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Nota editorial

Adeus!

Após seis anos e 11 números dedicados a esta revista, entendemos que chegou o momento de passar esta pasta para outras mãos tão, ou mais, entusiastas que as minhas. É com orgulho que afirmo que, durante este tempo, a revista se consolidou com publicações regulares, aplaudidas por colegas em vários pontos do mundo, mais diversas em conteúdos e geografias, e com mais autores tanto do mundo académico e de ONGs. Tornou-se ainda uma escola de escrita clara e concisa de ciência, edificando o respeito por normas, prazos e a estrutura do método científico. Este número vem confirmar esse percurso, com vários autores publicando pela primeira vez, como também o aumento da relevância das organizações nacionais, que figuram agora como as mais frequentes no total das afiliações, com os autores nacionais a passarem a ser os principais contribuidores (com mais de cinco publicações).

Neste último número, a primeira publicação intitula-se "*Elevada predação marinha das crias de tartaruga cabeçuda na Boavista, Cabo Verde"*. Os autores utilizaram sensos visuais e inquéritos aplicados aos pescadores, peixeiras e cozinheiros da ilha para identificar potenciais predadores das crias de *Caretta caretta* e estimar o impacto dos mesmos na mortalidade da espécie perto da costa. Este estudo mostra que os predadores identificados são sobretudo peixes demersais e que a mortalidade estimada perto da costa é muito elevada. É importante salientar que este estudo deve ser replicado noutros locais e alturas para que se possam retirar conclusões mais sólidas.

A segunda publicação é uma breve nota sobre a "*Monotorização de répteis na reserva natural da ilha de Santa Luzia*". Este trabalho tenta estabelecer as bases para um seguimento periódico deste grupo de animais terrestres com espécies exclusivamente endémicas, todas elas ameaçadas ou quase-ameaçadas. Segundo os autores, todos nacionais, tal seguimento deverá ser repetido anualmente, e em diferentes épocas do ano, para que se possam tirar conclusões relativamente a flutuações populacionais.

A terceira e última publicação é uma nota breve que descreve, pela primeira vez, a competição por interferência entre duas aves endémicas, a coruja e o francelho/ filili, na ilha do Maio. Os autores da nota "*Competição por local de nidificação entre aves de presa na ilha do Maio, Cabo Verde*", todos afiliados também a organizações nacionais, monitorizaram com câmaras e um telescópio um potencial local de nidificação, com os quais conseguiram registar imagens únicas deste processo.

Confio que irão apreciar este número e que o novo ano traga boas mudanças para todos. Resta-me agradecer aos 108 autores de 14 países de 54 organizações distintas que contribuíram para o sucesso desta revista ao longo destes seis anos. Um abraço! Adeus!

Doutora Raquel Vasconcelos
Editora-chefe da *Zoologia Caboverdiana*

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Editorial note

Goodbye!

After six years and eleven issues devoted to this journal, we have realized that it is time to pass the baton over to another so or more enthusiastic hands than my own. It is with pride that I can say that, during this period, the journal has consolidated itself with regular publications, praised by colleagues around the world, more diverse in contents e geographies, and with more authors both from the academy and NGOs. Additionally, it has become a school for clear and precise scientific writing, instituting respect for guidelines, deadlines, and the structure of the scientific method. This issue confirms this pathway, with several authors publishing for the first time, and also the increased relevance of national organizations, which now stand as the most frequent in the total of the affiliations, with national authors becoming the main contributors (with more than five publications).

In this last issue, the first publication is entitled "*High marine predation of loggerhead turtle hatchlings at Boavista, Cabo Verde*." The authors used a visual census and surveys applied to fishermen, fishmongers, and cooks of the island to identify potential predators of *Caretta caretta* hatchlings and to estimate their impact on the near-coast mortality of the species. This study shows that the identified predators are mainly demersal fishes and that the estimated mortality is very high. It is important to highlight that this study should be replicated in other areas and seasons to draw more meaningful conclusions.

The second publication is a short note on "*Reptile monitoring on the natural reserve of Santa Luzia Island."* This work tries to establish the baselines for a periodic monitoring of this terrestrial animal group with exclusively endemic species, all threatened or near-threatened. This monitoring should be, according to the authors, all nationals, repeated annually and at different times of the year, so that conclusions can be drawn regarding population fluctuations.

