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THE OCCURRENCE AND ECOLOGY OF THE GOLDEN-CHEEKED WARBLER IN THE HIGHLANDS OF NORTHERN CHIAPAS, MEXICO[1]

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Abstract. We detail 46 sightings of Golden-cheeked Warbler in the Highlands of Northern Chiapas, representing wintering birds as well as spring and fall migrants. In winter, the species was approximately 1% as abundant as Townsend's Warbler, the most numerous warbler. Among warblers detected, only Pink-headed Warbler was less numerous than Golden-cheeked Warbler. Sightings of male Golden-cheeked Warblers outnumbered those of females by a factor of 2.4. Golden-cheeked Warblers used a variety of habitats in the study area, especially pine-oak and pine forests. They foraged by gleaning in the upper half of the trees in which they were found, and they occurred almost exclusively in mixed-species flocks. Aggressive interactions involving Golden-cheeked Warblers were infrequent.

Key words: Golden-cheeked Warbler; Dendroica chrysoparia; *endangered; winter range; habitat; abundance; mixed-species flock; foraging; sex ratio; migrant; Mexico.*

Resumen. Se documentan 46 observaciones de *Dendroica chrysoparia* en las tierras altas del Norte del Estado de Chiapas, tanto de aves invernantes como de migrantes de otoño y primavera. Durante el invierno, la especie fue aproximadamente 1% tan abundante como *D. townsendi,* el parúlino más numeroso. Entre los parúlinos detectados incluyendo invernantes y residentes, sólo *Ergaticus versicolor* fue menos abundante que *D. chrysoparia.* Las observaciones de los machos de *D. chrysoparia* sobrepasaron a las de las hembras por un factor de 2.4. Esta especie utiliza una amplia variedad de hábitats en el área de estudio, especialmente los bosques de pino-encino y los de pino. Forrajean colectando entre el follaje en la mitad superior de los árboles donde se encuentran, y ocurren principalmente en parvadas de especies mixtas. Las interacciones agresivas que involucran a *D. chrysoparia* fueron muy poco frecuentes.

Palabras claves: Dendroica chrysoparia; *en peligro; rango invernal; hábitat; abundancia; parvada de especies mixtas; forrajeo; ratio de los sexos; migrante; México.*

INTRODUCTION

The Golden-cheeked Warbler (*Dendroica chrysoparia*) is listed by the United States Fish and Wildlife Service as "endangered" (Jahrsdorfer 1990). The species breeds exclusively in "cedar brakes" in the Edwards Plateau of Texas (Pulich 1976, Kroll 1980, AOU 1983), a highly restricted habitat in serious decline (Sexton 1992). Although the type specimen was taken in Guatemala in winter (Pulich 1976), the species is little known in the non-breeding season (Pulich 1976, Kroll 1980, Sexton 1992). In describing the winter range as "the highlands of Guatemala, Honduras, and north-central Nicaragua," but not Mexico, the Sixth Edition of the *Check-list of North American Birds* (AOU 1983) followed Pulich (1976) and not earlier statements by several authors (e.g., Alvarez del Toro 1980, Miller et al. 1957, AOU 1957). The exclusion of Mexico appears to have been based on Pulich's rejection of several sight reports and of two old specimens, one lost and one misidentified, along with his failure to find the species during a nine-day winter search in southeastern Mexico. Pulich (1976) assumed that valid records from Chiapas, Mexico, as late as 11 October, were of fall migrants rather than wintering birds. This assumption, which we question, implies a remarkably protracted southward movement. The vast majority of the species leaves Texas by the end of July,

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and some individuals are known to reach Chiapas by 9 August (Pulich 1976).

More recently, however, Braun et al. (1986) described two unequivocally winter (January) sightings (1978 and 1983), each of one male, in Chiapas. They also pointed out the difficulty of delimiting ranges of rare species in areas with a paucity of observations. To clarify the species's status, we investigated the seasonality, abundance, behavior, and use of habitat by Golden-cheeked Warblers in southern Mexico using three methods of observation.

