

## GENERAL NOTES

**Notes on migrants wintering at Monteverde, Costa Rica.**—In the course of fieldwork at Monteverde, Costa Rica, from 15 December 1976–6 March 1977 we kept detailed notes on the abundances, habitat preferences, and behavior of migrant birds. Since much of our information has not been published elsewhere we present it here.

Monteverde is a small dairy farming settlement located on a high bench (1300–1650 m elev.) of the Pacific slope of the Cordillera de Tilarán (10°18'N, 84°49'W). Extensive tracts of both primary forest and man-altered habitats are present, and the area's unusually steep moisture gradient provides extraordinary life zone diversity. The lower edge of the bench (1300–1400 m) experiences a pronounced dry season (December–April) while the migrants are in residence, but higher elevations (1500+ m) are drenched almost continuously by wind-blown mist. Reflecting this moisture gradient, the climax vegetation changes as one climbs the bench from a semi-deciduous premontane moist forest whose canopy may be lower than 18 m, to an epiphyte-laden lower montane rain forest whose canopy generally exceeds 30 m (see Holdridge, Life Zone Ecology, Trop. Sci. Ctr., San Jose, Costa Rica, 1967). Details of the climate and physiography of Monteverde are provided by Buskirk and Buskirk (Am. Midl. Nat. 95:288–298, 1976) and Powell (Am. Birds 31:119–126, 1977). For more information on our procedures and for data on the foraging behavior of the seven commonest migrant warblers and vireos see Tramer and Kemp (pp. 285–296 in Migrant Birds in the Neotropics, Smithson. Inst., 1980).

Sharp-shinned Hawk (*Accipiter striatus*).—Single individuals were seen on five occasions between 25 December and 1 March, indicating a small wintering population. Sharp-shins were usually glimpsed as they darted silently across openings between patches of forest. Birds seen well were adult-plumaged.

Cooper's Hawk (*A. cooperii*).—One was seen briefly in premontane moist forest 20 February. Another large *Accipiter* was glimpsed in poor light on 16 December; it was probably either this species or a Bicolored Hawk (*A. bicolor*). Stiles (p. 431 in Migrant Birds in the Neotropics, Smithson. Inst., 1980) lists *A. cooperii* as rare in Costa Rica.

Broad-winged Hawk (*Buteo platypterus*).—This species was the most conspicuous raptor at Monteverde, encountered on 58 of our 74 days afield. It was common at the forest edge and in parkland habitats (pastures in which about half of the tall canopy trees had been left standing). It occurred at all elevations. All birds were solitary individuals in immature plumage. Broad-wings rarely soared, and kept mostly below the treetops. They were very vocal, using the same high-pitched sustained whistles heard on their North American breeding grounds. Individuals could be located at a given site for weeks at a time, suggesting the existence of small and faithfully kept home ranges.

Yellow-bellied Sapsucker (*Sphyrapicus varius*).—Lone sapsuckers were seen on four days between 28 December and 27 January. All were detected by their cat-like mewing notes; all were foraging at the edge of dense lower montane rain forest at elevations exceeding 1500 m.

Yellow-bellied Flycatcher (*Empidonax flavescens*).—We saw a singing bird of this species on 26 February at the edge of a pasture bordering premontane moist forest. Stiles (1980) lists this flycatcher as a common winter resident in the lowlands of Costa Rica. This apparently constitutes the first sighting of the species at Monteverde.

Barn Swallow (*Hirundo rustica*).—Barn Swallows are apparently rare on the bench itself, although we observed them on each of five visits to pastures in the foothills (500–1100 m). On 5 January we saw several birds feeding with Blue-and-white Swallows (*Notiochelidon cyanoleuca*) and Rough-winged Swallows (*Stelgidopteryx ruficollis*) during a hike just below the edge of the bench.

Wood Thrush (*Hylocichla mustelina*).—Powell (1977) lists this species as uncommon at Monteverde. However, we found it to be very common in premontane moist forest between 1300 and 1450 m. For the most part Wood Thrushes foraged quietly in leaf litter under heavy shade and were easily overlooked. The birds were most abundant on the sides of the steep-walled ravines that dissect the lower bench. There they occurred singly at intervals of 100–200 m, an even spacing suggestive of intraspecific territoriality, although we have no direct evidence for this. Occasionally, when flushed by a human intruder, a thrush would utter a rapid *pick-pick-pick* series identical to the alarm notes given by this species in North America.

