Wilson Bulletin, 116(1), 2004, pp. 89–93

PHENOLOGY, HABITAT USE, AND NESTING OF THE RED-BREASTED CHAT (*GRANATELLUS VENUSTUS*)

JORGE H. VEGA RIVERA,[1,3] FERNANDO ALVARADO,[1] J. MANUEL LOBATO,[1] AND PATRICIA ESCALANTE[2]

ABSTRACT.—From March 1999 to August 2000, we conducted monthly mist netting in the Chamela-Cuixmala Biosphere Reserve, Jalisco, Mexico to document the phenology and habitat use of the Red-breasted Chat (*Granatellus venustus*). We collected information on its nesting biology during the breeding season of 2001. Chats (n = 116) were caught throughout the 18 months of the study; however, far fewer captures occurred during the dry season than during the wet season. Our capture data revealed that chats made greater use of deciduous (n = 88) than semi-deciduous forest (n = 28); there were no interactions among forest type, season, and gender. Birds in breeding condition were captured June–September and molting birds were captured August–October. We found 10 cup-shaped nests in June and July. Nests were 48–103 cm above ground in saplings ≤2 m high. Clutch size was 3–4 and only the female incubated. The incubation period was 14 days, and we estimated the nestling period to be approximately 8–10 days. Of eight nests found with eggs or young, three were depredated during the egg stage, three during the nestling stage, and two were successful. *Received 29 June 2003, accepted 18 March 2004.*

The New World genus *Granatellus* includes three species that occur in southwestern Mexico (Red-breasted Chat, *Granatellus venustus*), southern Mexico and northeastern Central America (Gray-throated Chat, *G. sallaei*), and the Amazonian lowlands of South America (Rose-breasted Chat, *G. pelzelni*) (Sibley and Monroe 1990). The conservation significance of these species is high because of their relatively restricted range, but virtually no details of their life history are known. Also, the systematic position of the genus is uncertain (Lovette and Bermingham 2002). There is only one description of a nest of the *francescae* group of *G. venustus* from the Tres Marias Islands (Grant 1964), and a recent description of two nests of Gray-throated Chats (Salgado-Ortiz et al. 2001).

The Red-breasted Chat is endemic to the tropical deciduous and semi-deciduous forest of western Mexico from northern Sinaloa south to Chiapas (American Ornithologists' Union 1983). Schaldach (1963:81) included Red-breasted Chats "among the rarest birds of the Pacific slope of Mexico"; Alvarez del Toro (1980) described them as uncommon in Chiapas and Ornelas et al. (1993) observed chats only twice during 2 years of work in the region of Chamela, Jalisco. Its relatively limited distribution, the lack of information on its basic biology, and the fact that it inhabits an endangered ecosystem (Janzen 1988, Lerdau et al. 1991) made the Red-breasted Chat a priority species for study. Here, we report on its phenology and habitat use. We also provide the first complete description of nest and eggs, and some details on nesting biology.

METHODS

We conducted our study at the Chamela Biological Station (3,300 ha), which is part of the Chamela-Cuixmala Biosphere Reserve (hereafter, the Reserve), Jalisco, Mexico (19° 22′ to 19° 35′ N and 104° 56′ to 105° 03′ W). Weather there is strongly seasonal with distinct rainy (June to October) and dry seasons. The Reserve (13,300 ha) is covered predominantly by undisturbed deciduous forest on dry hillsides, with patches of semi-deciduous forest extending along arroyo floodplains (Lott et al. 1987). Within the Reserve, 24 bird species endemic to Mexico have been recorded; of those, 20 are endemic to western Mexico (Arizmendi et al. 1990). See Vega Rivera et al. (2003) for a detailed description of the study area.

From March 1999 to August 2000, we conducted monthly mist netting along four 3-km-long trails, separated from each other by 1 km. The dominant vegetation types were decidu-

[1] Estación de Biología Chamela, Inst. de Biología, UNAM, Apt. 21 San Patricio, Jalisco, 48980, México.
[2] Dep. de Zoología, Inst. de Biología, UNAM, Apt. 70–153, México, DF 04511, México.
[3] Corresponding author; e-mail: jhvega@ibiologia.unam.mx

ous (n = 2) and semi-deciduous (n = 2) forest. Every month for 3 consecutive days and 5 hr/day, we placed 12 mist nets (12 m × 2.5 m, 6-mm mesh) along each trail; nets were separated by 100 m. Each chat we captured was banded with numbered aluminum bands and processed for body mass (to 0.1 g with a 50 g Pesola spring scale), bill and tarsus lengths (to 0.05 mm using dial calipers), and length of unflattened wing chord (to 0.5 mm using a flat-ended 15-cm ruler). We determined whether chats were in breeding condition by evaluating the presence of cloacal protuberance or brood patch. Age was evaluated by plumage and, for hatch-year birds, by the presence of unpneumaticized areas in the skull.