STUDY AREA

We sought Golden-cheeked Warblers within the 484 km² area of the municipality of San Cristóbal de las Casas, Chiapas, México (centered at 16°44′N, 92°38′W), at elevations from 2,100 to 2,550 m. The seven most common habitat types in this area, known as the Highlands of Northern Chiapas, are evergreen cloud forest; pine-oak forest (see Breedlove 1981 and González-Espinosa et al. 1991 for detailed descriptions); pine forest (artificially planted, mature *Pinus* spp., reaching 40 m); oak forest (essentially a special case of the pine-oak association described by González-Espinosa et al. 1991); shrub (including not only shrubland, González-Espinosa et al. 1991, but also areas with early successional trees other than *Pinus* spp. and *Quercus* spp., up to 4 m in height); *milpa* (traditional, small-scale corn, vegetable, and flower farming); and mixed (comprising three or more of the previous types and characterized by extensive vegetational "edges"). The pine-oak forest and the mixed habitat share features identified by Kroll (1980) as important components of the Golden-cheeked Warbler's Texas breeding grounds, namely edges and open mosaics.

METHODS

CENSUSES

Transect counts. As part of a broader study of habitat use by migrant birds, transects of 40 m by 1 km (Emlen 1971, Franzreb 1981) were established in the seven habitats described above. Each transect—except those in shrub and pine-oak forest—was visited weekly beginning at 06:00 for two to two-and-a-half hours, from October 1990 to mid-January 1991; mid-February to mid-April 1991; October 1991 to mid-January 1992; and from mid-February to the end of March 1992. The shrub and pine-oak forest transects were established during the second year, and were visited weekly from October 1991 to the first of April 1992. When a Golden-cheeked Warbler was encountered, sex, habitat type, date, locality, and altitude, along with the bird's method of foraging, its height above the ground, the height of the tree it used, whether it was a member of a mixed species flock, the composition of the flock, and notes on any aggression observed were recorded. We made no attempt to derive absolute population densities or determine "coefficients of detectability" for Golden-cheeked Warblers (Emlen 1971).

Casual observation. We use this term to describe accidental encounters with Golden-cheeked Warblers in the course of other field work or simple bird watching. Data are ad libitum (sensu Altmann 1974), and generally include sex, habitat type, date, locality, and altitude. In many cases, the full set of data mentioned for the transect counts above was recorded.

Point counts. After preliminary results of the two previous methods made it apparent that Golden-cheeked Warblers were a rare-but-regular part of the Highlands avifauna, we began a series of 335 10-min, 25-m radius point counts (Hutto et al. 1986) in eighteen non-contiguous localities. From 22 September to 11 December 1992, one or, more often, two observers visited localities within the study area. Each observer worked independently, making ten to twelve counts at least 200 m apart, typically beginning at 06:00–06:30 and finishing by 09:30–10:00. When a Golden-cheeked Warbler was encountered during a count, it was observed as long as possible, to a maximum of 15 min. Habitat and behavioral data recorded for the point counts were the same as those recorded for the line transects. On one occasion, two Golden-cheeked Warblers were encountered between point-counts. The same data were collected, and used in calculations concerning habitat use, but not abundance indices. Based on the previous results, we concentrated on pine-oak (142 point counts, 42.4%), oak (67, 20%), and pine (31, 9.3%) forests, and the mixed habitat type (32, 9.5%), at elevations from 2,200 to 2,550 m. Other counts were in shrub (47, 14%), and *milpas* (16, 4.8%) as encountered at 200-m intervals. Evergreen cloud forest is a relatively scarce and generally inaccessible habitat in the Highlands of Northern Chiapas (Bubb, unpubl. data), and

was not sampled using point counts during this study.

IDENTIFICATION

Since all members of the *Dendroica virens* superspecies (i.e., Townsend's Warbler, *D. townsendi,* Hermit Warbler, *D. occidentalis,* and Black-throated Green Warbler, *D. virens*) winter in the Highlands of Northern Chiapas (AOU 1983), we were particularly cautious in identifying members of the complex, especially immature females. All identifications of Golden-cheeked Warblers were based on sightings using binoculars by experienced persons, sometimes two or three together, familiar with the other species of the complex, and aware of the rarity of Golden-cheeked Warblers. Records always involved the observation of more than one of the various known field marks. In our study, adult males were most easily identified by the combination of white underparts, black throat and upper breast, and golden cheeks crossed by a well-defined black transocular line. Adult females and immatures were identified on the basis of yellow cheeks, crossed by a well-defined black transocular line, a streaked olive back, and starkly white underparts, entirely without yellow tones (Scott 1987).

