

SHORT COMMUNICATIONS

The Condor 91:462-465
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NIGHT SONGS IN THE RUFIOUS-COLLARED SPARROW¹

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Key words: Night song; Rufous-collared Sparrow; *Zonotrichia capensis*.

Virtually all passerines sing almost exclusively during daylight hours; the few well-known exceptions include the Eurasian nightingales (*Luscinia*), mockingbirds (*Mimus*), and certain sylviid warblers (*Locustella* and *Acrocephalus*). Accordingly, diurnal song in passerines is a well-documented and -studied phenomenon, and various functions have been ascribed or suggested: defense and maintenance of territories and mate attraction, among others (Baker 1982, Catchpole 1982). On the other hand, night song in passerines is little known and poorly described. The only recent report of nocturnal song in a normally diurnal species of which we are aware is that of the Eurasian Redstart, *Phoenicurus phoenicurus* (Lenz 1973), although nocturnal singing has been noted in *Zonotrichia leucophrys* (De Wolfe 1968) and *Z. albicollis* (Lowther and Falls 1968).

Miller and Miller (1968) reported that male Rufous-collared Sparrows, *Zonotrichia capensis*, occasionally give complete songs in full darkness, but did not provide any description on the form of the songs. Egli (1971) described the night songs of a single, caged Chilean Rufous-collared Sparrow (*Z. c. chilensis*). Herein we report the occurrence of night songs in wild individuals of another subspecies of Rufous-collared Sparrow (*Z. c. hypoleuca*), and compare them to diurnal songs from the same localities.

METHODS

The main study area was at the northern edge of the village of Los Nacimientos (latitude 26°52'S; longitude 67°38'W; approximate altitude 2,100 m) in Monte desert scrub (Morello 1958, Handford 1988) in north-eastern Catamarca province, Argentina. The area contained numerous dry washes with substantial riparian vegetation and had a high density of singing Rufous-collared Sparrows. Night songs were recorded during the early night of January 1988 (between 18:51 and 19:53 EST; sunset was at 17:54 EST). Nocturnal sing-

ing began at dusk while there was still some light evident on the horizon. Although recordings were made only early in the night, individuals have been noted singing the same kind of songs at various times throughout the night. Day songs were recorded on the morning of 19 January (between approximately 05:00 and 06:00 EST). It is known that the diurnal song of individual *Z. capensis* is highly stereotyped, both within and between seasons (Handford and Nottebohm 1976); there is a high degree of local consistency of song form among individuals (Nottebohm 1975, Handford 1981) and a sample of five birds or so gives a very good indication of the local song type (Handford 1988). Here, songs from seven day-singing individuals were recorded. All recordings were made with an Uher CR 260 AV recorder and a Sennheiser MZS 816 'shot-gun' microphone. Sonograms were prepared using a UNISCAN II spectrum analyzer (Multigon Industries, Mt. Vernon, New York) set at 10 KHz on a time base of 3.2 sec, and an EPSON FX-85 printer. In some cases, where the shape of syllables was not readily evident on 3.2-sec sonograms, a time base of 1.6 sec was used. These sonograms were used as a base for tracing the facsimiles shown in the figures. Statistical analyses were carried out using the SAS package (SAS Institute 1985).

RESULTS

Of 15 night songs recorded, only seven were of sufficient quality for quantitative analyses. Nocturnal songs appear to be very loud, and are certainly as vigorous as daytime songs. Minimum and maximum frequencies of the recorded nocturnal songs were 2.28 KHz (SD = 0.26 KHz) and 6.20 (SD = 0.63 KHz), respectively. Average duration of the song was 2.79 sec (SD = 0.50 sec). Night songs consisted of between nine and 12 'notes,' and the number of note types was greater than that found in the day songs. All night songs ended in descending whistled notes (internote interval of 420 msec, SD = 57 msec), qualitatively similar to those found in the very slow trill of typical day songs (Handford 1988). Additionally, broad frequency "chip" notes, U-shaped or inverted U-shaped notes, "click" notes of various shapes, and ascending whistled notes occurred in the first portion of some night songs, which note types are not found in any diurnal song of this region (Handford 1988). One particular night song, too

¹ Received 13 June 1988. Final acceptance 16 January 1989.

