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Notes on the Natural History of *Helicops leopardinus* (SCHLEGEL, 1837) (Serpentes: Hydropsini) in a large urban center

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Resumo

Os centros urbanos representam ecossistemas socioecológicos emergentes que impulsionam novas interações, mudanças comportamentais e, consequentemente, trajetórias evolutivas. Projeções populacionais indicam que mais de 60% da população mundial viverá em áreas urbanas até 2030, o que acarretará a diminuição de habitats e de espaço para a vida selvagem. Neste estudo, foram investigadas a ecologia alimentar e parasitária de uma população urbana da cobra-d'água *Helicops leopardinus*. Para isso, foram analisados 50 indivíduos provenientes de coleções científicas. Registramos o primeiro caso de *H. leopardinus* consumindo tilápia-do-nilo (*Oreochromis niloticus*), representando 50% do volume total de alimento registrado. Além disso, documentamos a presença do cestódeo *Ophiotaenia* sp., infectando 16% dos indivíduos amostrados. Esses achados destacam a flexibilidade ecológica da espécie e contribuem para a compreensão das respostas da fauna silvestre aos ambientes urbanos.

Palavras-chave: Biologia alimentar; Parasitismo; Espécies exóticas invasoras; Herpetofauna urbana

Abstract

Urban centers represent emerging socio-ecological ecosystems that drive new interactions, behavioral changes, and, consequently, evolutionary trajectories. Population projections indicate that over 60% of the world's population will live in urban areas by 2030, diminishing habitats and wildlife space. Herein, the feeding and parasitic ecology of an urban population of the watersnake *Helicops leopardinus* were investigated. For this study, 50 individuals from scientific collections were analyzed. We recorded the first case of *H. leopardinus* consuming Nile tilapia (*Oreochromis niloticus*), which accounted for 50% of the total food volume recorded. Additionally, we documented the presence of the cestode *Ophiotaenia* sp., infecting 16% of sampled individuals. These findings highlight the species' ecological flexibility and contribute to understanding wildlife responses to urban environments.

Key-words: Feeding biology; Parasitism; Alien invasive species; Urban herpetofauna

Urban centers represent emerging socio-ecological systems that reshape species interactions, behavior, and evolutionary trajectories (Lowry et al., 2013; Johnson et al., 2017). Urbanization alters ecological dynamics by reducing prey diversity, interrupting gene flow, and changing community composition, which directly affects dietary patterns of secondary and tertiary consumers (Chejanovski & Kolbe, 2019; Schmidt et al., 2020).

Helicops leopardinus, commonly known as the South American water snake, is widely distributed throughout South America, occupying a broad range of aquatic and semi-aquatic habitats. It is a nocturnal and predominantly aquatic species, viviparous with seasonal reproduction, and exhibits a generalist diet composed primarily of fishes, tadpoles, and adult amphibians (Ávila et al., 2006). Although both diet and parasitism have been documented for *H. leopardinus* under natural conditions, no studies have evaluated populations inhabiting urban landscapes, leaving the potential ecological effects of anthropogenic disturbance unknown.

We analyzed the diet and helminth fauna of *H. leopardinus* (Schlegel, 1837) from a highly urbanized area in northeastern Brazil. For this purpose, we examined fifty specimens deposited in the Coleção Herpetológica da Universidade Federal do Ceará (CHUFC), collected between 1985 and 2001 at the Santo Anastácio reservoir (3°44'30.0"S, 38°34'30.0"W), located on the Campus do Pici, Fortaleza, Ceará, Brazil (Figure 1). All examined specimens are listed in the Appendix.

All prey items were measured for length and width using a digital caliper (±0.01 mm), and their volumes were estimated following the ellipsoid formula proposed by Vitt (1991), where $V = (\pi/6) \times L \times W^2$. Thus, "volume" represents the estimated three-dimensional size (mm^3) of each prey item, providing a standardized measure of prey bulk for comparative dietary analyses.