The third and last publication is a short note that describes, for the first time, interference competition between two endemic birds, the barn owl, and the common kestrel, on Maio Island. The authors of the short note "*Nest site competition between birds of prey on Maio Island, Cabo Verde*," all affiliated as well to national organizations, surveyed with cameras and one telescope a potential nesting site, managing to get unique pictures of this process with it.

I trust you will appreciate this issue and that the new year will bring good changes to all of us. At last, I want to thank to the 108 authors of 14 countries and 54 different organizations that contributed to the success of this journal along these six years. A hug! Goodbye!

Raquel Vasconcelos, PhD
Editor-in-chief of *Zoologia Caboverdiana*

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Artigo original | Original article

High marine predation of loggerhead turtle hatchlings at Boavista, Cabo Verde

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RESUMO

A ilha da Boavista suporta a maior abundância de ninhos da subpopulação do Atlântico Nordeste de tartaruga comum *Caretta caretta*. Cerca de 80–85% estão concentrados no lado este da ilha. Os predadores marinhos nesta área têm um impacto importante sobre os neonatos de *C. caretta* perto da costa. Estudar este impacto permite estimar o recrutamento para posteriormente delinear novas medidas de conservação para a espécie. Este estudo estimou a predação de neonatos de *C. caretta* no mar com base em sensos visuais e inquéritos aos pescadores e peixeiras da Boavista. Os resultados revelaram que os predadores de neonatos são principalmente peixes demersais, especialmente garoupas vermelhas *Cephalopholis taeniops*. A mortalidade estimada perto da costa foi muito alta. A análise do conteúdo estomacal dos predadores revelou que os neonatos não constituem a principal presa dos peixes. No entanto, há a necessidade de reproduzir o estudo em outras áreas da ilha para ter uma visão mais ampla e mais dados para comparações espaciais e temporais.

Palavras-chave: Atlântico Oriental, conteúdo estomacal, inquéritos, peixes, predação

ABSTRACT

Boavista Island supports the highest abundance of nests of the Northeast Atlantic subpopulation of loggerhead turtle *Caretta caretta*. Around 80–85% of them are concentrated on the east side of the island. Marine predators in this area have an important impact on *C. caretta* hatchlings near the coast. Studying this impact allow us to estimate recruitment to later delineate new conservation measures for the species. This study estimated the predation on *C. caretta* hatchlings at sea based on visual census and surveys of fishermen and fishmongers on Boavista. Results revealed that predators of hatchlings are mainly demersal fishes, especially red groupers *Cephalopholis taeniops*. Estimated near-coast mortality was very high. The analysis of stomach contents of predators revealed that hatchlings do not constitute the key prey of fishes. Despite this, there is a need to reproduce the study in other areas of the island to have a broader view and further data for spatial and temporal comparisons.

Keywords: Eastern Atlantic, stomach contents, surveys, fishes, predation

INTRODUCTION

The loggerhead sea turtle *Caretta caretta* population of the East Atlantic is listed as threatened by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Casale & Marco 2015). The vast majority of the nests of the Northeast Atlantic are in the Cabo Verde Archipelago (Wallace *et al*. 2010). This increases the importance of the conservation actions of the species in this archipelago (Monzón-Arguello *et al*. 2010). In Cabo Verde, Boavista is the main nesting area, with 80–85% of the total nesting occurring along 40 km of beach in the eastern half of the island (Marco *et al*. 2012, Laloë *et al*. 2020, Patino-Martinez *et al*. 2021).

Hatchlings entering the sea are highly vulnerable to predation (Witherington & Salmon 1992, Thums et al. 2019). The abundance of marine predators in the coastal area has an important role in hatchling survival (Marco *et al*. 2012). Information about predators and predation rates on turtle hatchlings near the coast can be crucial for estimating recruitment (Mazaris *et al*. 2005) and delineating management measures (Booth *et al*. 2019).

