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Insect richness in the stomach of a nacunda Nighthawk (*Chordeiles nacunda*)

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ABSTRACT

The Nacunda Nighthawk (*Chordeiles nacunda*) is an aerial insectivore and migratory species widely distributed throughout open areas of South America. Here, we report the stomach contents of one female collected in May 2023 in south-central Brazilian Amazon, along the Aripuanã River. The stomach contents of the bird consisted of 136 insects, belonging to 11 orders and 19 families; four orders and nine families are new to the diet of this species. Most of the items found are insects common in open vegetation areas or pastures. This suggests that the bird was taking advantage of the habitat transformations occurring in south-central Amazonia, where native evergreen forests are being replaced by pastures for cattle ranching. The native vegetation at our study area was replaced by pasture sometime between 2018 and 2019.

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Bird diet; environmental services; habitat transformation; neotropical region; natural history; scientific collections

Riqueza de insetos no estômago de um corucão (*Chordeiles nacunda*)

RESUMO

O corucão (*Chordeiles nacunda*) é uma espécie de ave, com hábito aéreo e insetívoro, migratória amplamente distribuída na América do Sul. Descrevemos o conteúdo estomacal de uma fêmea de *C. nacunda* coletado na Amazônia brasileira em 2023. Encontramos na moela deste indivíduo 136 insetos pertencentes à 11 ordens e 19 famílias, sendo que representantes de quatro ordens e nove famílias ou subfamílias nunca haviam sido reportados cientificamente como presas desta espécie. A maior parte dos insetos é característica de áreas abertas, sugerindo uma situação oportunística, uma vez que a área onde registramos a espécie apenas recentemente fora convertida em pasto.

PALABRAS CLAVE
Coleções científicas; dieta de aves; história natural; região Neotropical; serviços ambientais; transformação de habitat

Learning about the diet of Neotropical birds is essential to elucidate their ecological requirements, dynamics in changing environments, and their role as providers of ecological services. Nonetheless, the feeding behavior of many Neotropical birds is still poorly documented and understood. The Nacunda Nighthawk (*Chordeiles nacunda*) ranges from northern Colombia

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and Venezuela to central Argentina and Uruguay (Sick 1997; Shogren 2020; Rego et al. 2024). *C. nacunda* nighthawks usually spend most of the day roosting on the ground in open areas, fields, savannahs, and pastures camouflaged as dry or burnt wood, or even as dry cattle manure (Yamashita and Soares 1994; Sick 1997; Shogren 2020). *C. nacunda* actively feeds while in flight preferably at twilight and at night but can also be recorded foraging in the middle of the day (Salvador and Bodrati 2017). In the Amazonian region, *C. nacunda* is associated with sand forests (e.g., Campinas and Campinaranas), river-associated habitats (especially during the drier season when sand and gravel bars are available), and human-transformed habitats.

The diet of *C. nacunda* is composed of insects captured in flight. Among the groups of insects listed as part of their diet are: Coleoptera (Carabidae, Cerambycidae, Staphylinidae, Scarabaeidae, Elateridae), Diptera, Formicidae, Hemiptera (Pentatomidae, Cercopidae, Belostomatidae, Cicadidae), Lepidoptera (Noctuidae), Odontata (Anisoptera), Orthoptera (Acrididae, Gryllidae, Tettigonidae), and Ephemeroptera (Zotta 1932, 1934; Beltzer et al. 1988; Haverschmidt and Mees 1994; Sick 1997; Cleere and Nurney 1998; Ffrench et al. 2012). Beltzer et al. (1988) found that 70% of the insects in stomachs of 26 *C. nacunda* belonged to the order Hemiptera, while the second most common insect order was Orthoptera.

Here, we analyze the stomach contents of a *C. nacunda* individual collected during an ornithological expedition to south-central Brazilian Amazon, along the lower portion of the Aripuanã River. We analyzed the stomach contents of *C. nacunda* separately for this study, because we were surprised by the number of arthropods in its stomach. Our paper contributes to the natural history of this nighthawk and serves as an example of ways to maximize specimen information from material obtained in the field.

