young (one collected) seen on Willow Creek west of Ben Lilly Camp on June 30. The species breeds at lower elevations in these mountains, and these may have wandered up from there.

**Troglodytes aedon parkmani.* House Wren. This wren was generally common in all habitats where fallen logs, brush, or loose rocks were available. Pairs apparently feeding young were seen near Ben Lilly Camp in the second week of July. Eleven specimens were collected, including a female with a brood patch and enlarged ovary (yolky ova to 6 mm.) near Bursum Camp on July 3.

**Turdus migratorius propinquus.* Robin. The Robin was rather common in pine forest and riparian spruce woodland but was less common about openings in fir and spruce–fir forests. A bird sitting on a nest 25 feet up in a pine was seen near Ben Lilly Camp on July 13, but the contents of the nest could not be determined. Seven specimens were collected, including a grown juvenal female at Ben Lilly Camp on July 10.

**Hylocichla guttata auduboni.* Hermit Thrush. This thrush was common throughout the study area except in pine forest, where it was rare, and spruce–fir forest, where it was uncommon. Large juveniles were seen near Ben Lilly Camp in late July. Ten specimens were taken, including a female with a hard-shelled egg in the oviduct on June 14 near Bursum Camp.

**Hylocichla ustulata swainsoni.* Swainson Thrush. A singing male was observed on June 28 and collected on June 30 in dense riparian spruce woodland approximately two and one-half miles

southwest of Ben Lilly Camp. The testes, grayish in color, were enlarged (6 × 12 mm.), as was the cloacal protuberance. Although not otherwise recorded, it is possible that this species breeds in small numbers in the eastern portion of these mountains.

**Sialia currucoides*. Mountain Bluebird. A female was seen twice at Ben Lilly Camp in early July, apparently gathering food for young. A pair was seen and the male (testes 7 × 14 mm.) collected, approximately 12½ miles north-northeast of Ben Lilly Camp on July 2. No others were recorded.

**Sialia mexicana bairdii*. Western Bluebird. This bluebird was common in pine forest near Willow Creek, nesting in old woodpecker holes. Four specimens were collected, including an incubating female (ovary with 3 plus ruptured follicles) at Indian Creek Camp on June 16.

**Myadestes townsendi townsendi*. Townsend Solitaire. The solitaire was rather uncommon in pine forest and pine–fir ecotone in the vicinity of Willow Creek where grown young were seen on July 11, 1959. In addition, several were heard and one collected (male, testes 7 × 11 mm.) on Black Mountain, in the main massif, on June 16. Males in breeding condition were collected near Ben Lilly Camp on June 29 (testes 6 × 12 mm.), July 9 (testes 6 × 15 mm.), and July 13 (testes 6 × 11 mm.).

These four specimens are darker above and below and grayer (less brownish) than a small series of breeding birds from the northern range of this species and may represent an approach to the subspecies *calophonus* of the Sierra Madre Occidental.

**Regulus satrapa apache*. Golden-crowned Kinglet. This species was uncommon in fir forest above 9000 feet and fairly common in spruce–fir forest. Two males were taken near Bursum Camp, one on June 11 (testes 4 × 6 mm.) and one on June 14 (testes 5 × 6 mm.).

**Regulus calendula cinerascens*. Ruby-crowned Kinglet. This kinglet was rather common in spruce–fir forest and riparian spruce woodland, less so in fir forest. Three specimens were taken, including a bob-tailed juvenal female near Ben Lilly Camp on July 1.

**Vireo solitarius*. Solitary Vireo. This species was uncommon in pine forest in the vicinity of Willow Creek. No specimens were secured.

**Vireo gilvus swainsonii*. Warbling Vireo. This vireo was common in deciduous growth in riparian spruce woodland and aspen groves in fir forest; it was less common in spruce–fir forests. Twelve specimens were collected, including laying females at Bursum Camp on June 14 (yolky ova to 4 mm., 4 ruptured follicles) and June 28 (yolky ova to 9 mm.).

**Vermivora celata orestera*. Orange-crowned Warbler. This species was fairly common in brushy growth in riparian spruce woodland and aspen groves in fir forest. Three specimens were taken, including a male with enlarged testes (5 × 7 mm.) on May 30 near Bursum Camp.

