Journal of Caribbean Ornithology

RESEARCH ARTICLE

Vol. 35:90–95. 2022

Variability of the Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*) diet

Arnaud Lenoble Laurent Charles Nathalie Serrand

Photo: Nathalie Serrand

Birds Caribbean

Journal of Caribbean Ornithology
Research Article Vol. 35:90–95. 2022
jco.birdscaribbean.org ISSN 1544-4953 https://doi.org/10.55431/jco.2022.35.90-95
Birds Caribbean
birdscaribbean.org

Variability of the Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*) diet

Arnaud Lenoble[1], Laurent Charles[2], and Nathalie Serrand[3,4]

Abstract Snails preyed upon by the Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*) were collected from two nesting sites in different regions and habitats on Grenada, with the aim of better understanding the diet of this endemic and endangered subspecies. Apart from the large snail *Megalobulimus oblongus*, which was present in the environment but not consumed by the kites, all five species previously reported in the literature (*Bulimulus wiebesi*, *Plekocheilus glaber*, *Drymaeus binominis*, *Orthalicus zebra*, and *Pleurodonte perplexa*) were documented as prey. Land snail species occur in variable numbers according to habitat type and localized environmental conditions, illustrating the kite's ability to exploit distinct areas of the island. Land snails consumed by the kite included both arboreal and ground-dwelling species, representing all the medium-sized (20–40 mm) species occurring on Grenada. Variation in snail species proportions were evident when comparing assemblages collected beneath nests to those scattered in the immediate vicinity of nests, suggesting seasonal factors or species selection for feeding young may influence the kite's food habits.

Keywords *Chondrohierax uncinatus*, diet, Grenada, Hook-billed Kite, snail consumption

Resumen Variabilidad de la dieta de *Chondrohierax uncinatus mirus* • Se recolectaron caracoles depredados por *Chondrohierax uncinatus mirus* en dos sitios de nidificación ubicados en diferentes regiones y hábitats de Granada, con el objetivo de comprender mejor la dieta de esta subespecie endémica y en peligro de extinción. A excepción del caracol de gran tamaño *Megalobulimus oblongus*, que estaba presente en el entorno pero que no fue consumido por los gavilanes, se confirmaron como presas las cinco especies anteriormente citadas en la literatura (*Bulimulus wiebesi*, *Plekocheilus glaber*, *Drymaeus binominis*, *Orthalicus zebra* y *Pleurodonte perplexa*). Las especies de caracoles terrestres se encuentran en números variables según el tipo de hábitat y las condiciones ambientales locales, lo que ilustra la capacidad de esta rapaz para explotar distintas áreas de la isla. Los moluscos terrestres consumidos por esta aves incluyen especies tanto arborícolas como terrestres, que representan todos los taxones de tamaño mediano (20–40 mm) que se encuentran en Granada. La variación en las proporciones de las especies de caracoles fue evidente al comparar los grupos recolectados bajo los nidos con los dispersos en sus inmediaciones, lo que sugiere que factores estacionales o la selección de especies para alimentar a las crías pueden influir en los hábitos alimentarios del gavilán.

Palabras clave *Chondrohierax uncinatus*, consumo de caracoles, dieta, Granada

Résumé Variabilité du régime alimentaire du Milan bec-en-croc de Grenade (*Chondrohierax uncinatus mirus*) • Les escargots consommés par le Milan bec-en-croc de Grenade (*Chondrohierax uncinatus mirus*) ont été collectés sur deux sites de nidification situés dans des environnements distincts de façon à mieux documenter le régime alimentaire de ce rapace endémique et menacé. En dehors du très gros *Megalobulimus oblongus*, présent dans l'environnement mais non consommé par le milan, les cinq espèces précédemment rapportées dans la littérature ont été retrouvées (*Bulimulus wiebesi*, *Plekocheilus glaber*, *Drymaeus binominis*, *Orthalicus zebra*, *Pleurodonte perplexa*). Les espèces d'escargots terrestres sont présentes en nombre variable selon le type d'habitat et les conditions environnementales locales, illustrant la capacité du milan à exploiter des zones distinctes de l'île. Les mollusques terrestres dont se nourrit le milan comprennent des espèces arboricoles ou vivant au sol, représentant tous les taxons de l'île dont la longueur de coquille est comprise entre 20 et 40 mm. Des variations dans les proportions des espèces d'escargots étaient évidentes en comparant les assemblages collectés sous les nids à ceux présents dans leur voisinage immédiat, ce qui suggère que des facteurs saisonniers ou la sélection des espèces pour l'alimentation des jeunes peuvent influencer les habitudes alimentaires du milan.