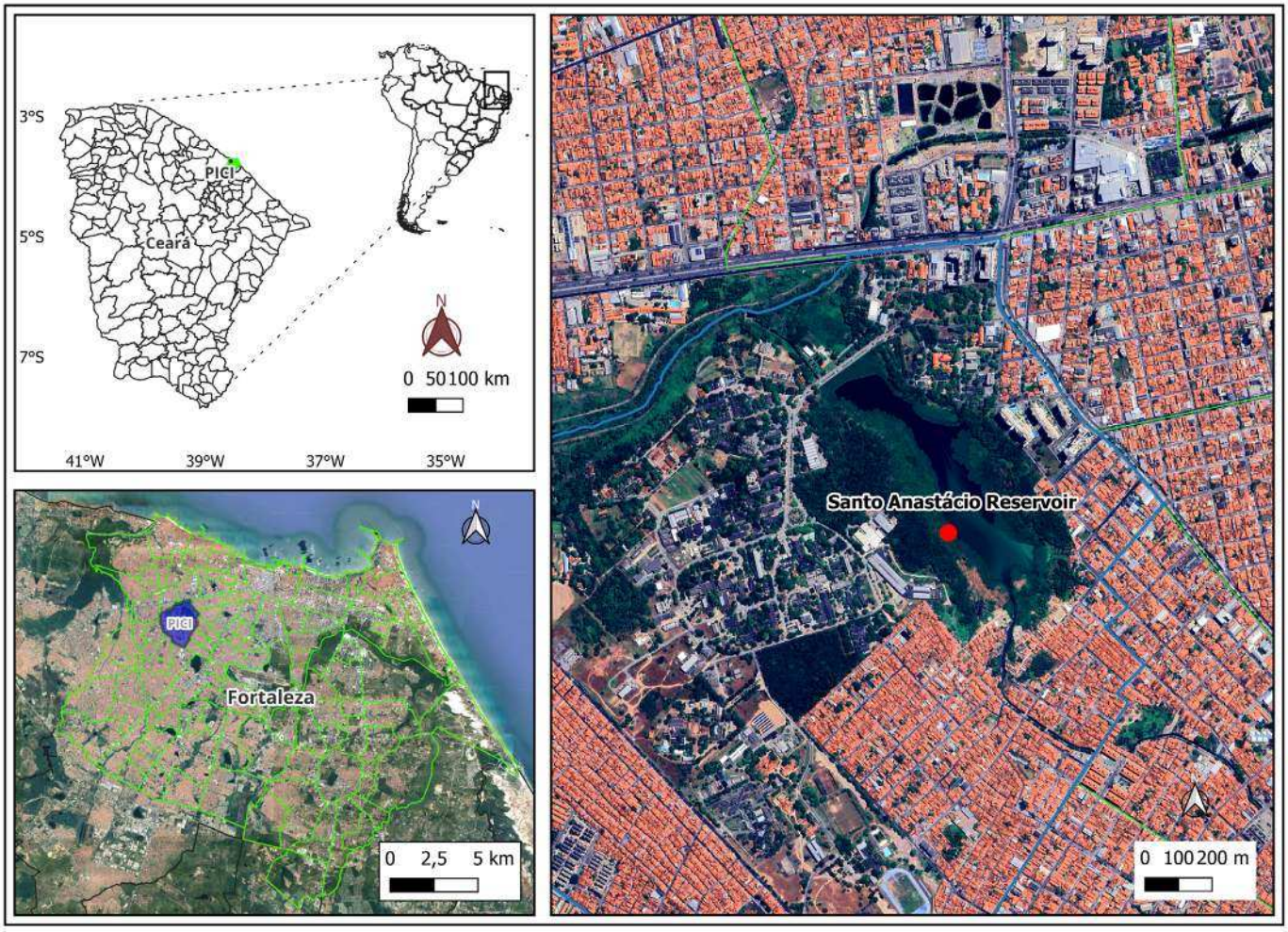


Figure 1. Location of the Santo Anastácio Reservoir, Fortaleza, Ceará, Brazil.