DATA ANALYSIS

Individuals of a given sex were counted as "certainly distinct" if they were seen at localities more than 2 km apart, or if seen at a single locality in different years. Individuals were counted as "most likely distinct" if they were recorded in decidedly different habitats less than 2 km apart, or if they were recorded two or more months apart, with no intervening sightings, at a single locality surveyed weekly. In a very few cases, individuals seen at one locality within a single day were counted as "most likely distinct" when expressly considered so by the observer(s), based on distance between the sightings in comparison with the warbler's estimated rate of travel, as well as on differing composition of mixed-species flocks involved. Birds failing to qualify for either category were considered "not distinct."

From the point-count data we were able to calculate relative abundance, though not an estimate absolute bird density (Hutto et al. 1986). We also calculated a frequency index f(25m), defined by Hutto et al. (1986) as the proportion of 25-m radius counts in which the species was detected. Since all detections of Golden-cheeked Warblers using this point count method were in pine-oak forest, the same indices were calculated using only points within this habitat. The absolute values for indices of abundance are difficult to interpret since detectability is not identical for various taxa, nor from region to region (Hutto et al. 1986). For this reason, we offer comparison abundance indices for certain other locally-occurring species.

For the transect studies, we calculated a frequency per transect, f(t), dividing the number of encounters (not individuals) of Golden-cheeked Warblers along a transect by the number of visits made to the transect. We used the f(t)'s to compare the likelihood of encountering Golden-cheeked Warblers across habitats. Data from casual observations indicated the types and variety of habitats in which the species may be found, though the amount of effort in each habitat is unknown.

Analysis of sex ratio was based on individuals considered "certainly distinct" or "most likely distinct" to avoid bias from repeat observations of a single individual. Analysis of flock composition used all observations. We also used all observations for our analysis of habitat use. Chi-square analysis was used to determine significance of sex ratios.

RESULTS

We made 46 observations of Golden-cheeked Warblers, from August 1990 to December 1992, comprising not only presumed migrants but wintering birds as well (Appendix I). The observations total 63 individuals. Of these, we consider there to have been 48 "certainly distinct" individuals while three more were "most likely distinct." Our earliest fall records were of one male Golden-cheeked Warbler on 5 August 1990 and one female, seen 11 August of the same year. Our latest spring records were six observations, of three certainly distinct individuals, from 31 March to 13 April.

ABUNDANCE

Golden-cheeked Warblers were nearly the least abundant of all resident or wintering warblers detected during the point counts (Table 1). Only the locally very rare Pink-headed Warbler (*Ergaticus versicolor*), was encountered less frequently. Townsend's Warbler was the most abundant warbler detected in point counts and

TABLE 1. Mean number of selected warblers from point counts conducted in the Highlands of Northern Chiapas, Mexico, September to December 1992. Townsend's Warbler was the most abundant of all warblers and Pink-headed Warbler the least abundant of all wintering or resident warblers.

Species	All sites (n = 335)		Pine-oak (n = 142)	
	Mean[a]	f(25 m)[b]	Mean[a]	f(25 m)[b]
Townsend's Warbler	1.15	0.49	1.32	0.54
Hermit Warbler	0.44	0.15	0.61	0.21
Black-throated Green Warbler	0.012	0.01	0.014	0.01
Green-cheeked Warbler	0.012	0.009	0.028	0.02
Pink-headed Warbler	0.006	0.006	0.014	0.01

[a] Mean number of individuals per 25-m-radius point count.
[b] The proportion of 25-m-radius counts within which the species was detected.

occurred in the largest proportion of counts (Table 1), considering either all points or only those in pine-oak forests. Golden-cheeked Warblers were approximately 100-times less abundant than Townsend's considering all points, and 50-times less abundant in pine-oak forests. Of the other members of the *D. virens* complex, Black-throated Green Warblers were almost as scarce as Golden-cheeked Warblers. They occurred more frequently at lower elevations (Pulich 1976; Macías-Caballero and Duncan, pers. observ.). Hermit Warblers were intermediate in abundance.

