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NOTES ON THE BIOLOGY AND SONG OF THE RED-LEGGED SERIEMA (*CARIAMA CRISTATA*)

BY KENT H. REDFORD AND GUSTAV PETERS

Very little, even of an anecdotal nature, has been written on the two living seriemas, the Black-legged or Burmeister's Seriema (*Chunga burmeisteri*), and the Red-legged, or Crested Seriema (*Cariama cristata*) (Blake 1977). Yet they are not rare in zoological collections and are fairly common in many areas of South America south of the Amazon. The Red-legged Seriema is found in grasslands and open scrub of central and eastern Brazil from the state of Ceara west to Mato Grosso State and eastern Bolivia, and south to Uruguay, Paraguay, and the Argentinian provinces of San Luis, La Pampa, and Entre Rios (Blake 1977, Frieling 1936). Indeed, the Red-legged Seriema is one of the most frequently seen large birds in central Brazil where KHR spent 2 yrs. It is even more frequently heard than seen because its loud distinctive songs carry for several kilometers.

This paper reports incidental field observations made on Red-legged Seriemas and presents an analysis of the vocalizations of several captive and wild Red-legged Seriemas. This information is combined with the limited published data for the two species of seriemas to construct hypotheses about the behavior of a little known species, and to propose further research to test these hypotheses.

METHODS

Data were collected during a 1981–1982 study of giant anteaters. Red-legged Seriemas were observed as the opportunity arose and notes taken on behavior, singing, and nests. The principal study area was Emas National Park, a 131,868 hectare park on the border of Goias and Mato Grosso do Sul States in southwestern Brazil (18°45'S and 52°45'W). Emas Park is in the cerrado ecosystem, a xeromorphic, semideciduous savanna composed of several distinct subunits (Eiten 1972). The most common subunit in Emas is grassland, followed by cerrado or semi-arboreal scrubland and by cerradao or tall cerrado characterized by a greater density of tall trees. Termite mounds form an important part of the landscape where the vegetation is open and are particularly common in areas adjacent to the park where cattle graze (Redford 1984).

Approximately 1500 mm of rain falls during the September–May wet

season (Anonymous 1981). Virtually no rain falls and the temperature can exceed 35° during the day during the rest of the year. Fire is an important element in the cerrado ecosystem; uncontrolled fires set outside the park enter and burn virtually the whole park every several years (Redford 1985).

Three calling sequences of one unsexed individual of a pair kept at the National Zoo in Washington D.C. were recorded on 31 August 1982. The recordings were made on Ampex 632 tape with a Uher tape recorder (Florida State Museum Master Tape No. 673). One calling sequence recorded by W. Belton in central Brazil (Cornell University Library of Natural Sounds, Cat. No. 20029) was also analyzed. We do not know to what extent the recordings contain the full length of the calling series.

Sonographic analyses were done in various frequency ranges between 20 and 8000 Hz. Sound spectrograms were produced on a Kay Sonagraph Model 7029A, Kay Digital Sonagraph Model 7800 and Voiceprint Model 4691A. All spectrograms were produced using wide band settings and flat shaping. Frequency and temporal parameters were measured in the sonagrams with overlay grids. No direct measurements of call intensity were made. Intensity data presented in this paper represent loudness of the calls as perceived by the observer.

RESULTS

Biology.—Red-legged Seriemas were commonly seen in and adjacent to the park, particularly in areas that had been recently burned or grazed where there appeared to be a greater number of invertebrates for which the birds were apparently searching. Seriemas were usually single (n = 25) or in pairs (n = 20), though groups of three (n = 4) and four (n = 1) were occasionally seen. Within a group, seriemas were usually close to each other. When one individual in a group or pair was frightened and ran, it was often followed by the other members. Seriemas were reluctant to fly and could be chased in a car at speeds up to 25 km/h before taking off. Their flights were short, usually consisting of a burst of rapid flapping followed by a long glide. Seriemas are strong, agile runners and can easily outdistance a human over uneven ground.

Seriemas nest in low trees. Six nests were found between 1 and 3 m in trees growing in open grassland or cerrado. Three nests found in September and October contained clutches of 2 eggs (pers. obs., Matthews, pers. comm., Ridgely, pers. comm.). One nest was observed by Matthews from a blind over a period of several weeks. Two eggs were hatched in a nest 2.5–3 m off the ground and the chicks were fed by both parents. The adult birds brought snakes or worm lizards to the nest. The adult birds always approached the nest on foot and jumped up into it (Matthews, pers. comm.).