Methods

During an ornithological survey expedition to study the bird community of the lower portion of the Aripuanã River, Amazonas, Brazil (Fig. 1), we collected a specimen of *C. nacunda* at dusk (17:30 h) on 20 May 2023. This specimen was collected on the left bank of the Aripuanã River (07°30' 42.29"S, 60°40' 6.41"W; elevation 55 m) in the municipality of Novo Aripuanã. This specimen is now deposited at the ornithological collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP115539). This bird was collected using a 20 gauge Boito shotgun with number seven lead ammunition. The bird was flying near the river's edge over a recently created pasture with small dew ponds. The same area was once covered by native upland tall forest (*terra firme*) until 2019, when it was illegally cleared for cattle ranching (Fig. 1). We deposited the stomach contents of the other birds collected in the ornithological collection of the MZUSP and they may be used in future studies.

Once back from the field the author RVPD closely inspected the stomach contents of the bird based on an identification previously published taxonomic key (Rafael and Melo 2012). RVPD identified 136 arthropod individuals belonging to different morphospecies (identification based solely on external morphology), in addition to fragments of other insects that could not be identified at any level.

Results

The *C. nacunda* specimen was an adult female with a 785 mm wingspan, and a mass of 184 g. The ovary of the bird measured 15 × 5 mm (with three large ova measuring ~2 mm in

