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SHORT COMMUNICATIONS

Birds of coniferous forest on Mount Graham, Arizona.—Because of interest in the effect upon the biota of Mount Graham by current development for astronomy, I repeated observations and censuses made there forty years ago. Avifaunal changes have occurred. Unlike my companion study in the Sierra Nevada (Marshall 1988), the losses at Mount Graham of nesting species—all at the lower altitudinal limit of *Pinus leiophylla chihuahuana* and *P. ponderosa arizonica*—lack an obvious connection to human interference with the environment.

Study area.—Mount Graham, in southeastern Arizona, is capped with old growth Engelmann spruce and alpine fir from 3000 m to the summit at 3267 m. This boreal forest of 8 km^2 is at its southernmost limits on the North American continent. Descending, one passes through other vegetation zones in sequence: Douglas firs and white firs mixed with spruce, and then mixed with Mexican white pines; south slopes of New Mexican locust and Gambel oak; ponderosa pine with Gambel oak; ponderosa pine mixed with silver-leaf oak; and finally Chihuahua pine with Arizona oak (Martin and Fletcher 1943, Hoffmeister 1956, Marshall 1957, Mohlenbrock 1987). From memory, notes, and photographs I detect no change in vegetation during the forty-year study period. Specifically, the trees at the mapped census area in Wet Canyon (Fig. 1) have not closed ranks about the little openings suitable for those foothill birds that forage among grasses, boulders, manzanitas, and nolinas.

The mesic luxuriance of Mount Graham's vegetation is shown by running streams supporting tall groves of maples, by the enormous Douglas firs that remain, by the profusion of understory flowers and green forbs, and by the gigantic stature of clear-trunked alders dominating Wet Canyon. Martin and Fletcher (1943) underestimated rainfall because they lacked gauge readings from comparable north slopes elsewhere in the state.

The bird-life of Mount Graham was partly analyzed from studies of a wider area by Henshaw (1875), Monson (1937), and Marshall (1957). This is the first complete documentation of birds that spend the summer in coniferous forest there. Other birds using Mount Graham forests in summer are early fall and late spring (well into June) migrants—species whose breeding range is set forth in the two state ornithologies (Phillips et al. 1964, Monson and Phillips 1981).

The 794.5 ha of boreal (Hudsonian) forest of alpine fir with Engelmann spruce is in one continuous tract, all but 23.5 ha of it enclosed within the 1229 ha fenced-off astrophysical area. I was not permitted to enter in 1991, but I did see tree-cutting, road-building, trucks hauling earth down to the foot of the mountain, and students looking for red squirrels (*Tamiasciurus grahamensis*). Other human activity included heavy logging until recently and a road-building scheme (prisoner road, Fig. 1), mercifully called off. The forest on the north slope was all cut, but the east slope appears natural.

Methods.—My field notes and census maps of summer resident birds found within coniferous forest at Mount Graham are deposited in the library of the Division of Birds, Smithsonian Institution. They document the identifications, occurrences, numbers, and activities of the birds. Actual dates of field censusing from 1949 to 1953 are in Marshall (1957). In 1991 I revisited the sites shown (Fig. 1) from 4 to 5 June and 17 to 18 July 1986, 17 to 19 and 21 to 23 June 1991. Gale Monson was my companion on the first 1991 visit, Tom Huels on the second. I examined all of H. W. Henshaw's and E. G. Holt's Mount Graham specimens in the Smithsonian Institution, and those of other collectors in the Western Foundation of Vertebrate Zoology, Louisiana State Univ., and Univ. of Arizona. Species