Mots clés *Chondrohierax uncinatus*, consommation d'escargots, Grenade, Milan bec-en-croc, régime alimentaire.

*Corresponding author: [1]PACEA UMR CNRS 5199, Université de Bordeaux, Ministère de la Culture et de la Communication, Avenue Geoffroy St Hilaire, 33615 Pessac Cedex, France; e-mail: arnaud.lenoble@cnrs.fr. Full list of author information is available at the end of the article.

The Hook-billed Kite (*Chondrohierax uncinatus*) is a diurnal raptor present throughout much of the Neotropical region, including the West Indian southernmost island of Grenada, where it is considered an endemic subspecies (*Chondrohierax uncinatus*

mirus). The Grenada Hook-billed Kite population was estimated at around 50–75 individuals by Thorstrom and McQueen (2008). This very low number of individuals demonstrated that the Grenada subspecies is seriously endangered (Blockstein 1988, Raffaele *et al.* 2010, Greeney *et al.* 2022). Moreover, a recent attempt to evaluate the number of individuals failed due to the lack of observations, suggesting a decline in the kite's population since the previous estimate (Campbell 2019). The specialized diet of the kite—comprised almost exclusively of land snails—and its preference for Grenada's dry forests render it particularly sensitive to habitat degradation by development, primarily the construction of tourism-related facilities (Smith and Temple 1982a, Blockstein 1988).

Due to the specialized feeding habits of the Hook-billed Kite, understanding its diet is critically important for evaluating the species' vulnerability to environmental change. However, little information is currently available concerning the composition of this raptor's diet. An old account exists of the Grenada Hook-billed Kite feeding on the large *Megalobulimus oblongus* snail (Bond 1961). Apart from this, three studies have described the diet of the Grenada Hook-billed Kite. Smith and Temple (1982a) reported the consumption of the small land snail *Bulimulus wiebesi*, occasionally supplemented with *Plekocheilus glaber* (referred to as *Endolichotus* [sic, *Eudolichotus*] *grenadensis* by the authors). In addition to *B. wiebesi*, subsequent research produced evidence for the consumption of the genus *Orthalicus* (Blockstein 1988), and a more recent study reported *Drymaeus binominis* and *Orthalicus zebra* as the main prey of the Grenada Hook-billed Kite, occasionally supplemented with *Pleurodonte perplexa* (Thorstrom *et al.* 2001). These latter two studies based their conclusions on shells collected in the dry scrub forest of the southwestern tip of Grenada, whereas Smith and Temple (1982a) did not include sufficient information to accurately identify the habitat from which their shell assemblage originated. These differences in snail species reported raise questions about the influence of environmental or biological factors on the Hook-billed Kite's diet. Here, we report the prey of the Grenada Hook-billed Kite based on several hundred shells collected from two different locations and habitats.

Methods

Grenada is the southernmost island of the Lesser Antilles, situated immediately north of Bond's line separating continental and Caribbean bird species (Lack 1976). With a land mass of 312 km² and a maximum elevation of 840 m, the island's mountainous terrain creates a gradient of climates from the coast to its highest point, as well as a gradient of vegetation ranging from dry deciduous scrub forest along the coast to evergreen forest at higher altitudes.

Shells were collected from two study sites 10 km apart between 14–18 December 2014. Sampling was carried out at the beginning of the dry season, shortly after the kite's breeding season, which extends from May to November in Grenada (Bierregard *et al.* 2020). The sampled sites were at Beausejour (12°06'21.6"N, 61°44'53.6"W), a semi-deciduous broad-leaved forest on Grenada's western coast, and at Mount Hartman (12°00'50.6"N, 61°44'52.9"W), a dry deciduous forest in the southern region of the island (Helmer *et al.* 2008). One day was spent at each site locating nests and collecting snails. The sites were several hundred meters away from any human development, situated on flat ground (Beausejour) or on the gentle slope of a low hill (Mount Hartman). Several large tree species were present at both sites, including the spineless wattle (*Acacia muricata*), the hog plum tree (*Spondias mombin*), and the copperwood tree (*Bursera simaruba*). The two sites differed in forest structure. The forest at Mount Hartman was more arid, with a complete loss of foliage during the dry season and had dry undergrowth and soil. The forest at Beausejour had leafy canopy cover, with a cool, shaded undergrowth and a moist and continuous plant litter.

