Ecological notes on Seriema species in the Paraguayan Chaco, with observations on *Chunga* biology

Daniel M. Brooks

Houston Museum of Natural Science, Department of Vertebrate Zoology, 5555 Hermann Park Drive, Houston, Texas 77030-1799, USA – dbrooks@hmns.org

ABSTRACT: I studied the ecology of Black-legged (*Chunga burmeisteri*) and Red-legged (*Cariama cristata*) Seriemas in the central Paraguayan Chaco from September 1989 to August 1990, including observations of a baited family group of *Chunga*. Both species are allotopic in habitat use, with *Chunga* typically associated with drier forested areas and *Cariama* inhabiting savanna and wetland periphery. Interspecific territories were overlapping. Wind velocity and temperature correlated significantly with activity of *Cariama* and baited *Chunga*, respectively. The average density of *Chunga* was 0.38/km². Reptiles are an important prey item and I describe an interesting feeding behavior. The breeding season in *Chunga* takes place during the Paraguayan summer (November – March). Bonding and courtship occurred around November and December, and the following 13 weeks were used for nest building, incubation, hatching, and chick development.

KEY-WORDS: Black-legged Seriema; breeding cycle; Chaco; habitat allotopy; Paraguay; Red-legged Seriema; tool use

Black-legged (*Chunga burmeisteri*) and Red-legged (*Cariama cristata*) Seriemas represent the family Cariamidae (Remsen *et al.* 2014), which is somewhat poorly known. Alvarenga (1982) indicated they are the closest living relatives of giant predatory Cenozoic birds (i.e., *Brontornis* and *Mesembriornis*) similar to *Diatryma*. Despite their large size, loud vocalizations, and overall conspicuousness, relatively little has been published on this family, which is surprising considering how common they are in many areas of South America (Redford and Peters 1986). This is especially true for *Chunga*, for which comparatively little is known relative to *Cariama* (c.f., Gonzaga 1996). Most of the information published on this family in the last two decades has related to captive birds (e.g., de Almeida 1994; Collins 1998; Hallager 2004; Padget 2010).

The objective of this note is to describe basic ecology of *Chunga* and *Cariama*, and determine whether habitat partitioning occurs between these taxa. Such mechanisms of allocation reduce the possibility of competition among species filling similar niches (Brooks *et al.* 2001). Additionally anecdotal biological observations are reported from studying a baited family group of *Chunga*.

METHODS

Study region

The main study site was Estancia Fortín Toledo (hereafter Toledo; 22°33'S; 60°30'W), located in the center of the Paraguayan Chaco (Department Boquerón) 35 km west of the Mennonite town of Filadelfia. This area has been extensively cleared for cattle production, like much of the central Paraguayan Chaco (Benirschke *et al.* 1989). The region is primarily grassland pasture punctuated with man-made ponds (*tajamares*) and some small forest tracts. The primary forest type is Quebracho Woodland (Short 1975) with thorny leguminous bushes (e.g., *Prosopis ruscifolia*) and *Opuntia* cactus (Lopez *et al.* 1987) as the dominant plants, with scattered trees (e.g., *Aspidosperma quebracho, Bulnesia sarmientii*, and *Schinopsis* sp.) up to 13 m in height. Isolated tracts of dense thorn forest are sometimes left remaining when land is cleared for agrarian purposes. Spiny terrestrial plants such as bayonet bromeliads (*Bromelia serra*) and star cactus (*Cleistocactus baumannii*) comprise dominant understory plants (Stabler 1985). Mean annual temperature is 26 C° and annual rainfall is 865 mm (Brooks 1998).

I also made observations on transects in the northern Chaco, a north-south habitat transition from the middle to upper Chaco was noted, with the latter characterized by increased forest stratification and higher canopy, less dense and thorny foliage, and an overall greater abundance of broadleaf species. I identified general habitat occupancy by overlapping a macrohabitat map (Olson *et al.* 2001) with seriema range maps from NatureServe (2014).