From May to August 2001, we walked along trails looking for singing males. Once we identified a male's territory, we searched intensively for the nest. Nest-building, food-delivery, and alarm behaviors were used to help us locate nests. Nests were visited every 3 days until clutch completion; nests with complete clutches were visited every day until hatching. We measured and weighed chicks 2 days after the last chick had hatched. Nests were measured after fledging.

We assessed habitat use (deciduous versus semi-deciduous forest; dry versus rainy seasons) and quality by examining chat abundance, age ratio, yearly persistence, and body mass corrected for wing length. Yearly persistence was calculated as the proportion of chats marked during the breeding season (June to September) that were recaptured in the study site during the dry months of January to April.

We used nonparametric Mann-Whitney U-tests (MINITAB, Inc. 1996) to compare captures between seasons and to determine gender differences in mass and wing chord. We tested the null hypothesis of mutual independence among variables (forest type × season × gender) by a chi-square three-way test of independence. Since the hypothesis was not rejected, we did not test for partial independence (Zar 1996:507). Statistical significance was set at $\alpha \leq 0.1$. All values are reported as mean ± SD.

RESULTS

Phenology.—We captured 116 chats (first captures only) during the 18-month period of mist netting. Of those, 21 were hatch-year (HY) birds and 95 were after-hatch-year birds (54 males and 41 females). Monthly captures (including recaptures) differed between seasons (Fig. 1A). From May to September (breeding season), the average number of captures per month was 14.0 ± 10.0, whereas during the rest of the year (non-breeding season) it was 3.0 ± 2.6 (Mann-Whitney U-test, U = 46, P = 0.034). Chats in breeding condition were captured from June through September (n = 50), with the proportion of birds in breeding condition peaking in July (Fig. 1B). Females tended to move longer distances between yearly recaptures (300 ± 386 m) than males (115 ± 109 m; U = 860, df = 54, P = 0.092). Eight males and five females captured during the 1999 nesting season were recaptured in the same nets the following nesting

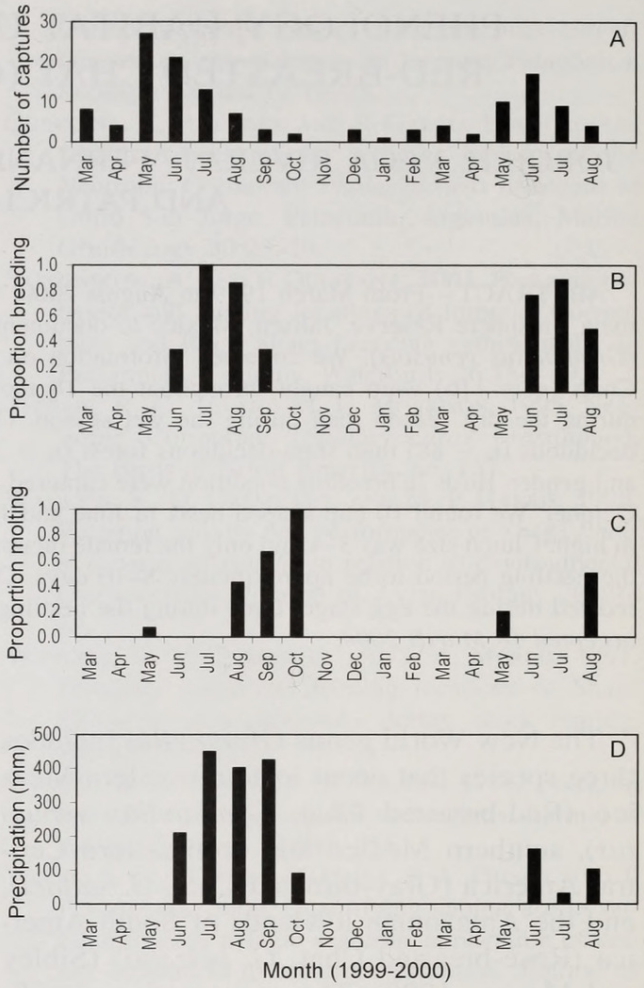

FIG. 1. Monthly distribution of captures of adult Red-breasted Chats (A), proportion of birds in breeding condition (B), proportion of birds molting (C), and precipitation (D) in the Chamela-Cuixmala Biosphere Reserve, Jalisco, Mexico, 1999–2000.

season (2000). All birds captured from December through February (n = 8) were HY and second-year males, and all HY birds (n = 21) were captured September–December.