DISTRIBUTION BY SEX

Sightings of male Golden-cheeked Warblers (n = 36) significantly outnumbered those of females (n = 15) by a factor of 2.4 ($\chi^2 = 7.84$, df = 1, $P \leq 0.01$). The true sex ratio, however, may be masked by the fact that male Golden-cheeked Warblers are more easily distinguished from the sibling species than are females. Thus, female Golden-cheeked Warblers seen imperfectly might not have been positively identified and would have gone unrecorded. This seems more likely to have occurred before observers were aware that Golden-cheeked Warblers were a part of the region's avifauna. Therefore we tested whether the results of the 1990–1991 season (18 males, 6 females) differed from the sightings of the 1991–1992 and 1992–1993 seasons (18 males, 9 females). We found that the two subsets of our sightings could have come from the same population ($\chi^2 = 0.353$, df = 1, $0.5 \leq P \leq 0.9$), and thus did not find a significant change through time in our ability to detect females relative to males.

HABITAT USE

We detected Golden-cheeked Warblers in all habitat types except *milpas* (Table 2). All detections of Golden-cheeked Warblers (four individuals in three observations) during the point counts were in pine-oak forest, which was also the habitat type with the greatest number of point counts. During the transect studies, however, there were nine independent observations, totalling 22 Golden-cheeked Warblers, in five habitat types. The likelihood values, f(t), of encountering a Golden-cheeked Warbler were rather uniform across habitat types. The likelihood was greatest in pine forest (0.14) followed by pine-oak forest (0.09) and the mixed habitat (0.09). No Golden-checked Warblers were found during transects or point counts in shrub or *milpa*.

FORAGING, AGGRESSION, AND SOCIABILITY

The mean estimated height and standard deviation at which we observed Golden-cheeked Warblers foraging was 10 ± 6 m (n = 26) while the mean estimated height of trees in which they foraged was 15 ± 6 m (n = 25). The mean ratio of foraging-height to tree-height was 0.72 ± 0.17 (n = 25), which is to say that these warblers were found in the upper half of the trees in which they foraged. Golden-cheeked Warblers foraged by gleaning from foliage and branches (n = 13) or gleaning from foliage and branches plus hanging-to-glean from the underside of leaves (n = 2).

We noted only two examples of aggression in our sightings, even though in most cases, we specifically looked for this behavior. In one case (11 December 1991), a female Townsend's Warbler displaced a male Golden-cheeked Warbler, and in the other (5 February 1992), a Crescent-chested Warbler (*Parula superciliosa*) attacked a Golden-cheeked Warbler of unrecorded sex.

Golden-cheeked Warblers occurred as members of mixed-species flocks in 90% (n = 36) of observations (see also Braun et al. 1986, Johnson et al. 1988). In one instance, one male and one

TABLE 2. Number of encounters (and individuals) of Golden-cheeked Warblers in different habitats of the Highlands of Northern Chiapas, Mexico, from August 1990 to December 1992, with measures of effort where known.

Method	Habitat						
	Pine	Pine-oak	Oak	Mixed	Cloud	Shrub	Milpa
Casual observations	1 (1)	11 (9)	7 (6)	7 (7)	1 (1)	1 (1)	0 (0)
Point counts	0 (0)	3 (4)	0 (0)	0 (0)	—[a]	0 (0)	0 (0)
no. of counts	31	142	67	32		47	16
Transects	5 (14)	4 (2)	2 (6)	3 (4)	2 (3)	0 (0)	0 (0)
f(t)	0.14	0.09	0.05	0.09	0.08	0.00	0.00

[a] Not censused with this method.

female Golden-cheeked Warbler occurred together without other species, and in another case, two males were seen together in the absence of other species. For 34 cases, detailed data on flock size and composition were recorded. Mean flock size was 16 ± 13 (range 2–50). The mean number of Golden-cheeked Warblers per flock was 1.4 ± 0.9. Species found most commonly (more than 50% of the time) in flocks containing Golden-cheeked Warblers were Townsend's Warbler, Hermit Warbler, Red-faced Warbler (*Cardellina rubrifrons*), and Solitary Vireo (*Vireo solitarius*) (Table 3).