Field methods

Field data were collected between September 1989–August 1990, during direct encounters while driving unpaved road transects. Weekly surveys extended 35 km from eastern Toledo to Filadelfia (70 km round-trip), and monthly surveys extended 9.3 km through western Toledo. Other areas were randomly surveyed during various times of the year. Additionally, approximately 2 km were walked daily to collect data on habitat association.

Chunga density was determined using strip transects following Balph *et al.* (1977). The road from Toledo to Filadelfla and back (70 km round-trip) was driven weekly during daylight hours. All seriemas seen 10 m from the center of the road were counted, and the resulting surveyed area comprised a 1.4 km^2 plot.

Daily observations of a familial group of *Chunga* lured to a baited site were made from a blind located 8 m from the bait. Study hours in the blind ranged from 0530–2000 h and averaged 225 min/day. Identification of individuals was possible using a combination of differences in size, feather arrangement, and plumage tint.

Temperature (C°) was recorded using a standard thermometer; rainfall (mm) was recorded using a standard rain gauge; cloud cover (clear = 1, partly cloudy = 3, cloudy = 5, overcast = 7, or rainy = 9); and relative wind velocity (stagnant = 1, occasional light breeze = 3, consistent light wind = 5, or windy = 7) were recorded several times during daylight hours. Monthly means were obtained for temperature, cloud cover, and relative wind velocity; a monthly total was obtained for mm of rainfall. The effects of these individual abiotic parameters on seriema activity (encounters) were measured using Pearson product-moment correlations.

RESULTS

Habitat allotopy

Both species of seriema were observed $\leq$ 0.5 km from forest tracts at Toledo. Although *Chunga* were frequently observed within these isolated tracts, *Cariama* were not. Moreover *Chunga* were always observed in more xeric areas, whereas *Cariama* were often associated with open, seasonally inundated conditions such as mesic savanna or wetland periphery.

During a survey in the northern part of the Chaco, which contains more forest and is less developed than the central Chaco, *Chunga* were seen on two separate occasions (group sizes = 1 and 2), with tracks at a third locale, and vocalizations just north of the Bolivian border. *Cariama* were not encountered during this survey of forested habitat, reinforcing that these two species are allotopic with regards to habitat selection.

The geographic range of *Chunga* is not entirely sympatric with *Cariama* (Fig. 1), having a more westward distribution in Argentina. Overlapping the geographic ranges of both species (NatureServe 2014) with associated habitats of biomes (Olson *et al.* 2001) corroborates that *Chunga* are restricted to drier forested areas, whereas *Cariama* are adapted to more open often mesic environments.

Additional ecological factors

In transitional patches between xeric forest and open habitats, seriemas were spatially sympatric. For example, an individual *Chunga* was observed ca. 30 m from a family of *Cariama* (an adult pair and two juveniles), suggesting that exclusive territories overlap interspecifically and direct competition may not occur between the two species.

Four abiotic factors (temperature, wind, rainfall, and cloud cover) were each correlated with activity of *Cariama* and baited and non-baited *Chunga* to assess if these environmental parameters influenced seriema activity. The only significant correlation with *Cariama* activity was wind ($r = 0.324$, $P < 0.05$, $n = 48$), and no significant correlations were found with non-baited *Chunga*. The only significant correlation with baited *Chunga* was temperature ($r = 0.372$, $P < 0.05$, $n = 48$), reflecting increased activity during warmer periods. Both species would stand in tree shade on excessively hot days. *Chunga* were relatively inactive at temperatures less than 27° C, and none were encountered during surveys with temperatures < 27° C. Although rainfall was not significant, baited *Chunga* left the feeding site during heavy, but not light, rain showers.

Chunga biology

Chunga density ranged 0 - 2.14/km^2 monthly with an annual mean of 0.38/km^2. Mean densities for the Austral spring = 0.35/km^2, summer = 0.29/km^2, fall = 0.80/km^2, and winter = 0.11/km^2.