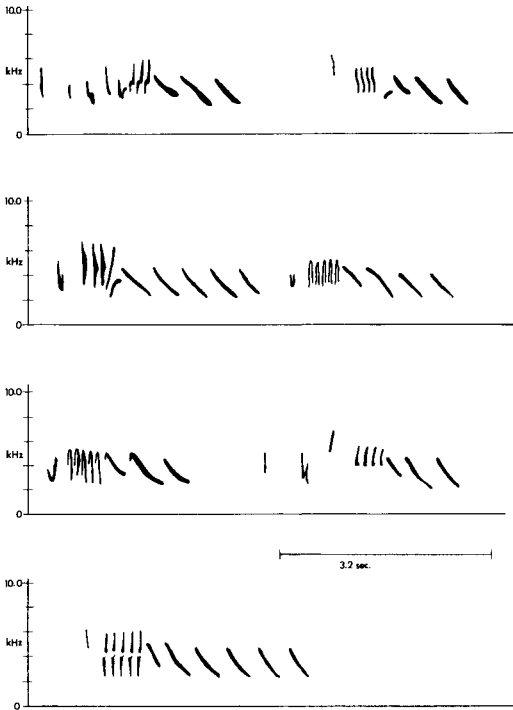


FIGURE 1. Traced facsimiles of sonograms of seven nocturnal songs of *Zonotrichia capensis hypoleuca* from Monte desert scrub in Los Nacimientos, Catamarca province, Argentina.

poor for clear resolution in a sonogram, consisted of a series of clicks, then three descending whistles, another series of clicks and two more descending whistled notes.

Minimum and maximum frequencies of day songs were 2.73 KHz (SD = 0.10 KHz) and 5.54 KHz (SD = 0.20 KHz), respectively. Average song duration was 1.46 sec (SD = 0.19 sec). Day songs consisted of either four or five descending whistled notes with an average internote interval of 360 msec (SD = 49 msec) (Fig. 2). Minimum and maximum frequencies were different between day and night songs (minimum frequency: $t = 4.26$, $df = 12$, $P > 0.005$; maximum frequency: $t = 2.66$, $df = 12$, $P > 0.05$). Frequency range (bandwidth) was also different ($t = 3.63$, $df = 6.4$, $P > 0.01$). Song duration was significantly different: $t = 6.47$, $df = 12$, $P > 0.0001$). Trill intervals of day songs and night songs were significantly different ($t = 3.78$, $df = 42$, $P > 0.001$).

We have no information on the reactions of other nonsinging individuals to nocturnal song, but there does not seem to be any immediate vocal response of one male to another male's singing. Moreover, not all males at this locality were singing during this night. In several cases, these night songs followed rapidly on the calling of plovers (*Vanellus cayennensis*).

DISCUSSION

A recent study (Handford 1988) has shown that the diurnal song of male *Z. capensis* across the whole

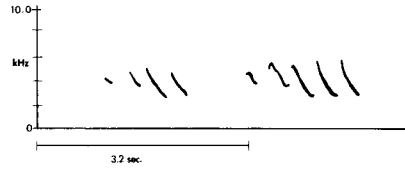


FIGURE 2. Traced facsimiles of sonograms of two representative "typical" *Z. c. hypoleuca* diurnal songs from the same location as in Figure 1.

northern Monte desert consists exclusively of three to six slowly-descending whistles each separated by 350 to 400 msec. These nocturnal songs, then, contain note types totally atypical of any Monte diurnal song, yet presumably they are produced by resident individuals which give typical "desert songs" during the day. However, we cannot rule out the possibility of the night songs being produced by nonterritorial "floater" individuals. Either way, these songs are not produced during the day.