**Vermivora virginiae*. Virginia Warbler. This warbler was fairly common in brushy growth in riparian spruce woodland, along with the preceding species, and in the pine–fir ecotone, especially where Gambel oak occurred. Large juveniles were collected near Ben Lilly Camp on July 8 (a female), July 9 (a male and a female), July 12 (a male), and July 13 (a ?female).

**Peucedramus taeniatus arizonae*. Olive Warbler. A singing male (testes 4 × 6 mm.) was collected in fir forest near Silver Creek Divide on June 7, and one or more birds were noted in pine–fir ecotone near Ben Lilly Camp on July 12, 13, and 31. The only other record I know of from these mountains is a male (testes 5 × 7 mm.) taken by John W. Hardy near Ben Lilly Camp on June 19, 1958. This specimen is in the collection of the University of Kansas (KU 35717).

Recent work by George (1962) has shown convincingly that this species does not belong in the Parulidae or any other New World nine-primaried Oscine group, but until its place in some other family is better defined it is left here as a matter of practicality.

**Dendroica auduboni memorabilis*. Audubon Warbler. This species was common in fir and spruce–fir forests and uncommon in other habitats. Full-grown juveniles were seen near Ben Lilly Camp as early as the second week in July. Twenty-seven specimens were collected, including a partial albino male (testes 5 × 8 mm.) on May 17, and a laying female (yolky ova to 4 mm.) on June 14, near Bursum Camp.

**Dendroica graciae graciae*. Grace Warbler. This warbler was uncommon in pine forest in the vicinity of Willow Creek where a male (testes 5 × 7 mm.) was collected on June 6.

**Oporornis tolmiei monticola.* MacGillivray Warbler. These warblers were fairly common in dense riparian spruce woodland brush in the narrower canyons of Willow Creek and its tributaries. A female (brood patch, ovary enlarged with several ruptured follicles) was collected on July 1 near Ben Lilly Camp, and a pair carrying food was seen there in the second week of July.

**Cardellina rubrifrons.* Red-faced Warbler. This species was common in fir forest and less so in riparian spruce woodland. In the study area it seems to require stands of short-needled coniferous trees with a mixture of deciduous trees or shrubs and a fairly well-developed ground cover. Seven specimens were collected, including a laying female (yolky ova to 8 mm.) on May 30 near Bursum Camp. All three adults collected after the first week of July were molting.

**Euphagus cyanocephalus.* Brewer Blackbird. Eight to 10 pairs bred near Ben Lilly Camp in riparian spruce woodland. Two nonflying young were seen there (one of which was collected) on June 18, and full-grown juveniles, still being fed by their parents, were observed as late as June 28. An adult male (testes 3 mm.) was collected there on July 2.

**Piranga ludoviciana.* Western Tanager. This tanager was generally uncommon except in spruce–fir and pine forests where it was rare. Six specimens were collected, including a female with an enlarged ovary (yolky ova to 4 mm.) on May 28, near Bursum Camp.

**Pheucticus melanocephalus melanocephalus.* Black-headed Grosbeak. This species was fairly common in forests in which aspen or other deciduous trees occurred, especially in fir forest. Two specimens were collected.

**Pipilo chlorurus.* Green-tailed Towhee. This species was fairly common in riparian spruce woodland along Willow Creek and in shrub-dotted (mainly *Salix scouleriana* and *Ribes pinetorum*) meadows on the interconnecting ridge between Willow Mountain and Whitewater Baldy. Four specimens were collected, including a nearly grown juvenal male on July 13, near Ben Lilly Camp.

I concur entirely with Sibley (1955) in merging *Chlorura* with the *ocai-erythrophthalmus* complex of *Pipilo*. The members of this group seem more similar among themselves than any is to the Brown Towhee group of *Pipilo*.

**Junco caniceps dorsalis.* Gray-headed Junco. This junco was fairly common in pine forest, riparian spruce woodland, and about openings in fir and spruce–fir forests. Ten specimens were collected, including a laying female (yolky ova to 7 mm.) on June 6, and a grown juvenal male on July 8, near Ben Lilly Camp. Other large juveniles were seen there as early as the last of June.