Each *Chunga* spent an average of 3 min ($N = 108$ separate visits) at the baited site, with a mode of < 1 min ($n = 37$, 34% of all observations) in the general viewable area. Non-bait food items consumed included a grass (appeared to be buffel grass *Cenchrus ciliaris*), leguminous shoots from algarrobo trees (*Prosopis alba*), large grasshoppers (Acrididae), green *Ameiva* lizards (*Ameiva ameiva*), small snakes (*Liophis* sp.), and small unidentified passerines. The presence of the baited group at the site diminished during periods of high rainfall likely reflects reduced dependence upon the bait site due to increased activity of reptiles, which appeared to make up the bulk of their natural diet.

An interesting feeding behavior was observed that could be interpreted as a form of tool use. *Chunga* used

'anvils' (i.e., cracking bases) to crack open hard boiled eggs and galletas (hardened pastry). By seizing a food item in the bill and raising it high above the head (head and neck perpendicular to ground), the bird swung down and released the food, smashing it over the anvil. This behavior was observed > 225 times and involved different types of anvils (i.e., salt lick rock, brick, lumber, or hard squash). The smaller pieces were consumed once a food item was broken. If an item was only cracked in two, the smaller piece would be smashed again or the larger piece would be held steady with the foot while the inner portions were consumed. Usually the food item was cracked within the first few throws. Accuracy of hitting the anvil diminished with number of throws. On one occasion a food item was thrown 12 times on four different anvils (hard squash, brick, lumber, and salt rock) before the item was consumed. After a few unsuccessful throws a food item was usually exchanged for another.

The breeding season in *Chunga* is during the Austral summer (December–February) when temperature and wind are fairly constant and high rainfall results in abundant food availability. Sightings of non-baited *Chunga* decreased slightly during this period (see above) due to established territories and nesting behavior commencing. Although typically a single chick is raised, two juveniles were observed with their parents on one occasion. Specific breeding dates and events were observed from the baited pair, as follows:

13 November: Pair arrives together at the feeding site for the first time

1 December: Pair observed unison calling

3 December: Courtship observed

7 December–7 March: Pair absent

8 March: One of the adults returns to the feeding site with a juvenile.

Thus nest building, incubation, hatching, and growth is approximately 13 weeks.

DISCUSSION

The results suggest *Chunga* is associated with more xeric areas, whereas *Cariama* is found in more open, often mesic habitats. This was observed at the main study site, as well as in other parts of the Chaco, and was also confirmed by overlaying range to habitat maps. While these results essentially corroborate the findings of others (cf. Gonzaga 1996), the findings of lack of interspecific territoriality, and the influence of various abiotic components are apparently novel to this study. Specifically, a single *Chunga* was observed near an adult pair of *Cariama* with offspring with no territorial consequence. Additionally wind velocity was significantly correlated with *Cariama* activity, and temperature was correlated with baited *Chunga* activity.

Many of the results for *Chunga* biology are novel, including density (seasonal mean, annual mean, and range) and feeding habits (e.g., reptiles in the diet), and certain aspects of reproduction (cf. Gonzaga 1996). The behavior involving utilizing an anvil to break food items is similar to that described in other species of birds, such as Egyptian Vultures (*Neophron percnopterus*; Van Lawick-Goodall and Van Lawick 1966). This could be considered a form of tool use because the anvil is an inanimate object serving as a functional extension of the animal (McFarland 1987), and the behavior was observed on numerous occasions ($n \geq 225$) upon different anvils.

More detailed autecological studies of habitat association, food habits, behavioral and reproductive ecology would be fertile areas for future research. In particular, the ability to quantify habitat with movements using telemetry equipment would be fruitful, as well as the ability to quantify preferred prey.

REFERENCES

Alvarenga, H. M. F. 1982. Uma gigantesca ave fossil do Cenozoico brasileiro. *Anais Academia Brasileira de Ciências*, 54: 697-712.