Nocturnal vocalizations in this species appear to be a widespread, if infrequent, phenomenon in that we have heard them in most of the many vegetation types (Handford 1988) in northwestern Argentina. Nottebohm (pers. comm.) also reports night singing in other parts of Argentina. Figure 3 illustrates nocturnal songs from three other localities: transition forest near Rio Paños just south of San Salvador de Jujuy, Jujuy province (San Salvador de Jujuy: 24°11'S latitude; 66°57'W longitude; approximate altitude 1,500 m); Monte desert scrub north of Pinchas, La Rioja province (Pinchas: 28°57'S latitude; 66°57'W longitude; approximate altitude 1,360 m); and lower montane grassland near Tafi del Valle, province of Tucuman (Tafi del Valle: 26°52'S latitude; 65°41'W longitude; approximate altitude 2,100 m). Songs may be interpreted aurally relatively unambiguously and a sonogram-type notation sketched (for example, see Nottebohm 1969, King 1972, Handford 1981). We have utilized this field notation in Figure 3. Usual diurnal songs at the Rio Paños site consist of a three- to four-note theme followed by a trill with an approximate internote interval of 100 msec. Day song at Pinchas is that described in Results above (slowly descending whistle notes). Finally, diurnal song at the lower montane grassland site above Tafi del Valle typically has a three-note theme (either slowly ascending or descending whistles) followed by a trill with an internote interval of between 40 or 60 msec (see fig. 2 in Handford and Nottebohm 1976).

In all cases, night songs appear to be longer, often with a more sustained trill, to sound "richer" and louder, and to be more complex than corresponding diurnal songs. Nocturnal songs at Los Nacimientos are about twice the duration, and involve approximately twice the number of syllables as day songs. Moreover, night songs occur within a greater frequency range, on average, and involve a greater variety of syllable types.

If these nocturnal songs are produced by adult males, whose diurnal songs are quite different, then a complexity in song learning is suggested. It is obvious that some if not all individuals have in their vocal repertoire a number of syllables which are not used during the day. Song learning is thought to be complete in *Z.*

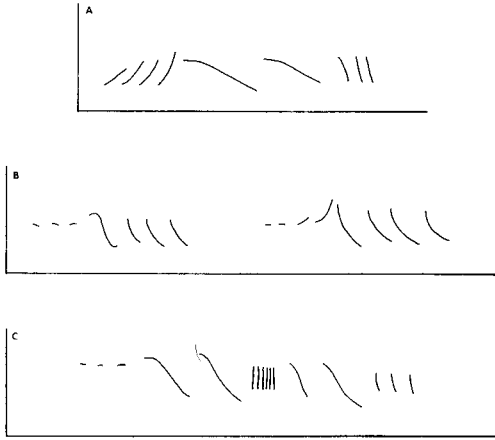


FIGURE 3. Hand-drawn sonograms (aurally interpreted) of nocturnal song from *Z. capensis* in (A) transition forest near San Salvador de Jujuy, Jujuy province, (B) Monte scrub near Pinchas, La Rioja province (two examples), and (C) lower montane grassland near Tafi del Valle, Tucuman province (geographic coordinates and descriptions of corresponding diurnal songs given in the text). X axis represents time, and Y axis represents frequency.

capensis by about 50 days of age after hatching (Egli 1971, Kroodsma and Baylis 1982). If this is the case, it suggests that male Rufous-collared Sparrows, in addition to learning diurnal song syllables and structure, learn these additional nocturnal song notes during this same critical period. This situation could be considered analogous to learned songs in females of the crowned sparrows. That is to say, female *Zonotrichia* are believed to learn the song of the natal area, but this is rarely if ever produced in natural situations (King 1972).

On the other hand, there is evidence in the White-crowned Sparrow, *Z. leucophrys* (Baptista and Morton 1988), that song learning extends beyond this 50-day period, and that much learning is "oblique," that is, from nonparental adults, and at locations away from the natal area. It is possible then that Rufous-collared Sparrows may learn song syllables from "foreign" individuals during migrations which they undertake themselves, or from transient migrant individuals who pass through the area. In the areas in question there are extensive migrations of other populations of *Z. capensis*, both during the early southern spring when high altitude breeders move through on their way to the puna region, and during the fall and winter when populations from the far south (Patagonia) move north to pass the winter. Puna breeders do not give the syllables described here during their normal daytime song (Handford 1988), although during their migration they give longer and more complex songs, often in flight, which contain additional elements not shown in their diurnal song (Handford 1980). Some Patagonian populations of *Z. capensis* have songs containing a variety of syllables not known from day songs of northwestern Argentina (King 1972; Handford, pers. observ.) and so the possibility exists that these night song elements

could derive from either (or both) spring and/or fall migrants, although why they should be rendered only during the night hours remains problematic.