Some time between 10 and 14 d after hatching the parents fed the young in the nest and then jumped down to the ground and vocalized quietly until 1 of the chicks left the nest. The 3 birds stayed near the nest with the parents calling continually for 15 min before walking away.

Within 5 min of the parents' departure, the second chick jumped from the nest and moved off towards its parents (Matthews, pers. comm.).

On only two occasions did we observe behavior other than singing and foraging. The first was a copulation in September. The male approached the female, hopped onto her back and remained in copula for 12 s before dismounting. The other behavior was an aggressive encounter between 2 seriemas that repeatedly jumped at one another, feet first, flapping their wings for balance. This behavior continued for about a minute before the birds, detecting the observer, fled.

Song.—Although seriema singing was heard from before dawn until well after dark, the majority of songs were heard in early–mid morning. The song is composed of three parts, not all of which are always sung together. For example, some birds sang only the introductory part of the song and then resumed foraging. Usually, however, several complete songs were sung in a row, the average length of 11 singing bouts being 70.5 s (range = 32–95). In such cases it was impossible to count the number of individual songs because more than one bird in a group was singing.

When one member of a pair began to sing the other member often began to sing as well. In such cases it appeared as if the second bird often began its song just as the song of the first bird was finishing. Since songs were often repeated many times within a bout, this out-of-phase placement of songs resulted in a continuous song. In one instance 3 members of a group sang at the same time.

A seriema often responded to the song of another bird by singing; this was true both within and between pairs. When a song was heard, the seriema stopped, listened for several seconds, and then either resumed its activity or sang. Before singing, virtually all birds jumped onto a *Cornitermes cumulans* termite mound, a fence, or a low tree (Fig. 1). Singing was performed in a very characteristic way: the introductory parts of the song were sung with the neck held straight while the loudest portions of the song were sung with the neck bent and the back of the head nearly touching the back of the bird (see photographs in Schneider 1957). Seriema songs are very loud and can carry several kilometers. Thus, up to 4 individuals or groups could often be heard singing simultaneously.

The vocalizations recorded and analyzed for adult seriemas are long, intense, and structurally complex sequences of tonal notes, i.e., songs (Pettingill 1970, Thorpe 1964). The 4 songs of the 2 individuals analyzed show a rather uniform structure. The songs were clearly organized into 3 phrases (terminology cf. Jellis 1977), each of which had a distinct composition and progressive change of certain structural parameters (Fig. 2 and Table 1). The general structure of these songs agrees with those described by Schneider (1957).

The first phrase (A) (Fig. 2) was a series of short notes with the intercall intervals becoming shorter as the phrase proceeded. In the second phrase (B), notes of the same structural type as in A were grouped into short sub-phrases (in pairs, triplets, or more elements), the interval between two successive sub-phrases being longer than any interval be-

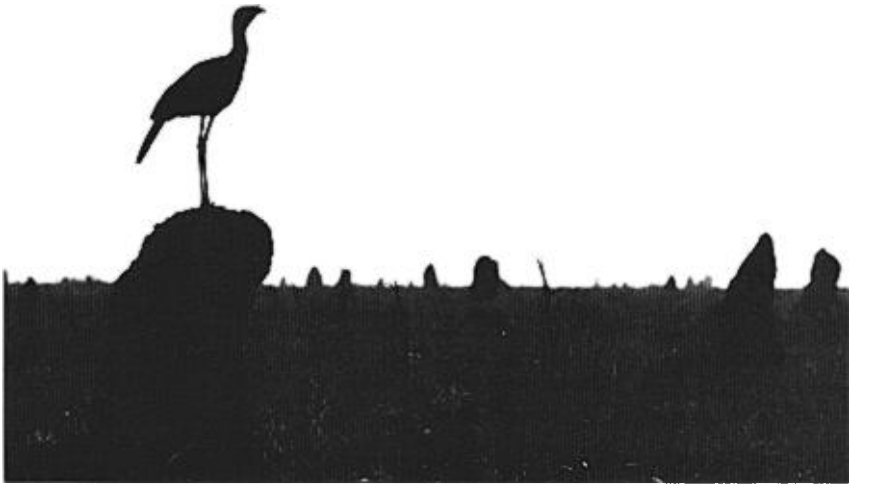

FIGURE 1. *Cariama cristata* in typical singing position on top of a termite mound.

tween notes within them. The third phrase (C) was the most structurally complex in the seriema's song. It consisted of bi-partite sub-phrases with 10 or more notes; the first section of the sub-phrases having fewer elements than the second. Phrase C was further divided into two parts because the entire song rose to a climax in phrase C.