Swainson's Thrush (*Catharus ustulatus*).—This bird is a scarce winter visitor to Monteverde; most individuals winter south of Costa Rica. We saw single birds on four occasions (16 December–13 February). Two sightings were of birds eating small fruits of two unidentified species of forest-edge trees. On both occasions Mountain Robins (*Turdus plebejus*), White-throated Robins (*T. albicollis*) and Mountain Elaenias (*Elaenia frantzii*) were eating fruit in the same trees but seemed indifferent to the thrushes' presence. In all four instances the thrushes were silent and inconspicuous, moving little and staying in dense foliage.

Yellow-throated Vireo (*Vireo flavifrons*).—We encountered this uncommon species on 18 of 74 days, always in the lower portion of the bench in the premontane moist forest or at its edge. The most notable thing about the species was its tendency to occur in pairs. We observed this arrangement in 16 of 23 sightings, and assume these to be male-female pairs because one bird was always brighter yellow and more clearly marked than the other. Yellow-throateds uttered occasional descending chatters or single scolding notes. They generally fed away from other species.

Solitary Vireo (*Vireo solitarius*).—A single bird was observed 30 December in a mixed foraging flock in premontane moist forest at 1375 m. It was very aggressive, chasing any small birds that approached within 1–2 m.

Philadelphia Vireo (*V. philadelphicus*).—This species was numerous at the forest edge below 1450 m, where we saw up to a dozen birds in a day. Philadelphias were less frequent in the forest interior and apparently absent above 1500 m. Like *V. flavifrons*, this species frequently occurred in pairs (well over 50% of our observations). This tendency runs counter to comments on these species by Slud (The Birds of Costa Rica, Bull. Am. Mus. Nat. Hist. 128:310, 312, 1964). Unlike *V. flavifrons*, Philadelphia Vireos often foraged with other species, especially Tennessee Warblers (*Vermivora peregrina*) and resident Brown-capped Vireos (*Vireo gilvus leucophrys*). They were usually silent, but we heard a bird in full song 28 February. Although all birds we observed were foraging for insects, we twice saw individuals regurgitate small fruit pits.

Black-and-white Warbler (*Mniotilta varia*).—This bird was fairly common below 1475 m elev. wherever there were large trees. This species foraged on trunks and large branches, similar to its behavior in North America. It often participated in mixed foraging flocks "led" by resident Golden-crowned Warblers (*Basileuterus culicivorus*), but consorted only rarely with conspecifics. No clear evidence of territoriality was noted, however.

Worm-eating Warbler (*Helminthos vermivorus*).—Apparently this secretive species winters regularly at Monteverde in small numbers. We saw single birds on four occasions between 2 January and 21 February, but very limited mist netting (fewer than 10 net days altogether) by Richard T. Holmes in late January and by ourselves in February resulted in the capture of four others. All records were for elevations below 1500 m. Members of the species were silent and stayed in dense undergrowth. Tramer brought one to within 3 m by crawling into the midst of a dark thicket, sitting motionless and squeaking for 5 min. The results of limited mist netting suggest that the Worm-eating Warbler is more numerous at Monteverde than our few sight records indicate.

Golden-winged Warbler (*Vermivora chrysoptera*).—Individuals were scattered through the premontane moist forest. This species was also one of the few migrants occupying the interior of wetter forests above 1450 m, although it was scarce there. We saw this bird on 31 of 74 days. Although it frequently participated in mixed foraging flocks we never saw two golden-wings together. This species had extremely specialized foraging habits, probing in dead leaf clumps almost exclusively (also noted by Morton, *Atlantic Nat.* 27:164–168, 1972). On one occasion we saw a male take nectar (?) from the flowers of *Erythrina lanceolata* (Leguminosae).

Tennessee Warbler (*V. peregrina*).—This species was very common in parkland and woodland edges; it frequently fed in lone shrubs or isolated trees in open pastures. We rarely saw it in the forest interior. Tennessees stayed below 1500 m elev. and fed mostly within 12 m of the ground. They were the only migrant insectivorous species to form monospecific flocks (three or more birds), but individuals also defended feeding territories around blooming *Erythrina* trees, whose nectar apparently comprises an important energy source for this species. For details see Tramer and Kemp (*Auk* 96:186–187, 1979).

Black-throated Green Warbler (*Dendroica virens*).—Probably the most abundant migrant at Monteverde, this species occurred from 1300–ca. 1550 m, although it was most common at the lower elevations. It foraged from near the ground to high in the canopy, with a modal foraging height of 6 m. Isolated tall trees, parkland and woodland edges were its favorite habitats.

