

CORALLUS HORTULANUS (Amazon tree boa): BAT PREDATION IN JAÚ NATIONAL PARK, BRAZIL. The Amazon tree boa, *Corallus hortulanus*, is a widespread neotropical boid, occurring throughout the Amazon region (Henderson, 1997). It is the most widely distributed member of the genus, and has one of the broadest known diets (see Henderson, 2002). Jaú National Park is situated some 220 km west of Manaus, Amazonas, on the south bank of the Rio Negro. The 2,272,000 ha of the Park are a mosaic of primary lowland rainforest (70%), swamps (17%), blackwater seasonally flooded forest (*igapó*, 12%), and white sand *campina* scrub and *campinarana* forest (Barnett *et al.*, 2006). *Corallus hortulanus* has previously been recorded from Jaú by Martins & Oliveira (1999) and by Neckel-Oliviera & Gordo (2004).

At 19:30 h on 28th April 2005 at the FVA-IBAMA floating research station (01°53.568"S, 61°41.842"W) above the Cachoeira do Jaú, we observed a juvenile *C. hortulanus* coiled in a corner of one of the station's rooms. The animal had just entered through a gap in the floorboards from the bat roost in the space between the station planking and the water below. The roost contained three or four species of bats of the genus *Artibeus*: *A. concolor*, *A. literatus*, plus *A. andersoni* and/or *A. cinereus*. The *C. hortulanus* individual measured 495 mm SVL, 698 mm TL. Some 270 mm along the body, the outline of a head, wing and body of a bat were clearly visible (see Figure 1). The head and body (H&B) was measured at 52 mm long and the forearm length (FA) was 41 mm. These measurements are characteristic of both *Artibeus andersoni* and *A. cinereus*. Both species have been reported from Jaú by Barnett *et al.* (2006). Though both are certainly valid species (Baker *et al.*, 2000; Wetterer *et al.*, 2000), *A. andersoni* and *A. cinereus* can only be separated by skull characters (Handley, 1987), and specimen collection was not permitted by our fieldwork license. However, we are confident it was one of these two partly because it was one of three/four species known to occur in the roost below the station and also because: 1) adults of all the other bat species recorded at the roost are bigger than the prey bat (*A. concolor*, H&B 61–64 mm, FA 47–48mm; *A. literatus* H&B 89–91 mm, FA 68–69 mm: see Emmons & Feer, 1997; Eisenberg & Redford, 1999); 2) breeding seasons in the region are strongly marked and occur between July–November and January–February for any of the *Artibeus* species larger than *A. andersoni/cinereus* (such as *A.*

concolor, *A. literatus*, *A. obscurus*, *A. platyrrhinus*: see Bernard, 2002), making it unlikely that the ingested bat was a juvenile of region's larger *Artibeus* species which might also use such a roost; 3) roost preference excludes other bat species with a similar combination of body and fore-arm lengths as the ingested animal (such as *Anoura caudifer*, *Carollia* spp., and *Uroderma* spp.), which are highly unlikely to use a multi-species roost the underside of the floating pontoon on which the research station rests (see Eisenberg & Redford, 1999; Nowak, 1999).

In the Neotropics, predation on bats by native snakes has been recorded for a variety of species. Although Hopkins & Hopkins (1982) recorded an Amazon tree boa (*Corallus hortulanus*) catching a bat (probably *Phyllostomus bicolor*: see Martins & Oliveira, 1999) that was hovering in front of a *Parkia* inflorescence the bat had come to pollinate, and Northern pine snakes (*Pituophis melanoleucus*) have been observed plucking Mexican funnel-eared bats (*Natalus stramineus*) from the air as they exited a roost (Gillette & Kimborough, 1970), the majority of such predation events are recorded at the bat's roosting sites. Such records include bat predation by

Figure 1. Juvenile *Corallus hortulanus* with recently ingested *Artibeus* bat. The head and forearm are clearly discernible.