One Hook-billed Kite nest was recorded at each study site. At Mount Hartman, an active nest was previously noted, and shells of consumed snails were collected directly below it several years earlier. The nest was known to have been occupied during consecutive years preceding the sampling period (Campbell 2019), and the visitor center's staff reported that the kites were seen in the area on a regular basis, including on the day shells were collected. The nest was located in one of the two large copperwood trees that tower above the area. At Beausejour, an occupied nest was observed in one of the site's tallest trees (species unknown) a few months before our fieldwork. A kite was also photographed at the nest just prior to our visit.

All shells of consumed snails within a 150-m radius of each nest were collected to examine which species were consumed as well as their relative abundance. Two types of accumulation were recorded: (1) a large number of shells ($n > 100$) directly beneath the nest, hereafter referred to as the "main concentration", and (2) shells grouped into smaller "clusters" ($n < 50$) scattered around the nest. In addition, a sample of uneaten dead snails found scattered on the ground was also collected to describe the land snail community at each site.

Shells were categorized as "consumed" only when they exhibited damage typically produced by kites extracting snails (Fig. 1; Smith and Temple 1982b). Shells were identified to species level according to the checklist provided by Charles (2009) and our own reference collection (LC, Museum of Natural History in Bordeaux), considering recent nomenclatural changes (Molluscabase 2022). In the case of the two Bulimulidae species, *Drymaeus binominis* and *Bulimulus wiebesi*, whose shells can be difficult to separate due to their similar morphology, particularly when incomplete, species determinations were made by comparing protoconchs with a 20× dissecting microscope. Primary diagnostic criteria included regularly spaced pit rows for *D. binominis* and axial riblets for *B. wiebesi*. In addition, the first whorl suture, which is deeper in *B. wiebesi* compared to *D. binominis*, was also considered as a species-specific trait (Fig. 1). Fisher's exact tests were used to compare differences between habitats and between the main concentration and clusters in each habitat. All analyses were conducted using R (R Core Team 2013).

Results

A total of 300 shells of snails eaten by the Hook-billed Kite were collected (Mount Hartman, $n = 154$; Beausejour, $n = 146$), documenting five species: *Orthalicus zebra*, *Bulimulus wiebesi*, *Drymaeus binominis*, *Plekocheilus glaber*, and *Pleurodonte perplexa* (Table 1; Fig. 1). Shells of seven other species were also collected in the vicinity of nests, representing uneaten snails (Table 1). The species