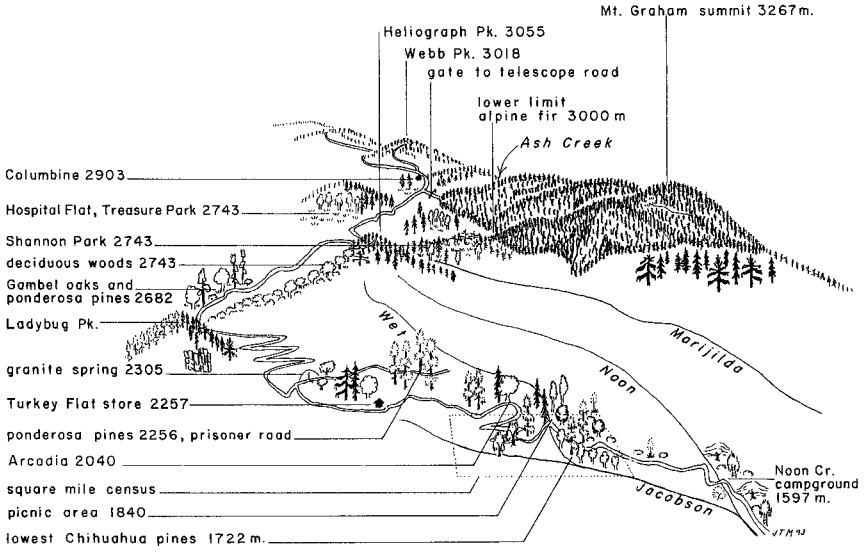

FIG. 1. Mount Graham from the east, showing altitude and characteristic vegetation of the places searched for birds.

represented by those specimens, which I identified to subspecies, are indicated by an asterisk in the results. My stereo tape recordings of 1986 and 1991, which confirm many identifications, are at the Univ. of Florida.

Results.—On 5 July 1951 I counted these numbers of pairs, flocks, or singing males along 3.1 km of trail through alpine fir and Engelmann spruce forest from a point on the south ridge of Mount Graham to the summit: Red-tailed Hawk (*Buteo jamaicensis**) 1, Band-tailed Pigeon (*Columba fasciata**) flock plus scattered individuals, Broad-tailed Hummingbird (*Selasphorus platycercus**) 12, Hairy Woodpecker (*Picoides villosus**) 8, Northern Flicker (*Colaptes auratus cafer**) 2, Cordilleran Flycatcher (*Empidonax occidentalis**) 7, Violet-green Swallow (*Tachycineta thalassina**) 1 group, Steller's Jay (*Cyanocitta stelleri diademata**) 4, Common Raven (*Corvus corax*) 1, Mountain Chickadee (*Parus gambeli**) 25, Red-breasted Nuthatch (*Sitta canadensis**) 6, Pygmy Nuthatch (*Sitta pygmaea**) 10, Brown Creeper (*Certhia americana**) 12, Golden-crowned Kinglet (*Regulus satrapa**) 12, Ruby-crowned Kinglet (*R. calendula**) 2, Hermit Thrush (*Catharus guttatus auduboni**) 25, American Robin (*Turdus migratorius**) 3, Yellow-rumped Warbler (*Dendroica coronata auduboni**) 20, Western Tanager (*Piranga ludoviciana**) 3, Yellow-eyed Junco (*Junco phaeonotus**) 12, Red Crossbill (*Loxia curvirostra bendirei**) flock of 12 plus scattered individuals, and Pine Siskin (*Carduelis pinus**) 2. I found most of them occupying the lower coniferous zones too, in decreasing abundance. Additional abundant species that I found mainly in the pine zones are the Turkey Vulture (*Cathartes aura*), Zone-tailed Hawk (*Buteo albonotatus*), Wild Turkey (*Meleagris gallopavo,* not seen 1986, 1991), Flammulated Owl (*Otus flammeolus*), Whip-poor-will (*Caprimulgus vociferus arizonae*), Solitary Vireo (*Vireo solitarius plumbeus*), Warbling Vireo (*Vireo gilvus**), Virginia's Warbler (*Vermivora virginiae**), Hepatic Tanager (*Piranga flava**), and Black-headed Grosbeak (*Pheucticus melanocephalus**). All but the turkey are as numerous today as they were in the early 1950s.

I heard or saw few Cooper's Hawk (*Accipiter cooperii**), Northern Goshawk (*Accipiter*

gentilis), Northern Pygmy-Owl (*Glaucidium gnoma*), Northern Saw-whet Owl (*Aegolius acadicus*), Acorn Woodpecker (*Melanerpes formicivorus*), Ruby-crowned Kinglet, Red-faced Warbler (*Cardellina rubrifrons**), and Pine Siskin. Greater Pewee (*Contopus pertinax**), American Dipper (*Cinclus mexicanus**), Western Bluebird (*Sialia mexicana**), Orange-crowned Warbler (*Vermivora celata**), and Olive Warbler (*Peucedramus taeniatus**) were not found.