Based on 13 adult chats captured during molt, a complete prebasic molt occurred from August to October. Seven molting HY birds were captured in September and October (Fig. 1C); from four individuals recaptured after their second prebasic molt, we confirmed that immatures attain adult plumage by the second prebasic molt. In May, we captured four chats with light molt on the neck and head.

Habitat use.—Significantly more individuals were captured in the deciduous forest (n = 88) than the semi-deciduous forest (n = 28) and there were no interactions among forest type, season, and gender (χ^2 = 8.04, df = 4, $P > 0.10$). Yearly persistence was lower in the deciduous (0.11) than in the semi-deciduous forest (0.14), but small sample sizes during the dry months (seven and three, respectively) precluded us from conducting a statistically meaningful analysis. No differences occurred in corrected body mass for individuals captured in deciduous (0.21 ± 0.002) versus semi-deciduous forests (0.20 ± 0.003; U = 6,469, P = 0.63). Corrected body mass was lower during the dry season (0.20 ± 0.001) than in the rainy season (0.22 ± 0.002; U = 3,353, $P < 0.01$).

Nesting biology.—We found 10 nests in July, in both deciduous (n = 8) and semi-deciduous (n = 2) forest. Nests were attached to a horizontal fork formed by two or three twigs (4.3 ± 0.2 mm diameter) in saplings 141 ± 26 cm high (range: 82–175 cm) and 16 ± 1.3 mm dbh of Euphorbiaceae (*Croton piramidalis*), Myrsinaceae (*Ardisia* spp.), Rubiaceae (*Randia* spp.), Acanthaceae, and Cappareceae. Mean nest height above the ground was 73 ± 19 cm (range: 48–103 cm).

The cup-shaped nests had very thin walls; eggs were visible through some areas of the walls. Primary materials used in nest construction were Spanish moss (*Tillandsia* spp.), thin (<1 mm) tendrils of Cucurbitaceae, inflorescences of *Lassiasis* spp., thin dark fibers, and spider silk; nests were lined with the finer materials. Fiber-like epiphytes (Spanish moss) hung 20–30 cm below the main nest cup, obscuring nest outlines and making nests quite cryptic. Mean nest depth was 4.7 ± 0.3 cm and mean inner rim diameter was 5.2 ± 0.9 cm.

TABLE 1. Morphological measurements (mm) and mass (g) of 10-day-old Red-breasted Chat nestlings (n = 6) and adults (n = 85) in the Chamela-Cuixmala Biosphere Reserve, Jalisco, Mexico, 1999–2000.

	Nestlings	Adults[a]
Mass	9.1 ± 0.7	12.1 ± 1.0
Wing chord	34.1 ± 2.4	57.1 ± 2.3
Tarsus	18.5 ± 0.8	19.8 ± 0.6
Culmen	4.2 ± 0.4	12.3 ± 1.9

[a] Red-breasted Chats showed significant gender differences in mass (male: 12.17 ± 0.82; female: 11.75 ± 0.90; Mann-Whitney test, U = 3,021, df = 56, 72, $P < 0.014$) and wing chord (male: 58.30 ± 1.89; female: 55.42 ± 1.75; U = 2,156, df = 56, 72, $P < 0.01$).

We found one nest before egg laying, six during incubation, one with nestlings, and two with pieces of eggshell. Eggs averaged 18.6 ± 0.2 mm (range: 17–20 mm) by 14.3 ± 0.2 (range: 13–17 mm); eggs were white with smooth surfaces. Only females were observed incubating; males spent most of the time singing nearby. Both females and males were extremely wary and typically they departed when we approached the nest. Based on the nest found before egg laying, chats laid one egg per day until clutch completion (four eggs); the incubation period lasted 14 days.

Just-hatched chicks were without feathers and had their eyes closed. At 3 days of age, nestlings had visible pinfeathers on their dorsal and ventral tracts; rectrices and remiges barely protruded at this stage. At 10 days, feathers in all regions were breaking sheaths; rectrices and remiges were almost entirely in sheaths. Primaries and secondaries were brown-gray, and primary and secondary coverts were gray with pale-brown margins (see Table 1 for measurements and weights).