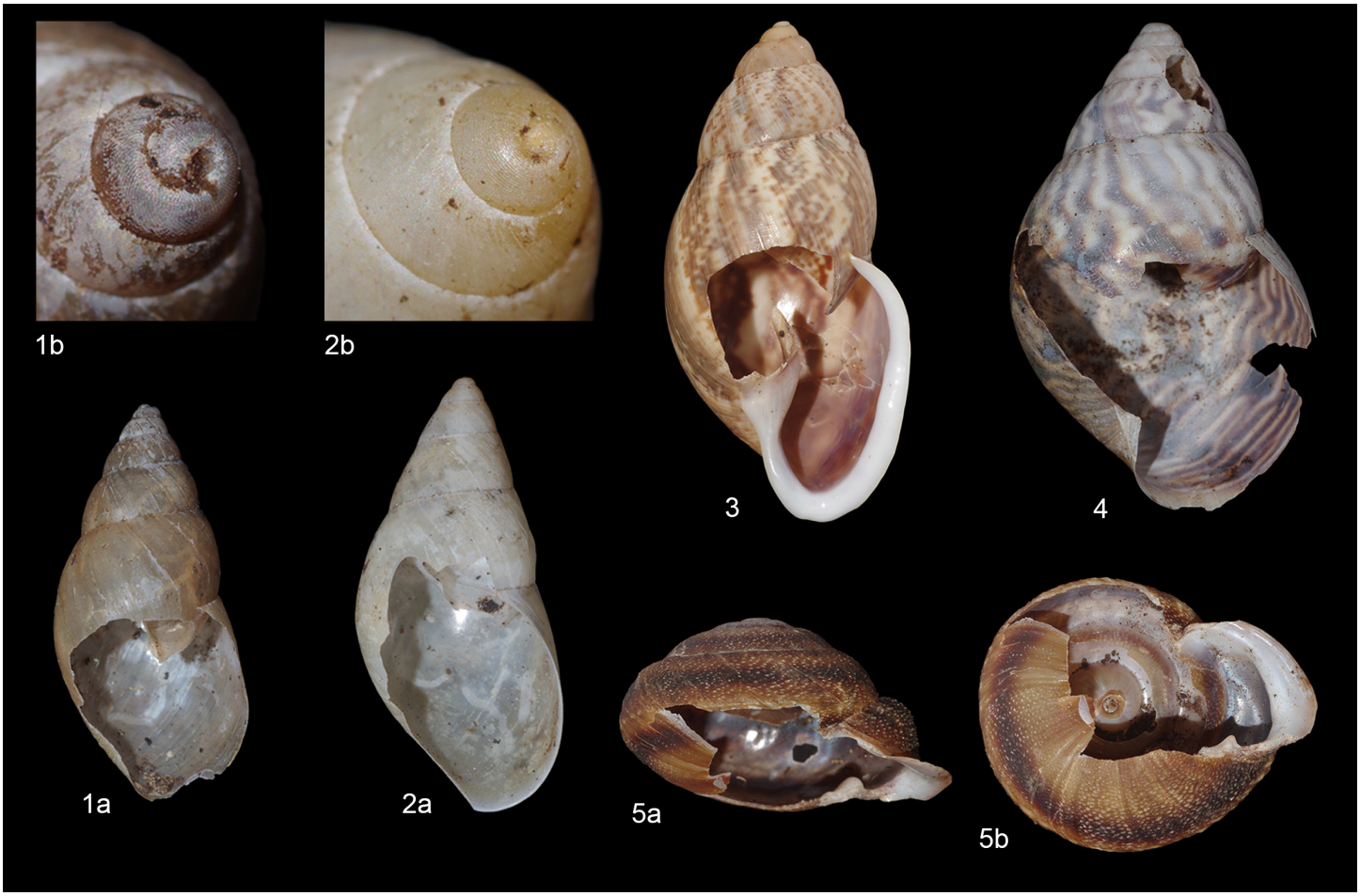

Fig. 1. Broken shells of snails eaten by Hook-billed Kites (shell height = h, diameter = d). 1) *Bulimulus wiebesi*; a. apertural view; b. protoconch detail (h = 22.74 mm); Mount Hartman. 2) *Drymaeus binominis*; a. apertural view; b. protoconch detail (h = 24.4 mm); Mount Hartman. 3) *Plekocheilus glaber*; apertural view (h = 37.7 mm); Beausejour. 4) *Orthalicus zebra*; apertural view (h = 36.6 mm); Mount Hartman. 5) *Pleurodonte perplexa*; a. apertural view; b. umbilical view (h = 14.6 mm, d = 25.6 mm); Mount Hartman.

consumed by the Grenada Hook-billed Kite in our sample were all medium-sized species (max. shell length 20–40 mm), whereas the snails collected, but not consumed by the kite, were either large species, such as *Megalobulimus oblongus* (max. shell length > 100 mm), or small species (max. shell length < 20 mm; Table 1).

Apart from *P. perplexa*, which was present in similarly low proportions at both sites (14% at Mount Hartman and 19% at Beausejour), the proportions of consumed species differed significantly between the two sites ($p < 0.001$; Table 1). Most of the damaged/consumed shells collected at Mount Hartman were *O. zebra* (51%) and *D. binominis* (33%); in contrast, *P. glaber* was the most preyed upon snail (70%) at Beausejour. Interestingly, the most common prey species at each site was absent or negligible at the other site. Although present in both habitats and sites, *B. wiebesi* was rarely consumed by the Hook-billed Kite in our samples, representing only 2% of the shells collected at Mount Hartman and none of the consumed snails at Beausejour.

The species composition differed significantly between the main concentrations and the clusters at both sites ($p = 0.006$ at Mount Hartman, $p < 0.001$ at Beausejour; Table 1). *O. zebra*, the most abundant species in the main concentration at Mount Hartman (58%), was present in low proportions in surrounding clusters (28%). At Beausejour, the main concentration consisted primarily of *P. glaber* (79%), which did not exceed 10% in the associated clusters.