Boa constrictor and Puffing snake (*Pseustes poecilonotus*: Gillette & Kimborough, 1970); *Boa constrictor* feeding on *Atribes jamaicensis* (Thomas, 1974) and on *Desmodus rotundus* (Villa & Lopez, 1966); the Cuban boa (*Epicrates anguilifer*) eating *Phyllonycteris poeyi* (Miller, 1904; Hardy, 1957), the Rainbow boa (*Epicrates cenchrus cenchrus*) eating *Carollia perspicillata* (Lemke, 1978), Puerto Rican boa (*Epicrates inornatus*) eating *Monophyllus redmani* and *Brachyphylla cavernarum* (Rodríguez, 1984), and Central American ratsnake (*Elaphe flavirufa*) eating *Rhogeessa tumida* and *Myotis* sp. (Rainwater & Platt, 1999).

Corallus hortulanus is known to be active at night on vegetation along river margins, including those of blackwater rivers (Martins & Oliveira, 1999). It has a wide prey base including fish, frogs (*Elachistocleis*, Microhylidae; unidentified Hylidae), lizards (*Anolis*), and birds (kingfishers, nightjars, parrots, songbirds). However, mammals made up nearly 60% of the diet items recorded by Henderson (2002). A sit-and-wait predator, it will often hang suspended from low vegetation facing the ground or higher up facing into bat flyways (Martins & Oliviera, 1999; Henderson, 2002). Such flyways often run clear to the ground where they are used by terrestrial mammals, including rodents and marsupials. Accordingly a number of rodent taxa (rats, porcupines and spiny rats) have been recorded in its diet (note: Martins & Oliveira, 1999 also reported mice, squirrels and small marsupials in the diet of *C. hortulanus* but, Robert Henderson [pers. comm.] points out that these records come from individuals which at the time were under the taxonomic umbrella of *C. hortulanus*; in fact they belong to *C. ruschenbergerii* [see Henderson, 1997, 2002]). A number of bats have also been recorded, including *Phyllostomus bicolor*, *Myotis* sp., and an unidentified bat of 55 mm head & body length (see Martins & Oliviera, 1999; Henderson, 2002), and an *Artibeus* (see below).

The record from Jaú is the second known occurrence of a member of the chiropteran genus *Artibeus* in the diet of *C. hortulanus*, Henderson (2002) having reported an instance of *C. hortulanus* capturing an *Artibeus jamaicensis* in Perú. Adults of *A. jamaicensis* are significantly larger than either *A. andersoni* or *A. cinereus*, with females averaging 81.8mm in total length and weighing 43.2 g (Eisenberg & Redford, 1999: for comparison, respective measurements for *A. andersoni* and *A.*

cinereus are 55 mm and 13 g). Henderson (2002) reports *C. hortulanus* capturing bats at a variety of locals, including the inflorescence of a flowering tree, and in the roof of a house. Other Neotropical boids are known to actively forage for bats and to make repeat visits to roosts (see summary in Henderson, 2002). Given the sit-and-wait nature of foraging in *C. hortulanus* (see above), it is most likely that the observed individual was treating the restricted space between the floor of the research station and the water in the flooded forest as a profitably constricted flight path from which bats could be plucked, rather than feeding on the roosting individuals themselves. Thus, while unusual because it is man-made, the nature of the feeding locale is still consistent with the known foraging ecology of the species (see Henderson, 2002).

The presence of a bat in the diet of an individual of this size is concordant with the ontogenetic shifts in diet observed for this species (see Henderson, 1993, 1997): younger individuals ate small lizards, frogs, birds and bats, while older larger individuals above 750 mm SVL birds become less important and mammals more so, with non-volant mammals predominating after 927 mm SVL (Henderson, 2002). A similar size-related transition in diet-composition has been reported for Australasian boids by Shine & Slip (1990).