DISCUSSION

Distribution through the year. Our earliest fall sightings are consistent with the earliest fall Chiapas specimen, 9 August 1950 (Pulich 1976). These dates are noteworthy since other members of the Black-throated Green complex do not arrive in Chiapas until the end of August or early September (Alvarez del Toro 1980; Macías-Caballero, pers. observ.). Our late-March and April observations were somewhat surprising since the species arrives at the Texas breeding grounds by mid-March (Pulich 1976). Nonetheless, Russell (fide Pulich 1976) reported a male in northern Mexico as late as 17 April. These late migrants, the only April records outside Texas, may have hatched the previous year (Gauthreaux 1988, Morse 1989). Our other March records, from 3–9 March, represented birds that were probably able to reach the breeding grounds by mid-March. These records concur with the observations and specimens from northeastern Mexico from 11–20 March (Pulich 1976, Johnson et al. 1988).

Distribution by sex. It is likely that the population of Golden-cheeked Warblers in the Highlands of Northern Chiapas consists of more males than females. The true sex ratio may be obscured, however, by the presence of female-plumaged immature males, and overlooked females. Our results show that the sex ratio of the 1990–1991 season was homogeneous with that of the 1991–1992 and 1992–1993 seasons when observers were more experienced. This suggests that females were not selectively overlooked. Indeed, it is plausible that a greater percentage of males than females winter in Mexico, closer to the breeding grounds, and that a higher proportion of females winter in the more southerly parts of the range, as occurs in other species (Ketterson and Nolan 1983, Morse 1989).

Habitat use, foraging and interspecific interactions. The diversity of habitats occupied by Golden-cheeked Warblers in the Highlands of Northern Chiapas is very different from their specificity for "cedar brakes" in the breeding season (cf. Kroll 1980), a situation known for other species as well (Askins et al. 1990, Hutto 1992, Rabenold 1980). The discrepancy between the small preference we observed for pine forests (transect data) versus that for pine-oak forest (point-count data) is probably unimportant because the number of sightings is small. Moreover, the existence of differing micro-habitats within a broader forest type creates a basic incompatibility between transect and point-count data (Wiens 1981).

Despite the increased diversity in habitat use, the foraging behavior we observed was quite similar to that described by Pulich (1976) for foraging on the breeding grounds. We, too, found gleaning to be nearly the exclusive method employed. Like Pulich, we did not observe flycatching or sallies-from-a-perch as foraging methods. In fact, gleaning is the method employed by the majority of *Dendroica* warblers during the winter

TABLE 3. Frequency as a percentage of occurrence, and mean number ($\bar{x} \pm$ SD) of individuals of species in flocks ($n = 34$) containing Golden-cheeked Warblers in the Highlands of Northern Chiapas, Mexico, August 1990–December 1992. Ranking is by greatest percentage of flocks, followed by mean number of individuals. When these lead to equal rankings, species sequence is that of AOU (1983).