**Spizella passerina.* Chipping Sparrow. This sparrow was uncommon in pine forest and riparian spruce woodland in the vicinity of Willow Creek. None was taken.

Melospiza lincolnii alticola. Lincoln Sparrow. The only record of this species was of a molting, adult male (testes 2 mm.) which was captured in a mist net at Ben Lilly Camp in a dense willow thicket on July 10. This bird may have been an early migrant, although it was not fat.

**Hesperiphona vespertina brooksi* × *H. v. montana.* Evening Grosbeak. This species was uncommon in riparian spruce woodland and adjacent forests in the vicinity of Willow Creek. Until early June it was also occasionally detected in fir and spruce–fir forests near Bursum Camp. The following specimens were taken near Ben Lilly Camp: a male (testes 6 × 10 mm.) and a female (brood patch, ovary enlarged, ova to 3 mm.) on June 29, and two males (testes 6 × 9 mm. and 6 × 10 mm.) and a female (brood patch, ovary enlarged, several ruptured follicles) on July 1.

These specimens are closer to *brooksi* in plumage but show some approach to *montana* in the paler dusky wash of the foreparts. The bill is between the large, stubby one of *brooksi* and the small, narrow, and elongate bill of *montana*.

**Spinus pinus pinus.* Pine Siskin. The siskin was fairly common throughout the study area in all habitats. Eleven specimens were taken, including a male (testes 5 × 7 mm.) near Indian Creek Camp on June 5 that was infested with larvae (possibly dipteran) in the visceral cavity and under the skin of the nape. A female (brood patch, ovary postbreeding) collected on June 27 near Bursum Camp had insect larvae (possibly lepidopteran) in the crop.

The mean wing and tail lengths (six males: wing, 73.8; tail, 46.1 mm.; five females: wings, 70.3; tail, 44.6 mm.) of this small series are only slightly larger than those listed by Aldrich (1946:

133) and Ridgway (1901:97–98) for breeding birds north of México. They are much smaller than measurements listed for the race *macropterus* by Ridgway (*op. cit.*:100).

**Loxia curvirostra benti* × *L. c. bendirei*. Red Crossbill. This species was fairly common throughout the summer in the vicinity of Willow Creek but was detected only sparingly in forests above 9000 feet after early June. I succeeded in collecting only two specimens: a female (ova to 2 mm.) on May 26 near Bursum Camp, and a female (old brood patch, ovary granular) near Ben Lilly Camp on June 17. The latter bird had white larvae (possibly lepidopteran) in the crop, apparently taken from spruce (*Picea pungens*) cones on which it was feeding.

The intermediate size (wing, 86.5 and 88 mm; culmen, 17.7 and 18 mm.; and bill depth, 9.5 and 9.7 mm.) and very worn plumage do not permit exact subspecific placement of these two specimens, although they may represent true *benti* as defined by Griscom (1937:129–132). Both these and a similar male (testes, 2 mm.; wing, 92; culmen, 16.3; bill depth, 10 mm.) collected on May 20, in the Chiricahua Mountains may represent remnants of an invasion of this species which took place during the winter of 1963–1964 (James, 1964:332). In the latter area, and probably at least occasionally on the Mogollon Plateau (Griscom, 1937:135), the subspecies *stricklandi* is the breeding form. Further collection might have revealed a larger breeding form in the study area, although this must remain a moot point. At any rate, the Red Crossbill is assumed to breed in the Mogollon Mountains.

In addition to the foregoing birds which were collected or assumed to breed in these mountains, the following were seen in the vicinity of Willow Creek: Cassin Kingbird (*Tyrannus vociferans*), Mockingbird (*Mimus polyglottos*), Blue Grosbeak (*Guiraca caerulea*), all recorded once, and the Lesser Goldfinch (*Spinus psaltria*), which was noted several times.