In phrase A call duration was relatively uniform at about 0.15–0.16 s. Intervals between the notes decreased in duration almost continually from a maximum of about 10 s at the beginning of the song to a minimum of about 1 s at the end of the phrase. The pitch of the notes remained nearly constant, the fundamental having its maximum frequency at 1.2–1.3 kHz.

The duration of the notes in phrase B stayed relatively uniform at between 0.15–0.16 s. In sub-phrases with 3 or more notes the duration of the intervals between notes usually became progressively shorter from a maximum of about 1 s to a minimum of about 0.2 s. The pitch of the notes in phrase B stayed about the same as in phrase A, the fundamental reaching its highest frequency at about 1.3–1.4 kHz. Notes in phrases A and B had a frequency range from about 0.4 to above 8 kHz with the main energy in the range between approximately 0.8–2.6 kHz.

Phrase C was structurally more complex than phrases A and B not only because of structural changes in the notes composing it but also because of changes in various other structural parameters. The gradual

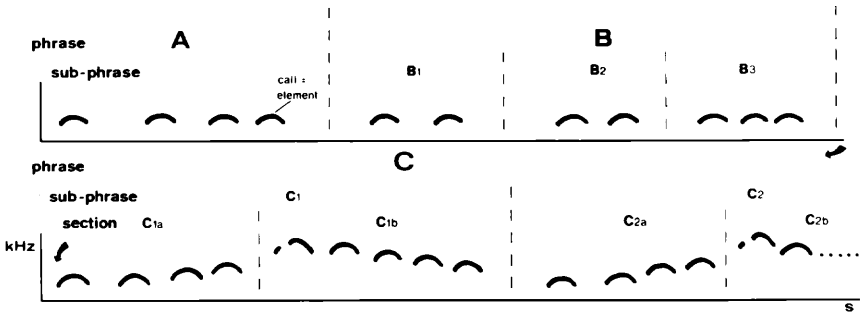

FIGURE 2. General structural scheme of *Cariama cristata* song. The bottom graph is a continuation of the top graph.

structural changes from one note to the next within a sub-phrase represented a continuum of intermediate forms of the basic note structure.

Like phrase B, phrase C consisted of sub-phrases which themselves were divided into two sections (Fig. 2), each with unique structural characteristics, an internal change in certain structural parameters and a progressive structural change from sub-phrase to sub-phrase (see Table 1). The interval between two successive sub-phrases was always longer than any interval between two successive calls within these sub-phrases.

The number of notes in the a and b sections (Table 1) of a sub-phrase in phrase C increased progressively until about the climax of the song and from then on stayed relatively constant. In the beginning of the song, a-sections had 4 or 5 notes and in the climax may have had up to 6, b-sections at the start of the song also had 4 or 5 notes, but may have had up to 10 or more by the climax.

The frequency range of the notes in phrase C was about 0.4 to above 8 kHz with the main components below 4 kHz. In all notes of sections a and b the fundamental had the highest energy. In the a-sections the first and/or second harmonic also had relatively high energy, further harmonics being only faintly represented. In the initial notes of the b-sections the first harmonic was the most pronounced after the fundamental. In the final notes the second harmonic had a higher energy than the first. In the first note of the b-sections in the beginning of phrase C the second harmonic had more energy than the first; in later sub-phrases this relationship was reversed.

DISCUSSION

The scant published information on the Red-legged Seriema can be combined with the data gathered in Emas Park and the fragmentary information available on the Black-legged Seriema, *Chunga burmeisteri,* to generate five hypotheses on various aspects of cariamid biology.

Feeding.—In Emas Park Red-legged Seriemas were commonly seen foraging in areas with cattle dung. As might be expected from this,

TABLE 1. Structural characteristics of song in *Cariama cristata* (refer to Fig. 2).