The Spotted Owl (*Strix occidentalis*), Magnificent Hummingbird (*Eugenes fulgens**), White-breasted Nuthatch (*Sitta carolinensis**), House Wren (*Troglodytes aedon brunneicollis**), and Grace's Warbler (*Dendroica graciae*) have increased dramatically since the 1950s. The Painted Redstart (*Myioborus pictus**) has decreased.

The remaining results deal with losses or reductions at my 132 ha census plot in Wet Canyon (not all of the 259 mapped ha of the square shown in Fig. 1 being accessible). For each species I add the number of pairs or singing males from my census of 1951 in all habitats—the various combinations of pines, riparian trees, evergreen oaks, and manzanita bushes. I found no flycatchers other than the abundant and ubiquitous Cordilleran Flycatcher after 1953 (except that I heard one Western Wood-Pewee, *Contopus sordidulus,* in 1986). The Western Wood-Pewee 11, Dusky-capped Flycatcher (*Myiarchus tuberculifer*) 8, Ash-throated Flycatcher (*Myiarchus cinerascens*) 3, and Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*) 2 were gone.

These oak woodland species were missing in 1986 and 1991: Western Screech-Owl (*Otus kennicottii aikeni**, specimen 1960) 2, Elf Owl (*Micrathene whitneyi*) 5, Common Poorwill (*Phalaenoptilus nuttallii**) 3, Black-chinned Hummingbird (*Archilochus alexandri**) 7, Strickland's Woodpecker (*Picoides stricklandi arizonae*) 1, Bridled Titmouse (*Parus wollweberi**) 5 and a flock, Bushtit (*Psaltriparus minimus*) 4 and a flock of 30, Canyon Wren (*Catherpes mexicanus**) 2 in 1952, Rufous-crowned Sparrow (*Aimophila ruficeps*) 5 and present in 1986, and Scott's Oriole (*Icterus parisorum*) 2. Although those species have probably just contracted their range into oak and riparian woodland at a lower altitude, the Bridled Titmouse is the only one that Tom Huels and I could find in oaks at Noon Creek campground (Fig. 1) in June 1991. Contrastingly, these denizens of the same habitat, the Scrub Jay (*Aphelocoma caerulescens woodhouseii**), Gray-breasted Jay (*Aphelocoma ultramarina**), Bewick's Wren (*Thryomanes bewickii**), Blue-gray Gnatcatcher (*Polioptila caerulea*), Hutton's Vireo (*Vireo huttoni**), Black-thoated Gray Warbler (*Dendroica nigrescens**), and Rufous-sided Towhee (*Pipilo erythrophthalmus**) have stood their ground in Wet Canyon.

Discussion.—The House Wren is the champion of change on Mount Graham. H. W. Henshaw's specimen of 1874 (Frontispiece) is the subspecies *brunneicollis,* the four of E. G. Holt in 1914 are grayish *parkmanii,* and all adults that Tom Huels and I saw close in strong sunlight in 1991 are *brunneicollis,* a field-identifiable subspecies (but see Marshall 1956) now an abundant summer resident everywhere on the mountain at least as far down as the willows at Noon Creek crossing. But in the 1950s it was rare and of unknown subspecies. Aside from two territories at the bottom of Wet Canyon in 1951, one of which was occupied in 1952, my only records are, for 1951: "29 June, Heliograph Peak, one singing at tower, one edge of meadow lower. 7 July, south slope of Heliograph Peak, 9000 feet, one singing in deciduous woodland."

The Red Crossbill also switched taxa from *stricklandi* in 1874* to *bendirei* in 1951*, 1966*, 1986*, and 1991*. Mexican, giant *stricklandi* now inhabits the neighboring Chiricahua Mountains, whereas the juveniles with single cranial layer show that *bendirei* nested on Mount Graham in 1991.