DISCUSSION

At the elevations covered in this study the Mogollon Mountains are Rocky Mountain in their biotic affinities, at least in regard to the flora and vertebrate fauna. Concerning birds, all but three species (*Contopus pertinax, Peucedramus taeniatus*, and *Cardellina rubrifrons*) of the 60 that are considered to breed in the Mogollons also breed in the Rockies, whereas only 39 of them breed in the Sierra Madre Occidental (Pac. Coast Avif., 1950; 1957). The species that are absent as breeders from the Sierra Madre Occidental are:

Dendragapus obscurus
Sphyrapicus varius
Sphyrapicus thyroideus
Dendrocopos pubescens
Picoides tridactylus
Nuttallornis borealis
Nucifraga columbiana
Parus gambeli
Sitta canadensis
Hylocichla guttata
Hylocichla ustulata
Sialia currucoides
Regulus satrapa (discontinuous)
Regulus calendula
Vermivora celata
Vermivora virginiae
Oporornis tolmiei (discontinuous)
Euphagus cyanocephalus
Piranga ludovicianus
Pipilo chlorurus
Junco caniceps

Of the 36 species which breed in both the Rockies and the Sierra Madre Occidental, 19 are considered subspecifically distinct in the latter area, at least from southern Chihuahua south (Pac. Coast Avif., 1950; 1957). In each case the populations of the Mogollon Mountains are either of the Rocky Mountain race, or are intergrades between it and the Sierra Madre form; in no case are they the latter sub-

species. The only races recognized as being distinct from those of the Rockies are *Dendrocopos villosus leucothorectis, Regulus satrapa apache,* and *Junco caniceps dorsalis.*

Several species which breed in the biotically similar, but more extensive White Mountains (Monson and Phillips, 1964), approximately 50 miles to the northwest in Arizona, have not been recorded in the Mogollons, including the Dusky Flycatcher (*Empidonax oberholseri*), Gray Jay (*Perisoreus canadensis*), Water Pipit (*Anthus spinoletta*), and Pine Grosbeak (*Pinicola enucleator*). It is possible that one or more of these species has been overlooked in the study area because of rarity, inconspicuousness, local or irregular distribution, or other factors. In addition, there are several species of the Rocky Mountains which are apparently absent or do not breed in any of the high mountains of the Mogollon Plateau, including the White-tailed Ptarmigan (*Lagopus leucurus*), Hammond Flycatcher (*Empidonax hammondii*), Wilson Warbler (*Wilsonia pusilla*), White-crowned Sparrow (*Zonotrichia leucophrys*), and the Brown-capped Rosy Finch (*Leucosticte australis*). Aside from problems of dispersal, the absence of at least some of these species from the Mogollon Plateau, and of certain White Mountain species from the Mogollon Mountains, may well be correlated with the limited area of certain habitats, for example, arctic–alpine or timberline.

The data obtained in the course of this study do not permit more than a few generalizations on the ecological preferences of the approximately 50 species of common birds which breed in the Mogollon Mountains. Most of these species were found in more than one vegetation type; many, such as *Dendrocopos villosus, Cyanocitta stelleri,* and *Spinus pinus,* occurred in all four types. Of the species which occurred in only one habitat, more were in pine forest (*Sialia mexicana, Vireo solitarius,* and *Dendroica graciae*) and "boreal" or fir and spruce–fir forests (*Dendragapus obscurus, Dendrocopos pubescens,* and *Regulus satrapa*) than in riparian spruce woodland (*Nuttallornis borealis, Oporornis tolmiei,* and *Euphagus cyanocephalus*). Avifaunal differences support the separation of fir forest from spruce–fir forest, although the distinction is not pronounced. For example, several species were either absent (*Cardellina rubrifrons* and *Vermivora celata*) or less common (*Hylocichla guttata* and *Vireo gilvus*) in spruce–fir forest than in fir forest. Other species (*Picoides tridactylus* and *Regulus satrapa*) were less common in fir forest than in spruce–fir forest. Of the rare species not covered in the preceding generalizations, most were found in pine forest (*Contopus pertinax* and *Sialia currucoides*).

SUMMARY

The Mogollon Mountains of southwestern New Mexico are a rather extensive and ecologically varied range that has been little studied ornithologically. Sixty species were found here in the summer of 1964 which were considered to be breeding in the four major vegetation types recognized as occurring above 8000 feet in these mountains. Comparison of the breeding avifauna of this range with other mountain systems leads to the conclusion that it, and other high ranges of the Mogollon Plateau, are predominantly Rocky Mountain in biotic affinities. In addition, some generalizations are made concerning habitat preference of the more common breeding birds found in these mountains.

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