Townsend's Warbler (*D. townsendi*).—This close relative of *D. virens* was fairly common in edge situations between 1350 and 1500 m. It differed ecologically from *D. virens* in that it spent a much larger proportion of the time near the ground, and hawked after flying insects more frequently. W. Buskirk (Ph.D. diss., Univ. Calif., Davis, California, 1972) reported *D. townsendi* mostly in conifers at Monteverde, but we found it regularly in other vegetation as well. *D. townsendi* and *D. virens* were the only migrant warblers to initiate agonistic interactions with other species. A color slide taken by Kemp, now at the American Museum of Natural History, is the first tangible evidence of this species' occurrence in Costa Rica (E. Eisenmann, pers. comm.), although it is now known to winter south to western Panama (F. G. Stiles, pers. comm.).

Chestnut-sided Warbler (*D. pensylvanica*).—This uncommon species wintered in small numbers inside the premontane moist forest. We encountered it on only 12 days. Only single birds were seen, usually in loose association with small mixed foraging flocks led by *Bascileuterus culicivoreus*.

Ovenbird (*Seiurus aurocapillus*).—Ovenbirds were common below 1475 m, where they foraged quietly in leaf litter on the forest floor. As in the vireos, we frequently saw two birds feeding close together.

Louisiana Waterthrush (*S. motacilla*).—Although Powell (unpubl.) lists waterthrushes as rare at Monteverde, we noted them on 11 occasions. It seemed that at least one bird resided in each deep ravine. We easily detected waterthrushes by walking ravine bottoms and listening for their loud *chip* alarm notes, given repeatedly as the birds flushed ahead of us. Waterthrushes were not encountered in any other habitat. Although the Northern Waterthrush (*S. noveboracensis*) has also been recorded at Monteverde, the four individuals we studied at close range had the pure white throat and superciliary stripe suggestive of *S. motacilla*.

Kentucky Warbler (*Oporornis formosus*).—This secretive bird of dense forest undergrowth was seen on only five occasions, but we often heard *chip* notes which we believe were this species, and limited mist netting in the premontane moist forest yielded an additional two to three birds daily. We conclude that a fairly large wintering population resides at Monteverde.

Wilson's Warbler (*Wilsonia pusilla*).—Wilson's Warblers were abundant, especially at

lower elevations on the bench. They stayed mostly within a few meters of the ground in dense cover, although a few birds were observed high in the canopy.

American Redstart (*Setophaga ruticilla*).—The only sight record for Monteverde is a lone bird we saw at the forest edge at 1450 m on 31 December.

Northern Oriole (*Icterus galbula*).—Orioles were common in parkland, citrus plantings, and edge habitats below 1400 m. They appeared singly or in small groups of both sexes. Orioles fed extensively on oranges, pecking 2-cm-wide holes in the peels and then gradually hollowing out entire fruits as they hung on the trees. Orioles also frequented *Erythrina* trees, where they are known to feed on nectar (F. G. Stiles, pers. comm.). All orioles seen were of the eastern (*I. g. galbula*) phenotype.

Summer Tanager (*Piranga rubra*).—This species was a fairly common denizen of parkland and woodland edge habitats, and occasionally occurred in the forest interior as well. We saw it on 33 days, and at elevations as high as 1525 m. The vast majority were males. Birds were often discovered by their *pi-tuck-tuck* call notes. They frequently hawked or hover-fed; we also suspected they were frugivorous since we often observed them in fruiting trees.

Western Tanager (*P. ludoviciana*).—The only record of this species at Monteverde was a dull specimen observed at the forest edge at 1350 m on 24 February. F. G. Stiles (pers. comm.) considers it common at lower elevations in Guanacaste Province, just northwest of Monteverde.

Rose-breasted Grosbeak (*Pheucticus ludovicianus*).—Single grosbeaks were seen on 2 January and 28 February in pasture trees at the lower edge of the bench (1350 m). The reasons for the scarcity of this species at Monteverde are unclear.

Indigo Bunting (*Passerina cyanea*).—This species was not listed for Monteverde by Powell (1977), but we found it to be fairly common in parklands and pastures below 1475 m. On several occasions flocks of more than two dozen were seen. The vast majority were in brown plumage.

Lincoln's Sparrow (*Melospiza lincolni*).—Tramer (Wilson Bull. 91:469–470, 1979) obtained the first sight records of this species for Costa Rica. The three sightings were in grassy or weedy situations, two in fields and one on a roadside. Although the observations spanned 30 days and occurred 1 km apart, all could conceivably have involved a single bird.