Structural changes in respective parts of the song	Phrase A Sequence of tonal calls of uniform duration and pitch	Phrase B Sequence of tonal calls of uniform duration and pitch, grouped in sub-phrases	Phrase C Sequence of tonal calls with changes in several structural parameters, grouped in sub-phrases
Within-phrase	Decreasing duration of intervals between calls (increasing intensity of calls)	Decreasing duration of intervals between sub-phrases (and intervals within sub-phrases) increasing number of calls per sub-phrase (increasing intensity of calls)	Decreasing duration of intervals between sections of sub-phrases; pitch-change within sub-phrases first increasing, later decreasing; increasing number of calls per sub-phrase (in the beginning); in the beginning increasing duration of sub-phrases
Within sub-phrase		Decreasing duration of intervals between calls in sub-phrases with ≥3 calls; increasing intensity of calls	See below
Within sections			a-sections: increasing intensity, pitch and duration of calls, decreasing duration of intervals between calls; b-sections: decreasing intensity, pitch and duration of calls

stomachs of the Red-legged Seriema contain grasshoppers, *Atta* ants, beetles, larval insects, a few small fruit, and tree gum (Burmeister 1938, Miranda-Ribeiro 1938). This species also eats snakes and other reptiles, small birds, and small mammals (Sick 1984). In the wild and in captivity *Cariama* grabs small vertebrates in its beak and beats them against the ground before dismembering them with its beak and claws (Miranda-Ribeiro 1938, Santos 1979, Sick 1984).

The Black-legged Seriema has similar food habits. In Tucuman, Argentina they were often observed foraging near cattle and horse dung. The gizzards of 4 individuals contained beetles, locusts, green leaves, and grass with a few hard seeds and the body of an entire rat or young cavy.

Black-legged Seriemas in captivity greedily fed on the bodies of rats and birds. As was the case with the Red-legged Seriema, the prey was beaten on the ground before being consumed (Boyle 1917).

Hypothesis. Seriemas are omnivores consuming prey in relationship to its availability. During the nesting season they catch more vertebrates to feed to the young.

Song transmission.—The *Cariama* song has been described as a cross between "the serrated bark of a young dog and the clucking of turkeys" (Burmeister 1938; translation by KHR). This song is heard during the day as well as before dawn and many birds may sing at the same time (Burmeister 1938). Most singing is done in the morning, and usually the bird sings from an elevated position. *Chunga*'s song has been described by Boyle (1917): "The call notes were a series of cries and yelps which were given in chorus; that is one individual would start his queer, turkey-like yelps, while other birds joined in until four or five would be chanting at the same time." Like the Red-legged Seriema, *C. burmeisteri* has a loud song that starts with a sustained call, followed by a series of calls in quick succession with progressively decreasing pitch. In the end of the song the short calls are merged. *Chunga* songs are usually heard in the morning and the evening and rarely at other times of the day.

Hypothesis. Singing from an elevated position in the morning serves to reduce losses in sound propagation (Morton 1975, Marten and Marler 1977, Wiley and Richards 1978).

Song attenuation.—Most calls of the *Cariama* song have their energy peak in the range between 1 and 2 kHz, which in forest habitats attenuates less than either lower or higher frequencies (Marten and Marler 1977, Marten et al. 1977). In grassland habitat excess attenuation increases with increasing frequency (measurements taken 1 ft [30 cm] above the ground; Morton 1975). In nonpasserine grassland birds in Panama Morton (1975) found an emphasized frequency range around 3.1 kHz which is considerably higher than the main energy frequencies in the seriema's song.

Hypothesis. The main frequency range in a seriema's song is probably relatively little affected by excess attenuation.

Development of young and of singing.—The nest of *Cariama cristata* is large and poorly constructed, similar to the nests of raptors and located within 5 m of the ground. Its clutch is usually 2 or 3 eggs which are incubated for 26–30 d (Burmeister 1938, Miranda-Ribeiro 1938, Santos 1979). In captivity one chick was fed meat, mice, hard-boiled eggs, and cockroaches by its parents and left its nest at 1 mo of age (Seth-Smith 1912). Sick (1984) reports seriema chicks leaving the nest at 12 d, already with the ability to sing portions of the adult song albeit weakly. According to Heinroth (1924) a 12 day-old captive *Cariama* called "in the typical manner of the seriema" (translation by GP); probably referring to the species' song. He also reported that the same individual produced this same vocalization at 1 mo of age in response to the unison calls of cranes.

Eisentraut (1935) reported a low-intensity single note begging call of

a 2-wk-old *C. burmeisteri*. The same individual, a short while later, produced the adult song only slightly modified and at a lower intensity. By the age of 2–3 wks, juveniles of both species of seriema seem able to produce the adult song. The fact that in the wild young leave the nest by 2 wks of age indicates rapid physical development coupled with this rapid acquisition of the complex adult song.