Balph, M.H.; Stoddart, L.C. & Balph, D.F. 1977. A simple technique for analyzing bird transect counts, *Auk* 94: 606-607.

Benirschke, K.; Byrd M.L. & Low, R.J. 1989. The Chaco region of Paraguay: peccaries and mennonites, *Interdisciplinary Science Reviews*, 14: 144-147.

Brooks, D.M. 1998. *Competition and coexistence in Neotropical birds: a latitudinal comparison*. Ph.D. dissertation. College Station: Texas A&M University.

Brooks, D.M.; Pando-V., L.; Ocmin-P, A. & Tejada-R, J. 2001. Resource separation in a Napo-Amazonian gamebird community, p. 213-225. In: Brooks, D.M. & Gonzalez-F., F. (eds.). Biology and conservation of cracids in the new millennium. Houston: Misc. Publ. Houston Mus. Nat. Sci. No. 2.

Collins, S. 1998. Breeding the Red-legged Seriema. *AFA Watchbird*, 25: 50-51.

de Almeida, A.C. 1994. Notas sobre a biologia reprodutiva da seriama *Cariama cristata* (Linnaeus, 1766) (Gruiformes - Cariamidae). *Revista Nordestina de Biologia*, 9: 49-59.

Gonzaga, L.P. 1996. Family Cariamidae (Seriemas), p. 234-239. In: del Hoyo, J.; Elliott, A.; and Sargatal, J. (eds.). Handbook of the birds of the world, v. 3. Barcelona: Lynx Edicions.

Hallager, S. 2004. North American Regional Studbook for the Red-legged seriema. Smithsonian National Zoological Park.

Lopez, J.; Little, Jr., E. L.; Rombold, J. S. & Hahn, W. J. 1987. Arboles comunes del Paraguay. Washington, D.C.: Peace Corps.

McFarland, D. (ed.). 1987. The Oxford Companion to Animal Behavior. Oxford: Oxford University Press.

NatureServe. 2014. Animals and ecosystems of Latin America database. http://www.natureserve.org/infonatura (access 9 January 2014).

Olson, D. M., Dinerstein, E.; Wikramanayake, E. D.; Burgess, N. D.; Powell, G. V. N.; Underwood E. C.; D'Amico J. A.; Itoua, I.; Strand, H. E.; Morrison, J. C.; Loucks, C. J.; Allnutt, T. F.; Ricketts, T. H.; Kura, Y.; Lamoreux, J. F.; Wettengel, W. W.; Hedao, P. & Kassem, K. R. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. *Bioscience*, 51: 933-938.

Padget, A. E. 2010. *Structure and possible function of vocalizations of captive red-legged seriemas (*Cariama cristata*)*. M.Sc. thesis, Knoxville: University of Tennessee.

Redford, K. H. & Peters, G. 1986. Notes on the biology and song of the red-legged seriema (*Cariama cristata*). *Journal of Field Ornithology*, 57: 261-269.

Remsen, J. V., Jr.; Cadena, C. D.; Jaramillo, A.; Nores, M.; Pacheco, J. F.; Pérez-Emán, J.; Robbins, M. B.; Stiles, F. G.; Stotz, D. F. & Zimmer, K. J. 2014. A classification of the bird species of South America. American Ornithologists' Union. http://www.museum.lsu.edu/~Remsen/SACCBaseline.html (access 9 January 2014).

Short, L. 1975. A zoogeographic analysis of the South American Chaco avifauna. *Bulletin of the American Museum of Natural History*, 154: 163-349.

Stabler, D. B. 1985. *Pflanzen in Paraguay*. Asuncion: Zamphiropolos S. A.

Van Lawick-Goodall, J. & Van Lawick, J. 1966. Use of tools by Egyptian Vultures *Neophron percnopterus*, *Nature* 212: 1468-1469.

Associate Editor: Luciano N. Naka

Cariama cristata