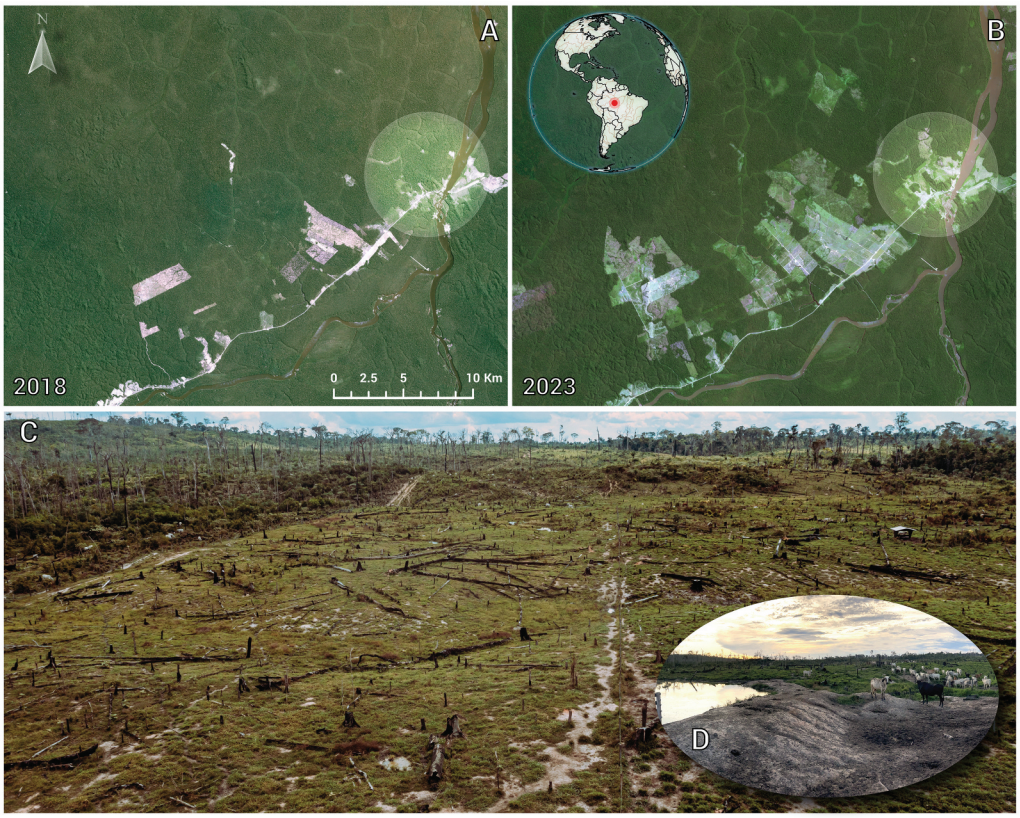

Figure 1. Locality where we collected an individual of a *Chordeiles nacunda*. (A) Satellite imagery from 2018, the area highlighted in the circle corresponds to the location where we found the *C. nacunda*. (B) Satellite imagery of 2023 of the same area shown in A. Note the increase in the deforested area between the two periods. We collected the *C. nacunda* along the Aripuanã River, in the area highlighted by a lighter circle (07°30′42.29″S, 60°40′.41″W; 55 m). (C) Aerial picture taken during the 2023 field expedition showing the damage caused to native environments by deforestation for cattle ranching. (D) Landscape picture of the same area is shown in C.

diameter each), the oviduct was convoluted, there was no bursa of Fabricius, and the bird was not molting. We also noted body fat stored between this individual's organs, near the furcula, and under the skin. The stomach (50 × 60 × 25 mm) contents alone weighed 26.30 g, ~15% of the bird's total weight, and prey items were temporarily preserved in 70% ethanol. We deposited the arthropods found in the stomach in the entomological collection of the MZUSP.

In total, we found insects from 11 orders, and 19 families (Fig. 2, Table 1). The most abundant orders were Hemiptera ($n = 46$), Coleoptera ($n = 36$), Orthoptera ($n = 20$), and Hymenoptera ($n = 8$). The most diverse insect orders were Coleoptera (14 morphospecies), Orthoptera (12 morphospecies), and Hymenoptera (5 morphospecies). Although hemipterans were the most abundant of all insects, 40 of 46 total hemipterans belonged to the same species, a giant water bug from the Belostomatidae family (Fig. 2). The giant water bugs were the most abundant morphospecies. The water bugs had a flat ovoid shape, being 2.5 cm long by 2 cm wide on average.