Ten snake individuals (20%) contained prey items, comprising three fish species: *Oreochromis niloticus* (Linnaeus, 1758), *Hoplosternum littorale* (Hancock, 1828), and *Synbranchus marmoratus* Bloch, 1795, in addition to unidentifiable fish remains. Unidentified fish accounted for 50% (n=5) of the prey occurrences and 23.9% of the total ingested volume. The alien invasive species *O. niloticus* (Nile tilapia) represented 30% (n=3) of the prey items and contributed to 50.4% of the total prey volume, being the most frequent and voluminous prey species. *H. littorale* and *S. marmoratus* were less frequent, each occurring in 10% (n=1) of the individuals and contributing 6.2% and 19.5% of the total volume, respectively.

This study reports the first record of *O. niloticus* in the diet of the genus *Helicops*. In the Santo Anastácio reservoir, *O. niloticus* was introduced for fishing purposes and has become dominant as a result of eutrophication and habitat modification (Sánchez-Botero et al., 2014; Rodrigues-Filho et al., 2017; Araújo et al., 2019). Its success, however, is also strongly associated with intrinsic biological traits, such as high ecological plasticity, rapid growth, broad diet, tolerance to adverse environmental conditions, which enhance its competitive advantage over native species (see Canonico et al., 2005; Attayde et al., 2007; Attayde et al., 2011).

Comparatively, studies from natural environments reported a more diverse diet for *H. leopardinus*, including multiple fish and amphibian taxa (Ávila et al., 2006), and similar piscivory for related species such as *H. angulatus* and *H. polylepis* (Teixeira et al., 2017). The prevalence of an invasive prey species in this urban population may reflect opportunistic exploitation of available food resources, a pattern commonly observed among vertebrates inhabiting urbanized environments (Baker et al., 2000).

Helminth examination revealed the presence of the cestode *Ophiotaenia* sp. in 16% of examined individuals, with a mean abundance of 2.48 ± 0.61 helminths per host (i.e., the average number of parasites considering all hosts, infected or not) and a mean infection intensity of 15.5 ± 4.51 individuals per infected host (i.e., the average parasite load among infected snakes), located in both the intestine and stomach. This pattern contrasts with other *Helicops* populations, in which nematodes have been reported as the dominant parasites (Jiménez-Ruiz et al., 2002; Rossellini, 2007). Previous records for *H. leopardinus* and closely related species include infections by *Camallanus* sp. Railliet & Henry, 1915, *Infidum similis* Travassos, 1916 and the pentastomid *Sebekia oxycephalum* (Diesing, 1836) (Rego & Vicente, 1988; Silva et al., 2015), taxa commonly associated with piscivorous diets and aquatic lifestyles (Ávila et al., 2006).

Our findings expand the knowledge of *H. leopardinus* natural history, documenting its diet and parasite associations within a large urban center. The results highlight the influence of human-altered aquatic systems on trophic ecology and parasitic dynamics, emphasizing the need to consider urban ecosystems in herpetofaunal conservation strategies.

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Apêndice I. Specimens examined

Helicops leopardinus (n = 50): BRAZIL: Ceará: Fortaleza: Açude Santo Anastácio, Universidade Federal do Ceará, Campus do Pici – Pici, CHUFC 4128, 1788, 1137, 1101, 1200, 1190, 4194, 1294, 1335, 1790, 1810, 1789, 2666, 2582, 1201, 1802, 1799, 1801, 1161, 1795, 1797, 1792, 1143, 1304, 1817, 4148, 1300, 1806, 1110, 1310, 898, 1178, 1307, 1793, 1796, 1346, 1813, 1312, 1339, 1302, 1308, 1344, 4197, 1342, 1807, 1812, 1316, 1320, 1811.



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