The species composition of consumed/damaged shells in the main concentration differed significantly from uneaten/undamaged shells collected in the nearby environments ($p < 0.001$ at both Mount Hartman and Beausejour). However, the assemblages of consumed/damaged shells in clusters did not differ significantly from uneaten/undamaged shells in the nearby environments at Mount Hartman ($p = 0.11$) and were less statistically different compared to the main concentration at Beausejour ($p = 0.014$). This suggests that the shell composition of the clusters is more similar to that of the surrounding environment than are the shells in the main concentrations.

Discussion

All five snail species documented by Smith and Temple (1982a), Blockstein (1988), and Thorstrom *et al.* (2001) were identified in our study, including two tree-dwelling snails (*Orthalicus zebra* and *Drymaeus binominis*) and three ground-dwelling snails (*Bulimulus wiebesi*, *Pleurodonte perplexa*, and *Plekocheilus glaber*) that also occur in the lower stratum of vegetation (Charles 2009).

Table 1. Typical shell length (mm) and number of unconsumed or consumed snails collected from both locations (MC: main concentration, C: cluster of shells within a 150-m radius of the nest). The typical size of the different snail species is taken from Charles (2009), supplemented by the measurement of specimens collected by LC when necessary.

		Unconsumed Shells		Consumed Shells									
				Mount Hartman						Beausejour			
Snail Species	Shell Length (mm)	Mount Hartman	Beause-jour	MC	C1	C2	C3	C4	Total	MC	C1	C2	Total
Beckianum beckianum	6–8	5	3										
Leptinaria unilamellata	8–10	5											
Helicina sp.	10–12	10											
Subulina octona	9–16	8											
Aperostoma grenadense	12–16		8										
Bulimulus wiebesi	20–22	4	1	2				1	3				
Drymaeus binominis	20–24	12	1	34	1	1	2	13	51	9	6		15
Pleurodonte perplexa	20–26	10	23	16			1	4	21	16	11	1	28
Orthalicus zebra	30–35	3	1	71		1	4	3	79	1			1
Plekocheilus glaber	35–40		11							100		2	102
Megalobulimus oblongus	100–130	12	1										
	Total	**69**	**49**	**123**	**1**	**2**	**7**	**21**	**154**	**126**	**17**	**3**	**146**

Of these species, *P. glaber* was the most common prey species documented at Beausejour, which contradicts Thorstrom *et al.*'s (2001) observations that the kite's diet is specialized for arboreal snails, suggesting that the kite's diet composition may be influenced by additional environmental or biological factors.

Shell size also appears to be an important factor determining the kite's prey selection. First, the largest of Grenada's land snails, *Megalobulimus oblongus*, was collected only as undamaged shells at both sites. Contrary to Bond's (1961) assertion, this large land snail may not form part of the kite's diet, as suspected by Smith and Temple (1982a) and Blockstein (1988). The large size of this snail, which reaches 100–130 mm in shell length, probably precludes its consumption by the kite (Smith and Temple 1982a). Second, the species consumed by the kites were all medium-sized species, which are the largest snails on the island after *M. oblongus*. Of these medium-sized species, kites favored consumption of the larger species of this size range, at least during the breeding season, when snails longer than 3 cm were found in abundance directly beneath the nests, regardless of whether they were arboreal (*O. zebra* at Mount Hartman) or ground-dwelling species (*P. glaber* at Beausejour).

Differences in consumed snail species reported in previous studies were interpreted by Thorstrom *et al.* (2001) as potentially reflecting seasonal variations in snail abundance. However, our data suggest that differences in snail species consumed by the kites at the two nesting sites are related to local habitat type rather than seasonal variation, as *O. zebra* and *B. wiebesi* are more common in dry forest, *P. glaber* is more common in semi-deciduous forest, and both *D. binominis* and *P. perplexa* are found throughout the island (Charles 2009). Additionally, Beausejour, where *P. glaber* was most frequently consumed by the kites, has more humid conditions compared to the dry forest environment of Mount Hartman, where *O. zebra* and Bulimulidae were the most abundant prey species. This pattern is consistent with Blockstein (1988) and Thorstrom *et al.*'s (2001) observations that damaged shell accumulations in dry scrubland locations included both *O. zebra* and Bulimulidae. Unfortunately, Smith and Temple (1982a) did not specify the habitat conditions where they collected their sample of *P. glaber*. However, plotting the locality indications on the forest map of Helmer *et al.* (2008) revealed that semi-deciduous forests similar to those at Beausejour are dominant in the area where the authors made their observations, suggesting that their determinations are consistent with the relationship between habitat type and snail species consumed in our study. The small sample size of our study does not exclude the possibility that the observed variability reflects individual prey preference. A larger number of observations is necessary to confirm this interpretation.