Other species.—Four other migrant species were encountered during our stay. These also nest in Costa Rica, so it is impossible to know whether the birds we saw were migrants. These species are (1) Turkey Vulture (*Cathartes aura*), an abundant migrant through Central America (N. Smith, pp. 51–65 in *Migrant Birds in the Neotropics*, Smithsonian Inst., 1980) but also resident at Monteverde; (2) Swallow-tailed Kite (*Elanoides forficatus*), a species seen on three occasions late in our stay; (3) Red-tailed Hawk (*Buteo jamaicensis*), seen three times in late February; and (4) Rough-winged Swallow (*Stelgidopteryx ruficollis*). The swallow was common at Monteverde; both breeding and migrant forms are likely there (see Stiles, Auk 98:282–293, 1981) but we did not attempt to distinguish them.

The rapid pace of deforestation in the tropics has caused concern for the future of long-range migrant birds (see Terborgh, p. 23 in *Migrant Birds in the Neotropics*, Smithsonian Inst., 1980). At Monteverde the extensive forest plays a vital role in the ecology of many migrant species. Of the 29 migrants discussed above, all save three appear to be dependent on at least some forest cover. For most of those species patches of second growth woodland with edge may be sufficient. However, eight species (Cooper's and Sharp-shinned hawks, Wood Thrush, Worm-eating, Chestnut-sided and Kentucky warblers, Ovenbird, and Louisiana Waterthrush) were birds of the forest interior whose continued presence at Monteverde may well depend on the preservation of sizeable tracts of mature forest. Most of the protected mature forest at Monteverde is wet forest not favored by migrants. Therefore, the future of the eight species listed above may well depend on the preservation of the premontane moist forest, currently unprotected.

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**Decline of the Roadrunner in Missouri.**—A gradual northeastward range expansion of the Roadrunner (*Geococcyx californianus*) has been documented over the past 50 years. In the late 19th century Goss (*History of the Birds of Kansas*, Geo. W. Crane and Co., Topeka, Kansas, 1891) described the Roadrunner's range as being "northern Mexico, north to southern Colorado and California, east into Texas and southwest Kansas." Expansion of this range into eastern Kansas and Oklahoma was first reported in the 1930's (Colvin, *Auk* 52:88, 1935). Sutton (*in* Bent, U.S. Natl. Mus. Bull. 176, 1940) cited the Roadrunner's range as extending east to south-central Kansas and central Oklahoma. Subsequent extension in Arkansas was reported by Baerg (*Condor* 52:165, 1950) and James (*Arkansas Acad. Sci. Proc.* 14:8–13, 1960). First documentation of Roadrunners in Missouri was by Brown (*Condor* 65:242–243, 1963) who reported 12 sightings in the southwestern part of the state dating back to 1956. Probasco (5th Midwest Prairie Conference Proc., Iowa St. Univ., Ames, Iowa, 1976) provided further documentation of the bird in Missouri. This northeast expansion coincided with range extensions northward in California (Kimsey, *Condor* 55:215, 1953) and Utah (Hayward et al., *Great Basin Naturalist Memoirs, Birds of Utah*, No. 1, Brigham Young Univ. Press, Provo, Utah, 1976) and eastward into Louisiana (Lowery, *Louisiana Birds*, Louisiana State Univ. Press, Baton Rouge, Louisiana, 1955).

To further document the range expansion of the Roadrunner in Missouri, a survey by Jim Rathert within the Missouri Department of Conservation provided information on many sightings of Roadrunners in southern Missouri. All sightings were made or substantiated by Conservation Agents familiar with the avifauna of the area. Based on these results and extensive personal communication with bird watchers, Breeding Bird Census participants and Audubon Christmas Count personnel, we determined that the Roadrunner's range continued to expand both north and east in Missouri until 1976. By this time Roadrunners had been sighted throughout 36 counties in southern Missouri, extending north to the Missouri River (Fig. 1) but centered in the glade areas of the southwestern part of the state.

Beginning with the severe winter of 1976–77, the Missouri population of Roadrunners began a decline which continued through 1978–79, probably due to three successive severe winters. The 1978 distribution was much reduced from previous years (Fig. 1). The Audubon Christmas Bird Count data for Oklahoma also showed a decline from 26 Roadrunners sighted in 1976 to 17 in 1977 and one in 1978, despite an increase in the number of observers (*Am. Birds*, Vols. 31–33, 1977–1979).

Decline of the Missouri Roadrunner population may have been caused by starvation indirectly brought about by severe winter weather. Although Roadrunners are highly opportunistic feeders and eat a variety of small vertebrates, they rely on invertebrates, chiefly insects, during the nonbreeding season (Bryant, *Univ. Calif. Publ. Zool.* 17:21–50, 1916; Sutton, *Bull. Oklahoma Ornithol. Soc.* 5:30, 1972).

Climatic data for the region were studied to investigate the possible role of severe winter weather in preventing Missouri Roadrunners from obtaining food. During the period of active range expansion in Missouri, winter weather was characterized by snow cover that was