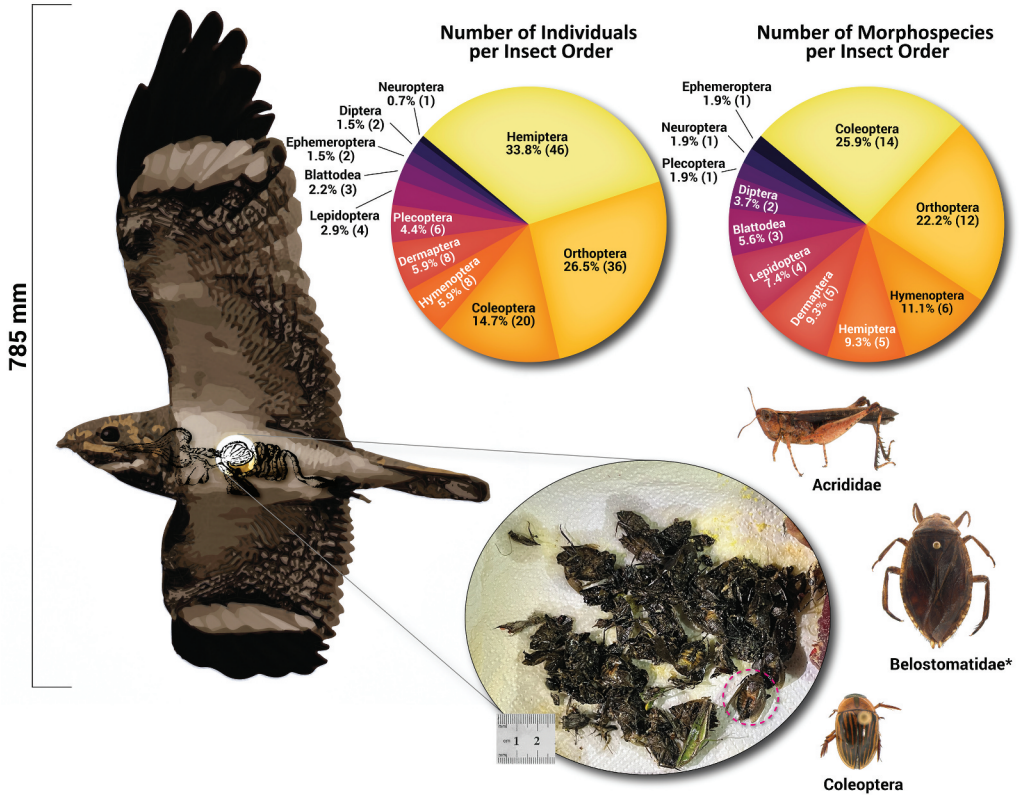

Figure 2. Graphic abstract for easy visualization of the insect abundance and diversity found in the stomach of a *Chordeiles nacunda*. Pictured: stomach contents before preservation in ethanol 70%. A dashed pink circle highlights one of the 40 adult giant water bugs (*Belostoma* sp., Belostomatidae). Individuals of a giant water bug (Belostomatidae), a grasshopper (acrididae), and one Coleoptera accessioned in the Museu de Zoologia da Universidade de São Paulo entomological collection are also pictured (lower right). The image of the bird in flight is from a different individual than the one we describe. We obtained the photo from the online platform WikiAves (WA5509896) with the author's permission (photo: Mario Candeias).

We found that the most well-preserved individuals were those with hard protective structures such as beetles (Coleoptera) and true bugs (Hemiptera). Insects with smooth parts like the different morphospecies of ants (Hymenoptera) were more difficult to properly identify and although we did not accession them as museum specimens, we quantified the number of individuals found (Fig. 2, Table 1).

Discussion

According to the literature, this is the heaviest female of *C. nacunda* ever recorded (Belton 1984; Haverschmidt and Mees 1994; Cleere and Nurney 1998). All insects found in the stomach of the *C. nacunda* reported here were flying insects. Our findings coincide with previous reports, as most prey items in the *C. nacunda* stomach contents belong to the order Hemiptera (Beltzer et al. 1988; Sick 1997). Likewise, Hemipterans previously found in the

Table 1. Taxonomic groups of insects in the stomach contents of a *Chordeiles nacunda* from the Brazilian Amazon.