Species	Percentage of flocks	$\bar{x}$
Townsend's Warbler, *Dendroica townsendi*	91	4.4 ± 5.1
Hermit Warbler, *Dendroica occidentalis*	53	2.7 ± 4.2
Red-faced Warbler, *Cardellina rubrifrons*	53	0.9 ± 1.1
Solitary Vireo, *Vireo solitarius*	53	0.7 ± 0.9
Wilson's Warbler, *Wilsonia pusilla*	44	0.6 ± 0.9
Crescent-chested Warbler, *Parula superciliosa*	41	0.6 ± 1.1
Black-and-white Warbler, *Mniotilta varia*	35	0.3 ± 0.6
Hutton's Vireo, *Vireo huttoni*	29	0.4 ± 0.7
Olive Warbler, *Peucedramus taeniatus*	24	0.5 ± 1.2
Greater Pewee, *Contopus pertinax*	21	0.2 ± 0.4
Black-throated Green Warbler, *Dendroica virens*	18	0.3 ± 0.8
Tufted Flycatcher, *Mitrephanes phaeocercus*	15	0.2 ± 0.7
Tennessee Warbler, *Vermivora peregrina*	15	0.2 ± 0.5
Mountain Trogon, *Trogon mexicanus*	15	0.1 ± 0.4
Hammond's Flycatcher, *Empidonax hammondii*	12	0.1 ± 0.3
Painted Redstart, *Myioborus pictus*	9	0.1 ± 0.4
Slate-throated Redstart, *Myioborus miniatus*	9	0.1 ± 0.3
Bushtit, *Psaltriparus minimus*	6	0.3 ± 1.3
Nashville Warbler, *Vermivora ruficapilla*	6	0.06 ± 0.24
Chestnut-sided Warbler, *Dendroica pensylvanica*	6	0.06 ± 0.24
Gray Silky-flycatcher, *Ptilogonys cinereus*	3	0.3 ± 1.7
Blackburnian Warbler, *Dendroica fusca*	3	0.06 ± 0.34
White-eared Hummingbird, *Hylocharis leucotis*	3	0.03 ± 0.17
Garnet-throated Hummingbird, *Lamprolaima rhami*	3	0.03 ± 0.17
Spot-crowned Woodcreeper, *Lepidocolaptes affinis*	3	0.03 ± 0.17
House Wren, *Troglodytes aedon*	3	0.03 ± 0.17
Least Flycatcher, *Empidonax minimus*	3	0.03 ± 0.17
Empidonax sp.	3	0.03 ± 0.17
Black Phoebe, *Sayornis nigricans*	3	0.03 ± 0.17
Yellow-throated Vireo, *Vireo flavifrons*	3	0.03 ± 0.17
MacGillivray's Warbler, *Oporornis tolmiei*	3	0.03 ± 0.17
Golden-browed Warbler, *Basileuterus belli*	3	0.03 ± 0.17
Hepatic tanager, *Piranga flava*	3	0.03 ± 0.17

(Macías-Caballero 1993, Morse 1989). Our observation that wintering Golden-cheeked Warblers forage in the upper half of trees is at odds with Kroll's (1980) single sighting from Guatemala, but accords well with Pulich's (1976) findings for the breeding season. While aggressive competition for resources among wintering migrant warblers is known (Macías-Caballero 1993, Greenberg et al. 1993), we observed very few interspecific aggressive interactions and no intraspecific ones.

Because we found the species almost exclusively among mixed flocks of passerines, we suggest that searching such flocks may be the most effective strategy for finding Golden-cheeked Warblers in other localities. If the density of Golden-cheeked Warblers in our study area is typical of the rest of the wintering grounds, observers elsewhere will need to make the equivalent of hundreds of point counts to assess the species's abundance. The habitats in which we found Golden-cheeked Warblers are not rare in the Highlands of Northern Chiapas, though conversion to *milpa* agriculture continues. The species's plasticity in wintering habitat use suggests, however, that its current population decline is more likely a result of habitat loss on the breeding grounds than of changes in its wintering areas.

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APPENDIX I. Sightings of Golden-cheeked Warbler in the Highlands of Northern Chiapas, Mexico, August 1990–December 1992.