To some extent, our results differ from the observations of Smith and Temple (1982a) and Blockstein (1988). For example, *B. wiebesi*, a major food source for the kite according to these studies, was rare in our samples regardless of the habitat type. However, Blockstein (1988) tentatively classified the small, spired snails he collected as the ground-dwelling species *B. wiebesi*, whereas Smith and Temple (1982a) considered snails in this taxon as being arboreal. Because *B. wiebesi* and *D. binominis* share a very similar shell morphology, and the authors did not specify the attributes they based their identifications on, it remains possible that some or all of the snails classified by these authors as *B. wiebesi* could, instead, represent *D. binominis*.

Finally, although our limited data do not rule out alternative hypotheses, seasonal changes may influence the composition of the Hook-billed Kite's diet, as suggested by Thorstrom *et al.* (2001). Under this hypothesis, shells accumulated directly

below the nests represent snails brought by adults to feed chicks (Smith 1982) during the rainy season when nesting occurs (Thorstrom *et al.* 2001, Thorstrom and McQueen 2008), and shells accumulated in scattered clusters represent snails consumed by adult kites while perched, outside of the chick-feeding period. However, our results cannot be used to differentiate between different periods of shell accumulation, and some authors have reported shell accumulations under the nest and under perches simultaneously while adults were raising young (e.g., Fleetwood and Hamilton 1967). Alternatively, snail species collected beneath the nest and in scattered clusters may represent snails consumed during the same season, with differences in species proportions attributable to selective chick feeding. This hypothesis is supported by the observation that shells found directly beneath the nest were predominantly the largest species eaten by kites, which may reflect a preferential selection by adults for feeding their young. The current lack of data concerning the circadian rhythm and seasonality of Grenada's land snails, combined with a lack of knowledge regarding the precise period of shell accumulation, make our observations insufficient for resolving these issues, and thus merit further investigation.

In summary, our observations indicate that the Grenada Hook-billed Kite preys on a variety of medium-sized snails, ranging 20–40 mm in length and including both tree- and ground-dwelling species. The proportions of land snail species fed upon by the kite was related to habitat type. Our results demonstrate that the kite feeds on multiple snail species, allowing the kite to occupy different ecosystems. This is consistent with Thorstrom and McQueen's (2008) observations of kite nesting sites in semi-deciduous forests. Furthermore, determining where, and under what conditions, medium-sized snail species are found in abundance may help to identify areas where the threatened Hook-billed Kite would thrive in Grenada.

Acknowledgments

This work was conducted under a research permit delivered on 16 December 2014 by the Forestry and National Parks Department of Grenada (FNDP). We especially thank Chief Officer A. Jeremiah who facilitated our research, and agents A. Dragon and D. Francis who kindly guided us in our collections. We thank Brad Gravina for help with improving the English text, as well as Ryan Philipps, one anonymous reviewer, and the editorial team for their comments and suggestions, which greatly improved the manuscript. The analysis of the material was funded by the CNRS BIVAAG project: "Biodiversité Insulaire Vertébrée, floristique et malacologique Ancienne de l'Archipel de Guadeloupe", with support from a European PO-FEDER grant 2007-2013 (grant n°2/2.4/-33456), the Guadeloupe Regional Council, the DEAL of Guadeloupe, the DAC of Guadeloupe, and by the CNRS GDR 3591 TaphEnA "Taphonomie, Environnement et Archéologie". The writing of this manuscript was supported by the FEDER program 2016–2020 "Ecosystème insulaire tropical, réponse de la faune vertébrée terrestre à 6 000 ans d'anthropisation de la Guadeloupe (ECSIT) / Terrestrial vertebrate responses to 6000 years of human activity in a tropical island ecosystem" of the CNRS and a European PO-FEDER 2014-2020 grant (grant n°2016-FED-503).