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REFERENCES

- Baker, R. J., Porter, C. A., Patton, J. C. & Vandenbusche, R. A. (2000). Systematics of bats of the family Phyllostomidae based on RAG2 DNA sequences. *Mus. Texas Tech Univ., Special Publ.* **202**, 1–16.
- Barnett, A. A., Sampaio, E., Kelko, E., Shapley, R. L., Fischer, E., Camargo, G. & Rodriguez-H., B. (2006). Bats of Jaú National Park, central Amazonia, Brazil. *Acta Chiropterol.* **8**, 103–128.
- Bernard, E. (2002). Diet, activity and reproduction of bat species (Mammalia, Chiroptera) in Central Amazonia, Brazil. *Rev. Brasil. Zool.* **19**, 173–188.
- Eisenberg, J. F. & Redford, K. H. (1999). *Mammals of the Neotropics, Vol. III: The Central Neotropics: Ecuador, Peru, Bolivia, Brazil*. Chicago University Press, Chicago, x + 609 pp.
- Emmons, L. H. & Feer, F. (1997). *Neotropical rainforest mammals: a field guide. 2nd edition*. Chicago: University of Chicago Press. vii + 396 pp.
- Gillette, D. D. & Kimbrough, J. D. (1970). Chiropteran mortality. In: *About Bats*, pp. 262–283. Slaughter, B. H. & Walton, B. W. (Eds.). Dallas, TX: Southern Methodist University Press.
- Handley, C. O., Jr. (1987). New species of mammals from northern South America: fruit-eating bats, genus *Artibeus* Leach. In *Studies in Neotropical Mammalogy: Essays in Honor of Philip Hershkovitz Fieldiana (Zoology)* **39**, 163–172. Patterson B. D. & R. M. Timm (Eds.).
- Henderson, R. W. (1993). On the diets of some arboreal boids. *Herpetol. Nat. Hist.* **1**, 91–96.
- Henderson, R. W. (1997). A taxonomic review of the *Corallus hortulanus* complex of Neotropical tree boas. *Caribb. J. Sci.* **33**, 198–221.
- Henderson, R. W. (2002). Neotropical Treeboas: Natural History of the *Corallus hortulanus* Complex. Malabar, FL: Krieger Publ. Co.
- Hardy, J. D. (1957). Bat predation by the Cuban boa, *Epicrates anguifer* Bibron. *Copeia* **1957**, 151–152.
- Hopkins, H. C. & Hopkins, M. J. G. (1982). Predation by a snake of a flower-visiting bat at *Parkia nitida* (Leguminosae: Mimosoideae). *Brittonia* **34**, 225–227.
- Lemke, T. O. (1978). Predation upon bats by *Epicrates cenchrus cenchrus* in Colombia. *Herpetol. Rev.* **9**, 47.
- Martins, M. & Oliveira, R. E. (1999). Natural History of forest snakes of the Manaus region, central Amazonia. *Herpetol. Nat. Hist.* **6**, 78–150.
- Miller, G. S., Jr. (1904). Notes on bats collected by William Palmer in Cuba. *Proc. US Nat. Mus.* **27**, 377–348.
- Neckel-Oliveira, S. & Gordo, M. (2004). Anfíbios, lagartos e serpentes do Parque nacional do Jaú. In: *Janelas para a biodiversidade no Parque Nacional do Jaú: uma estratégia para o estado da biodiversidade na Amazônia*, pp. 161–176. Borges, S. H., Iwanaga, S., Durigan, C.C. and Pinheiro, M.R. (Eds.). Manaus: WWF-FVA-IBAMA.
- Nowak, R. M. (1999). *Walker's Mammals of the World. 6th edition*. Chicago: Chicago University Press. Vol. 1, li + 836 pp.
- Rainwater, T. R. & Platt, S. G. (1999). *Elaphe flavirufa* (tropical rat snake). Predation and diet. *Herpetol. Rev.* **30**, 46.
- Rodriguez, G. A. (1984). Bat predation by the Puerto Rican boa, *Epicrates inornatus*. *Copeia* **1984**, 219–220.
- Shine, R. & Slip, D. (1990). Biological aspects of adaptive radiation of Australasian pythons. *Herpetologia* **46**, 283–290.
- Thomas, M. E. (1974). Bats as a food source for *Boa constrictor*. *J. Herpetol.* **8**, 188.
- Villa, B. & Lopez, W.F. (1966). Cinco casos de predación de pequeños vertebrados en murciélagos de México. *Anns Inst. Biol. Univ. Nac. México* **37**, 187–193.
- Wetterer, A. L., Rockman, M. V. & Simmons, N. B. (2000). Phylogeny of phyllostomid bats (Mammalia: Chiroptera): data from diverse morphological systems, sex chromosomes, and restriction sites. *Bull. Amer. Mus. Nat. Hist.* **248**, 1–200.

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