	Date	Habitat[a]	Elev (m)	Number ♂	♀	?[b]	Method[c]	Observer[d]	Comment[e]
1.	5 Aug 90	P-O	2,100	1			Cas	PJB	
2.	11 Aug 90	Oak	2,450		1		Cas	PJB	
3.	1 Sep 90	P-O	2,500	1			Cas	PJB	
4.	16 Oct 90	Oak	2,200	1			Cas	CMC, RG	
5.	31 Oct 90	Oak	2,450	1			Trans	RMV	
6.	24 Nov 90	Pine	2,250	5			Trans	RMV	
7.	27 Nov 90	Mix	2,200	1	1		Trans	RMV	
8.	12 Dec 90	Mix	2,200	1			Trans	RMV	Not distinct from #7
9.	17 Dec 90	Pine	2,250	2			Trans	RMV	Not distinct from #6
10.	12 Jan 91	Mix	2,200	1			Cas	CMC	
11.	31 Jan 91	P-O	2,300	2			Cas	CMC, JS	
12.	22 Feb 91	Mix	2,200	1			Cas	CMC	
13.	26 Feb 91	Mix	2,200		1		Cas	RMV	Not distinct from #12
14.	26 Feb 91	Cld	2,550	1			Cas	CMC	
15.	9 Mar 91	Mix	2,200	1			Cas	CMC	
16.	7 Apr 91	Oak	2,450	2			Cas	CMC	
17.	7 Apr 91	Oak	2,450		1		Cas	CMC	
18.	9 Apr 91	Oak	2,450		1		Cas	CMC	Not distinct from #17
19.	12 Apr 91	Cld	2,550		1		Trans	CMC	Not distinct from #17
20.	13 Apr 91	Pine	2,250	1	1		Trans	CMC	♂ most likely distinct from #6
21.	24 Sep 91	Mix	2,100		1		Cas	CMC	
22.	28 Sep 91	P-O	2,400	1			Cas	ERI, RG, CEG	
23.	2 Oct 91	Pine	2,250	2	1		Trans	CMC	
24.	2 Oct 91	Mix	2,100		1		Cas	CMC	Not distinct from #21
25.	10 Oct 91	Mix	2,200		1		Trans	CMC	
26.	15 Oct 91	P-O	2,400	1			Trans	RMV	Not distinct from #22
27.	18 Oct 91	P-O	2,400	1			Cas	ERI	
28.	28 Oct 91	P-O	2,400	1			Trans	CEG	Not distinct from #22
29.	26 Nov 91	P-O	2,250	1			Trans	CMC	Not distinct from #23
30.	11 Dec 91	P-O	2,400	1			Cas	CMC	Not distinct from #22
31.	10 Jan 92	Mix	2,200	1			Cas	ERI	
32.	22 Jan 92	Pine	2,250	1			Cas	ERI	
33.	22 Jan 92	Oak	2,200	1			Cas	CMC	
34.	31 Jan 92	P-O	2,300	2			Cas	CMC, JS, PJB	
35.	5 Feb 92	Oak	2,150	1	1		Point	ERI, JS	
36.	3 Mar 92	Cld	2,550	2			Trans	CEG	
37.	5 Mar 92	P-O	2,400			1	Trans	CEG	Not distinct from #22
38.	31 Mar 92	Pine	2,250	1	1		Trans	CMC	♂ most likely distinct from #32
39.	27 Oct 92	P-O	2,100	1			Point	CMC	
40.	11 Nov 92	Oak	2,300		1		Point	CDD, IB	
41.	13 Nov 92	P-O	2,300	1	1		Point	CMC	
42.	29 Nov 92	P-O	2,500	1			Cas	CDD, IB	Not distinct from #39
43.	3 Dec 92	P-O	2,350		1		Point	CMC	
44.	4 Dec 92	P-O	2,310	1	1		Cas	CDD	
45.	12 Dec 92	P-O	2,310	1			Cas	CDD, IB	Not distinct from #44
46.	12 Dec 92	Shr	2,310	1			Cas	CDD, IB	Most likely distinct from #45

[a] Habitat codes: P-O = pine-oak forest, Cld = evergreen cloud forest, Mix = mixed vegetation, Shr = shrub. See text for more complete descriptions.
[b] ? = Sex unrecorded.
[c] Method codes: Cas = casual observation, Trans = 40 m × 1 km transect, Point = 10-min, 25-m radius point count.
[d] Observers: Ilze Balodis, Peter Bichier, Philip J. Bubb, Claudia Macías-Caballero, Charles D. Duncan, Claudia Elia González, Russell Greenberg, Ernesto Ruelas-Inzunza, John Sterling, Rosa María Vidal.
[e] See text for definitions of "certainly distinct" and "most likely distinct" as applied to sightings.