Finally, we should point out that we cannot rule out the possibility that these night songs are produced by females; we feel it is unlikely that juveniles could be involved, since at the time of this study, only very few, young juveniles would be about (Handford 1980), and also these songs have been heard before any nestlings leave the nest. In addition, we might add that interpretation of these night songs would be easier if we had a complete inventory of the vocal repertoire of all age/sex categories, under all motivational situations. Miller and Miller (1968) do provide something of such an inventory but only some calls are shown as sonograms; however, none of the descriptions suggest sounds corresponding to the novel elements reported here (except, as noted above, the *chip* note). The possibility remains though, that these night songs represent a motivational hybrid.

We wish to express our gratitude to Pedro Blendinger for his help in the field. We also thank Lynn Brodsky for suggestions on the improvement of earlier versions of this manuscript, and Mike Rae for help in the analyses. This study was funded by an Natural Sciences and Engineering Research Council of Canada grant to Paul Handford.

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The Condor 91:465-467
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MORPHOMETRICS, METABOLIC RATE AND BODY TEMPERATURE OF THE SMALLEST FLIGHTLESS BIRD: THE INACCESSIBLE ISLAND RAIL¹

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Key words: *Atlantisia rogersi*; *body temperature*; *flightlessness*; *Inaccessible Island*; *metabolic rate*.

The Inaccessible Island Rail *Atlantisia rogersi* is restricted to Inaccessible Island (37°15'S, 12°30'W), a 12-km² island in the Tristan da Cunha Island group, central South Atlantic Ocean. It is the only extant member of its genus (Olson 1973) and it is generally accepted to be the smallest flightless bird in the world (Collar and Stuart 1985), although there are few published morphometric data (Lowe 1928, Hagen 1952). The wings and tail are greatly reduced, and the feathers have few barbules, resulting in a soft, hair-like plumage unique among rails (Lowe 1928). Little is known of the ecology of the Inaccessible Island Rail (Collar and Stuart 1985). It is widespread at Inaccessible Island, occurring in almost all habitats, but spends much of its time in runs and burrows (Lowe 1928, Hagen 1952). We present morphometric data for Inaccessible Island Rails and examine their metabolic rate and body temperature to assess the extent to which their lifestyle has modified their energy metabolism.

MATERIALS AND METHODS

We caught Inaccessible Island Rails using mist nets, scoop nets, or by hand during September-October 1987

and October-November 1988. We measured, aged, and sexed birds (after Elliott 1957, Richardson 1984), and recorded linear measures with Vernier calipers (for bill measurements, to the nearest 0.1 mm) or a stopped wing rule (for flattened wing chord and tarsus, to the nearest 0.5 mm). Mass was recorded to the nearest 0.2 g on a 100 g Pesola balance. Student's *t*-tests were used to test the significance of intersexual size differences.

We estimated metabolic rates (MR) from oxygen (O₂) consumption measured in translucent, airtight chambers (volume 5 liter) using an open flow-through system. Air from outside the laboratory was pumped through a regulating flowmeter into the chamber, over the bird, and out through the following equipment: a silica gel drying tube, a Rotameter flowmeter, and a silica gel/Carbosorb/silica gel tube leading to a Taylor Servomex OA570 paramagnetic oxygen analyzer (after Adams and Brown 1984). Incurrent air was used to set the oxygen analyzer at a standard 20.94 %O₂ every hour during experiments. The Rotameter flowmeter was calibrated against a Hastings Mass Flowmeter (Model ECPR-1A).

Esophageal temperature (assumed to approximate core body temperature, T_b) was measured within 1 hr of capture using a thermocouple inserted at least 15 mm down the esophagus. We then placed test birds into a chamber and allowed them to become accustomed to their surroundings for 1 hr before taking readings of flow rate, %O₂, and chamber temperature. Readings were taken at 30-min intervals for 22 hr, after which time we again recorded esophageal tempera-

¹ Received 28 June 1988. Final acceptance 16 January 1989.