Hypothesis. Young seriemas assist their parents in defending a territory. This includes singing territorial songs.

Territoriality.—Red-legged Seriemas frequently respond to the songs of conspecifics. Birds will stop and listen to a song, responding if the song is from another group, or joining if the song is being sung by a group member. The third or fourth bird in a group is almost definitely the offspring of a pair and at least 3 and probably 4 birds in several groups have been heard singing simultaneously.

Boyle (1917) described one captive *Chunga* as repeatedly running at a tree and hitting it with both feet. This behavior is similar to that described earlier in the agonistic interaction between two *Cariama* and is expected when singing does not serve to separate seriemas.

Hypothesis. Seriemas are territorial and their loud songs serve to separate family groups.

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LITERATURE CITED

ANONYMOUS. 1981. Plano de manejo. Parque Nacional das Emas. Doct. tec. No. 4 MA/IBDF and FBCN. Brasilia.

BLAKE, E. R. 1977. Manual of Neotropical birds. Vol. 1. Univ. Chicago Press, Chicago.

BOYLE, H. S. 1917. Field notes on the seriema (*Chunga burmeisteri*). Auk 34:294–296.

BURMEISTER, H. 1938. Contribuicao para a historia natural da seriama. Rev. Museu Paulista 23:91–152.

EISENTRAUT, M. 1935. Biologische Studien im bolivianischen Chaco. VI. Beitrag zur Biologie der Vogelfauna. Mitt. zool. Mus. Berlin 20:367–443.

EITEN, G. 1972. The cerrado vegetation of Brazil. Bot. Rev. 38:201–341.

FRIELING, H. 1936. *Cariama cristata* L. als Anpassungsform an das Savannenleben. Z. Morph. Okol. Tiere 30:673–730.

HEINROTH, O. 1924. Die Jugendentwicklung von *Cariama cristata*. J. Ornithol. 72:119–124.

JELLIS, R. 1977. Bird sounds and their meaning. British Broadcasting Corporation, London.

MARTEN, K., AND P. MARLER. 1977. Sound transmission and its significance for animal vocalization. I. Temperate habitats. Behav. Ecol. Sociobiol. 2:271–290.

———, D. QUINE, AND P. MARLER. 1977. Sound transmission and its significance for animal vocalization. II. Tropical forest habitats. Behav. Ecol. Sociobiol. 2:291–302.

MIRANDA-RIBEIRO, A. DE. 1938. A seriema. Rev. Museu Paulista 23:39–90.

MORTON, E. S. 1975. Ecological sources of selection on avian sounds. Am. Nat. 109: 17–34.

PETTINGILL, O. S. 1970. Ornithology. Burgess, Minneapolis.

REDFORD, K. H., 1984. The termitaria of *Cornitermes cumulans* (Isoptera, Termitidae) and their role in determining a potential keystone species. Biotropica 16:112–119.

———. 1985. Emas National Park and the plight of the Brazilian cerrados. Oryx 19: 210–214.

SANTOS, E. 1979. Da Ema ao Beija-flor. Itatiaia, Belo Horizonte.

SCHNEIDER, K. M. 1957. Uber gegliederte rufweisen bei Tieren. Beitr. Vogelk. 5:168–183.

SETH-SMITH, D. 1912. Proc. Zool. Soc. London 1912:557–558.

SICK, H. 1984. Ornitologia Brasileira. Editora Universidade de Brasilia, Brasilia D.F.

THORPE, W. H. 1964. Singing. Pp. 739–750, *in* A. L. Thompson, ed. A new dictionary of birds. Nelson and Sons, London.

WILEY, R. H., AND D. G. RICHARDS. 1978. Physical constraints on acoustic communication in the atmosphere: implications for the evolution of animal vocalizations. Behav. Ecol. Sociobiol. 3:69–94.

Center for Latin American Studies, Grinter Hall, University of Florida, Gainesville, Florida 32611 USA (KHR), *and Zoologisches Forschungsinstitut und Museum Alexander Koenig, D-5300 Bonn 1, Adenauerallee 150-164, West Germany* (GP). Received 27 Dec. 1985; accepted 27 May 1986.

NOTES AND NEWS

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JENNIFER CLARKE, WASHINGTON STATE UNIVERSITY, White-tailed Ptarmigan in the Sierra Nevada Mountains: a comparative study of an introduced population, $200.

CHERI L. GRATTO, UNIVERSITY OF NORTH DAKOTA, Endocrinological analysis of sandpiper social systems, $200.

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