Title Page Illustration

Snail shells accumulated beneath a nest of the Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*) at Mount Hartman, Grenada, on 16 December 2014. The shells were pictured before collection. Three species are depicted: *Orthalicus maracaibensis*, *Drymaeus binominis*, and *Helicina* sp. The *O. maracaibensis* shells exhibit the typical damages of snail consumption by the kite. Photographer: Nathalie Serrand.

Author Information

[1]PACEA UMR CNRS 5199, Université de Bordeaux, Ministère de la Culture et de la Communication, Avenue Geoffroy St Hilaire, 33615 Pessac Cedex, France; e-mail: arnaud.lenoble@cnrs.fr; [2]Muséum de Bordeaux: sciences et nature, 5 place Bardineau, 33000 Bordeaux, France; e-mail: l.charles@mairie-bordeaux.fr; [3]Inrap, Centre archéologique de Guadeloupe, 97113 Gourbeyre, Guadeloupe (F.W.I.), France; e-mail: nathalie.serrand@inrap.fr; [4]UMR CNRS 7209, Archéozoologie et Archéobotanique, Muséum national d'Histoire naturelle, 57 rue Cuvier, 75005 Paris, France.

Literature Cited

Blockstein, D.E. 1988. Two endangered birds of Grenada, West Indies: Grenada Dove and Grenada Hook-billed Kite. Caribbean Journal of Science 24:127–136.

Bond, J. 1961. Extinct and near extinct birds of the West Indies. Pan-American Section, International Council for Bird Preservation, Research Report 4:1–6.

Campbell, E.A. 2019. Status and Distribution of Two Diurnal Raptors on the Island of Grenada: Grenada Hook-Billed Kite (*Chondrohierax uncinatus mirus*) and Antillean Broad-winged Hawk (*Buteo platypterus antillarum*). MNRM Thesis. University of Manitoba, Winnipeg, MB, Canada.

Charles, L. 2009. A contribution to the knowledge of land and freshwater Mollusca of Grenada (Lesser Antilles). Survey Report. Ministry of Agriculture, Lands, Forestry, Fisheries, Public Utilities and Energy, Grenada, and Société d'Histoire Naturelle l'Herminier, Nantes, France.

Fleetwood, R.J., and J.L. Hamilton. 1967. Occurrence and nesting of the Hook-billed Kite (*Chondrohierax uncinatus*) in Texas. Auk 84:598–601.

Greeney, H.F., and P.F.D. Boesman. 2022. Hook-billed Kite (*Chondrohierax uncinatus*), version 3.0. *In* Birds of the World (B.K. Keeney, ed.). Cornell Lab of Ornithology, Ithaca, NY.

Helmer, E.H., T.A. Kennaway, D.H. Pedreros, M.L. Clark, H. Marcano-Vega, L.L. Tieszen, S.R. Schill, and C.M.S. Carrington. 2008. Land cover and forest formation distributions for St. Kitts, Nevis, St. Eustatius, Grenada and Barbados from decision tree classification of cloud-cleared satellite imagery. Caribbean Journal of Science 44:175–198.

Lack, D. 1976. Island Biology: Illustrated by the Land Birds of Jamaica (Studies in Ecology). University of California Press, Berkeley, CA.

MolluscaBase. 2022. MolluscaBase.

R Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Raffaele, H., J. Wiley, O. Garrido, A. Keith, and J. Raffaele. 2010. Birds of the West Indies. Princeton University Press, Prince-

ton, NJ.
Smith, T.B. 1982. Nest and young of two rare raptors from Mexico. Biotropica 14:79–80.
Smith, T.B., and S.A. Temple. 1982a. Grenada Hook-billed Kites: recent status and life history notes. Condor 84:131.
Smith, T.B., and S.A. Temple. 1982b. Feeding habits and bill polymorphism in Hook-billed Kites. Auk 99:197–207.
Thorstrom, R., E. Massiah, and C. Hall. 2001. Nesting biology, distribution, and population estimate of the Grenada Hook-billed Kite *Chondrohierax uncinatus mirus*. Caribbean Journal of Science 37:278–281.
Thorstrom, R., and D. McQueen. 2008. Breeding and status of the Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*). Ornitología Neotropical 19:221–228.

Cite this article as:

Lenoble, A., L. Charles, and N. Serrand. 2022. Variability of the Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*) diet. Journal of Caribbean Ornithology 35:90–95. https://doi.org/10.55431/jco.2022.35.90-95