Both males and females fed nestlings; during the first few days of brooding, males presented food to females, who then fed the young. Young fledged at 8–10 days of age, but this may be an underestimate of fledging age due to our activities at nests. Of seven nests found with eggs and one with nestlings, young fledged from only two; three nests with eggs and three with young were depredated.

DISCUSSION

Survey data suggest that Red-breasted Chats are uncommon along the Pacific slope

(Schaldach 1963) and in our study area (Hutto et al. 1985; Hutto 1989, 1994; Ornelas et al. 1993). According to our data, chats are permanent residents in the Chamela-Cuixmala Biosphere Reserve, where they were very common during the breeding season and uncommon the rest of the year. We do not know whether our data reveal real changes in the abundance of this species, or reflect the greater effort of this study. Nevertheless, it is puzzling that far fewer birds were captured during part of the dry season. This pattern suggests either that the birds may become less susceptible to trapping, or that at least part of the population may migrate locally to higher elevations (American Ornithologists' Union 1983) or habitats not sampled during this study (e.g., second-growth forest). Ornelas et al. (1993) suggested that the low detectability of this and other species in Chamela was either because they were rare or because they preferred more humid habitats. However, as we showed earlier, this species was neither uncommon, nor did it seem to prefer the more humid, semi-deciduous habitats. Low numbers recorded for this species could be due to its preference for second-growth habitats during the dry season. However, Hutto (1989, 1994) did not find chats in his study sites outside the Reserve; he reported chats occurring only in the "undisturbed" forest of the Reserve. It is evident that long-term studies are necessary to understand the spatial and temporal distribution of birds historically regarded as sedentary (Winker et al. 1997).

For the chat and other passerines, the end of the dry season seems to mark the beginning of the breeding season (Ornelas et al. 1993; JHVR unpubl. data). Although the first chats in breeding condition were captured in June, other activities such as territory selection and settlement, mate selection by females, nest-site selection, and construction of the nest, may have been initiated earlier. The Yellow-green Vireo (*Vireo flavoviridis*), a species that migrates from South America to breed in the Reserve, shows the same pattern; it arrives in the Reserve in May, but the first birds in breeding condition appear in June (JHVR unpubl. data). In Chamela, insect production starts after the first rains (Lister and Garcia 1992), which in the years of our study occurred in late June (Fig. 1D).

Nests of the Red-breasted Chat resemble those described for the insular subspecies, *G. v. francescae* (Grant 1964), and the Gray-throated Chat (Salgado-Ortiz et al. 2001). Nest dimensions and location are similar, but neither Grant (1964) nor Salgado-Ortiz et al. (2001) mentioned material hanging from the cup. Salgado-Ortiz et al. (2001) reported that only females build the nest and incubate eggs; they also indicated that a complete clutch contains two eggs, whereas most of our nests had four eggs. We believe that this difference may not be real, because they found only one nest with a complete clutch.

Worldwide, tropical deciduous forest may be the most endangered major tropical ecosystem (Janzen 1988). In Mexico, only 27% of the original cover of tropical deciduous forest remained in 1990, and less than 10% of the area covered with deciduous forest is now under some type of protection (Trejo and Dirzo 2000). Stotz et al. (1996) stated that severe habitat disturbance in most dry-forest zones in the Neotropics has greatly affected birds that are deciduous-forest specialists. They identified the Red-breasted Chat as one of eight "indicator" species for conserving tropical deciduous forest of the Pacific lowlands in Mexico. Currently, this forest type is only protected in the Chamela-Cuixmala Biosphere Reserve. We hope the information we provide here will aid in conservation efforts for this species and its habitat.

ACKNOWLEDGMENTS

Funding was provided by CONACYT, the Denver Zoological Foundation, and Instituto de Biología, UNAM. Logistical support in the form of vehicles, equipment, and office space was provided by Estacion de Biología Chamela, Instituto de Biología, UNAM. We are indebted to T. Valdivia, D. Curiel, and I. Fariza for assistance in the field. We thank A. Mehaan for improving the English in an earlier version of this manuscript. Comments from R. Hutto and two anonymous referees greatly improved our manuscript. Partial funding for fieldwork was provided by Instituto de Biologia, UNAM and CONACYT (fellowship # 167320 to FA).

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