Order	Family (subfamily)	Morphospecies	Individuals	Descriptions
Blattodea*	ND	sp. 1	1	head
		sp. 2	1	whole individual
		sp. 3	1	whole individual
Coleoptera	Carabidae	sp. 1	1	whole individual (adult)
		sp. 2	1	whole individual (adult)
		sp. 3	1	whole individual (adult)
	Cerambycidae	sp. 1	1	partial
	Chrysomelidae	sp. 1	1	whole individual
	Curculionidae	sp. 1	1	whole individual
	Elateridae	sp. 1	1	whole individual
	Hydrophilidae	sp. 1	1	whole individual
	Scarabeidae	sp. 1	3	3 heads and one mandible
		sp. 2	1	incomplete individual
		sp. 3	1	head and prothorax
	Scarabeidae (Ruteliinae)	sp. 1	4	3 whole individuals and one partial
	ND	sp. 1	2	2 partial heads
		sp. 2	1	1 partial head
Dermaptera	Forficulidae	sp. 1	3	3 individuals
		sp. 2	2	2 abdomens
	ND	sp. 1	1	whole individual (adult)
		sp. 2	1	whole individual (adult)
		sp. 3	1	abdomen
Diptera	cf. Ephydridae*	sp. 1	1	ND
	Limoniidae*	sp. 1	1	adult
Ephemeroptera*	ND	sp. 1	2	1 head and a thorax from one individual; thorax and partial head from another
Hemiptera	Belostomatidae*	sp. 1	40	whole individuals
	Cydnidae*	sp. 1	2	oral apparatus and partial head (Homoptera)
	Pentatomorpha	sp. 1	1	whole individual
	ND	sp. 1	1	one individual without the head (Pentatomidae?)
	Homoptera (suborder)	sp. 2	2	Two partial bodies and a head
Hymenoptera	Formicidae*	*Odontomachus* sp.	1	queen (winged individual)
		sp. 1	1	queen (winged individual)
		sp. 2	1	winged individual
		sp. 3	3	three winged queens
		sp. 4	1	queen (winged individual)
		sp. 5	1	queen (winged individual)
Lepidoptera	ND	sp. 1	1	Microlepidoptera (micromoph)
		sp. 2	1	1 head, and likely body of butterfly
		sp. 3	1	moth
		sp. 4	1	partial moth
Neuroptera*	Chrysopidae*	sp. 1	1	head, prothorax, and likely abdomen
Orthoptera	Acrididae (Gomphocerinae)	sp. 1	1	whole adult female
	Acrididae	sp. 1	1	partial individual
	Acrididae (Acridinae)	sp. 1	3	three partial adults
	Gryllidae (Gryllinae)	sp. 1	13	13 entire adult females
		sp. 2	4	4 entire adult females
		sp. 3	1	adult male
	Phalangopsidae*	*Lerneca* sp.	8	eight whole adult males
	Tettigoniidae (Conocephallinae)	sp. 1	1	adult male
	Trigonidiidae*	sp. 1	1	adult female
	Grylloidea (superfamily)	sp. 1	1	head and body most likely from the same individual
		sp. 2	1	one whole disfigured
	ND	sp. 1	1	one leg
Plecoptera*	Perlidae*	sp. 1	6	six adults, some without abdomen

ND = not determined; * = new diet records for the *C. nacunda*. The letters **cf**. following a taxon's name indicate that we are not fully certain of the identification of that taxon, but the identification provided has the highest probability of being correct.

stomach of *C. nacunda* individuals belong to the families Pentatomidae (stink bugs) and Belostomatidae (Beltzer et al. 1988; Sick 1997). In addition to these, we also identified other insect orders as part of these nighthawk's diet, namely Blattodea, Neuroptera, and Plecoptera. The mass of insects found in the specimen we studied also coincides with a previous report. Sick (1997) found a *C. nacunda* with a high richness of insects in its stomach, accounting for ~25% of the bird's total weight.

Most of the identified species in the *C. nacunda* specimen stomach were grasshoppers and beetles commonly found in open areas and grasslands (Rafael and Melo 2012). A large portion of the insect taxa that we found (Belostomatidae, Plecoptera, Hydrophilidae) are generally associated with freshwater habitats. These insects stay close to water environments for oviposition and foraging, living at most of their lives close to rivers or lakes (Rafael and Melo 2012). All insects in the *C. nacunda* stomach were winged adults, which suggests they were captured in flight. Among the insects found in the stomach contents were small flies (Diptera) and alate ant males and queens (Hymenoptera) from different morphospecies; these were <5 mm and could have been eaten unintentionally when the bird was trying to capture another larger insect.

Although the large number of insects from different orders we found within the *C. nacunda* stomach is not unusual or unexpected, quantitative studies about the diet of Caprimulgidae in the Neotropics are rare. Because this kind of dietary study relies on the collection of fecal samples, food boluses or, as a last resort, collecting specimens, the relative contribution of these insectivorous birds in providing ecological services even for common species remains underappreciated or underestimated (Michel et al. 2020). An example of how important these studies can be is that a large portion of the insects found in the stomach of a *C. nacunda* in Uruguay were pentatomids that are harmful to rice crops (Sick 1997). Our report underscores the importance of these birds in agricultural pest control.