In 1949 to 1953 I searched for Spotted Owls all over Mount Graham and had no difficulty in finding them in neighboring southern Arizona mountains during that period. Therefore I

feel it safe to say that they were absent from Mount Graham (or else sequestered on the remote north slope). The first record was by Dave Steadman (field notes deposited at New York State Museum, Albany), who heard one on 28 September 1979 in fir forest at Hospital Flat and on 30 September 1979 another in spruce forest of Webb Peak. My first encounter was on 18 June 1991, when Gale Monson and I listened to a male that called all night from the east face above the prisoner road (CD).

No evidence from my studies on other mountaintops of southern Arizona (Marshall 1957, Phillips et al. 1964) explains the dearth of Greater Pewees, American Dippers, Western Bluebirds, Orange-crowned Warblers, and Olive Warblers. All had been collected by Henshaw or Holt, although the pewees were from September and Henshaw classed them as migrants.

No bird species to my knowledge is confined to the alpine firs inside the astrophysical area. Assuming that the entire area is not developed, those birds common in 1951 should persist. They were all abundant in lower coniferous zones in 1991. The four species of flycatchers are rare or gone altogether. Because their breeding habitat in the Pinaleno Mountains is pristine and unchanged, there must be destruction of vegetation where birds from these particular summer colonies maintained their winter territories (Marshall 1988). Wade C. Sherbrooke (in litt.) and Helen Snyder (in litt.) report normal numbers of these flycatchers for the Chiricahua Mountains in the 1991 season, as does Sheri Williamson (in litt.) for the Huachuca Mountains.

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Seasonal and diurnal mass variation in Black-capped Chickadees and White-throated Sparrows.—During the winters of 1989–90 and 1990–91, we recorded mass of free-ranging Black-capped Chickadees (*Parus atricapillus*) and White-throated Sparrows (*Zonotrichia albicollis*) in northern New Jersey. The data presented here are the first records of seasonal and diurnal mass variation for untrapped passerines in North America. Previous studies have shown that captivity and handling can significantly bias results of studies of avian mass (King and Farner 1966, Castro et al. 1991, Refsnider 1993).

Study area and methods.—We recorded mass of Black-capped Chickadees in Mendham, New Jersey (40°46′N, 74°32′W) from November 1990 through March 1991. We weighed White-throated Sparrows from January through March in 1990 and 1991. The study site was in a residential suburban neighborhood containing several feeders. Local weather conditions during the two winters of observation were milder than usual with less than normal precipitation (National Climatic Data Center 1989–91).

We initially captured birds in mist nets or wire traps and marked them with USF&W bands and a unique combination of colored plastic leg bands. The birds were released within 30 min at the site of capture. Periodically throughout the winter season, we recorded body mass as birds alighted on the platform of a baited electronic digital balance that had an accuracy of 0.1 g and an operating temperature range of −5°C to +35°C. We recorded mass during three periods of the day (1)"AM" (sunrise minus 30 min to sunrise plus 2 h), (2) "Midday" (11:00–13:00 EST) and (3) "PM" (sunset minus 2 h to sunset plus 30 min). The balance was connected by cable to a personal computer inside the building. During a bird's visit, 20 consecutive readings at 0.4-sec intervals were recorded. We included only those weight measurements judged to be stable or those that met the following criteria (1) if, within the list of weights recorded during a single visit, there was a minimum of three consecutive weights that differed by no more than 0.1 g, the mean of the consecutive weights was accepted as the body mass during that visit, or (2) if no such group of three existed, the mean of four or more consecutive weights was accepted, so long as none of the values differed by more than 0.2 g (twice the sensitivity of the balance) from the mean. For the AM period the earliest mass recorded was selected for analysis, for the midday period the mass recorded nearest 12:00 was chosen, and for the PM period the latest recorded mass was selected.

We analyzed the data using SAS (1985) procedures in order to generate descriptive statistics. We tested for the reduction in variance explained when comparisons were made between linear and quadratic regression analyses (Steel and Torrie 1960). We used correlation coefficients to test significance of linear regression models. We used goodness of fit,