We suggest that our approach of accessing specimens in museum collections, along with their preserved and accessioned stomach contents, provides valuable insights into the natural history, migration, and ecology of understudied species, especially in rapidly changing regions like the Brazilian Amazon. This approach may inform us how fast different species can adapt to new environmental conditions. However, it is important to acknowledge its limitations, as stomach contents are better at preserving hard-shelled insects (e.g., Coleoptera) than soft bodied insects (e.g., Lepidoptera).

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Author contributions

All the data used in this manuscript is available in the main text, figures, and tables. F. Schunck, G .R. Lima, M.A.Rego, and G. Del-Rio conducted the fieldwork, and wrote and edited the manuscript. M.

A. Rego and G. Del-Rio produced the figures. R. Vilhena Perez Dios analyzed the stomach content and prepared the main table of this manuscript. L.F. Silveira wrote and edited the manuscript providing key insights for the final product.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Permits and ethics protocols

Specimen collection and animal handling were performed under IBAMA permit 28,294–20 and IACUC/CEUA protocol 001/2016.

Generative AI

Generative AI was not used in the production of this manuscript.

Literature cited

Belton W. 1984. Birds of Rio Grande do sul, Brazil. Part 1, Rheidae through Furnariidae. Bull Am Mus Nat Hist. 178(4):369–636. http://hdl.handle.net/2246/576 .
Beltzer AH, Ríos de Salusso ML, Bucher EH. 1988. Alimentación del Ñacunda (*Podager n. nacunda*) en Paraná (Entre Ríos). El Hornero. 13(1):47–52. doi: 10.56178/eh.v13i1.1118.
Cleere N, Nurney D. 1998. Nightjars: a Guide to the Nightjars, Nighthawks, and their relatives. 1st ed. New Haven, CT: Yale University Press.
Ffrench R, O'Neill JP, Anderton J. 2012. A Guide to the birds of Trinidad & Tobago. 3rd ed. Ithaca, NY: Comstock Publishing.
Haverschmidt F, Mees GF. 1994. Birds of Suriname. 2nd ed. Vaco, N.V: Uitgeversmaatschappij.
Michel N L, Whelan C J, Verutes G M. 2020. Ecosystem services provided by Neotropical birds. The Condor 122(3). doi: 10.1093/condor/duaa022.
Rafael JA, Melo GR, Eds. 2012. Insetos do Brasil—Diversidade e Taxonomia. Primeira edição. Holos. https://www.martinsfontespaulista.com.br/insetos-do-brasil—diversidade-e-taxonomia-543476/p.
Rego MA, Del-Rio G, Brumfield RT. 2024. Subspecies-level distribution maps for birds of the Amazon basin and adjacent areas. J Biogeogr. 51(1):14–28. doi: 10.1111/jbi.14718.
Salvador, S. A., A. Bodrati. 2017. Biología reproductiva y otros aspectos de la historia natural del Ñacunda (Chordeiles nacunda nacunda) en Argentina. Historia Natural 7:39–54.
Shogren E. 2020. Nacunda Nighthawk (Chordeiles nacunda). In: Billerman SM, Keeney BK, Rodewald PG Schulenberg TS, editors. Birds of the world. Ithaca, NY: Cornell Lab of Ornithology. doi: 10.2173/bow.nacnig1.01.
Sick H. 1997. Ornitologia Brasileira. Segunda Edição. Rio de Janeiro, RJ. Brasil: Nova Fronteira.

Yamashita C, Soares RC. 1994. O mimetismo do curiango (*Podager nacunda*), Caprimulgiformes e a ocupação pontual dos sítios degradados produzidos por herbívoros de grande porte. IV Congresso Brasileiro de Ornitologia. 140.
Zotta Á. 1932. Notas sobre el contenido estomacal de algunas aves. El Hornero. 5(1):77–81. doi: 10.56178/eh.v5i1.247.
Zotta Á. 1934. Sobre el contenido estomacal de aves argentinas. El Hornero. 5(3):376–383. doi: 10.56178/eh.v5i3.275.