Knowledge about predation in turtle hatchlings is still limited (Pitcher et al. 2000), since it has been estimated by following hatchlings with observers in different ways that can scare away its predators or reduce hatchling's swimming speed, thus altering natural predation rates (Stewart & Wyneken, 2004). The vast majority of related studies have too small sample sizes to draw accurate conclusions and many studies are based on theoretical considerations (Witherington & Salmon 1992, Gyuris 1994, Glen 1996). Previous studies show that hatchlings are most often predated in coastal waters, when they are near or crossing coral reefs, artificial structures, and rocky bottoms (Thums *et al*. 2019, Reising *et al*. 2015, Oñate-Casado *et al*. 2021). The rates of predation of hatchlings in the sea obtained for several turtle species so far are highly variable. For instance, Gyuris (1994) obtained predation rates in hatchlings of green turtle *Chelonia mydas* of 31%, Thums *et al*. (2019) of 72% in hatchlings of flatback turtles *Natator depressus* (Garman 1880), Reising *et al*. (2015) and Oñate-Casado *et al*. (2021) of 6.9% and 19.4%, respectively, for hatchlings of hawksbill turtles *Eretmochelys imbricate* (L., 1766). For loggerhead turtles, Türkecan & Yerli (2007) estimated a predation rate of hatchlings of 4.8% after a 30-minutes follow-up. Whelan & Wyneken (2007) found a rate of 4.6% after 15 minutes following *C. caretta* hatchlings after they entered the sea.

The present study is pioneer in Cabo Verde and aims to contribute to the knowledge of loggerhead sea turtle predator species and their hatchling mortality rates at sea.

MATERIAL AND METHODS

The study took place between the 1st of October and the 22nd of November 2020, on Boavista Island that host the main nesting rookery of Cabo Verde (Fig. 1).

Three methodologies were used: surveys, dissection of potential predatory fishes of the turtle hatchlings and follow-up of hatchlings to estimate mortality in coastal waters.

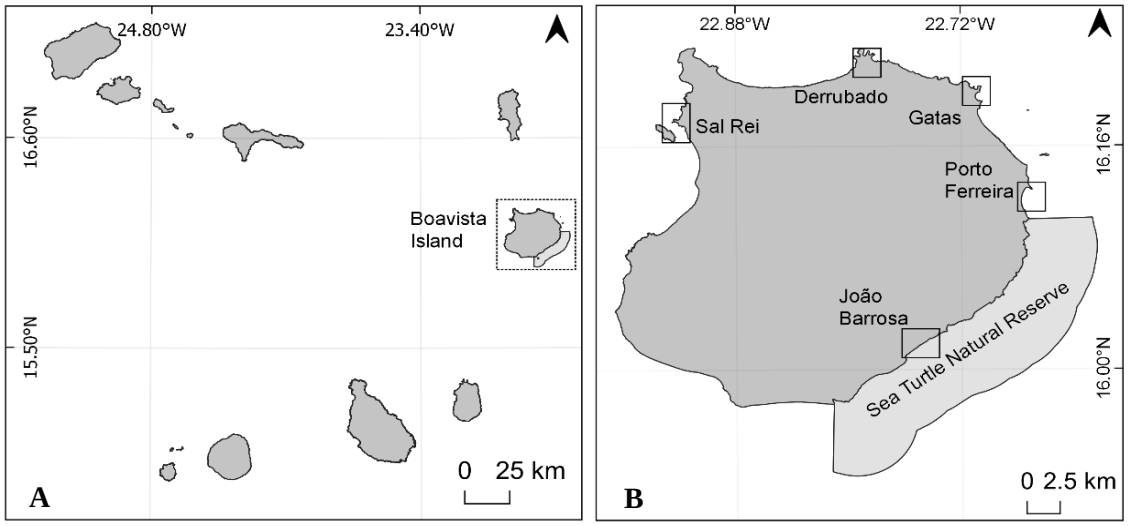

Fig. 1. Study area and study sites. **A)** Map of the Cabo Verde Archipelago, highlighting its location and Boavista Island, the study area. **B)** Location of the study sites. João Barrosa beach (Sea Turtle Natural Reserve) was the site where the follow-up of hatchlings was carried out to estimate mortality in coastal waters. The four harbours on Boavista, where surveys and dissection of potential predatory fish were carried out, are also mapped.

The interviews were oral, anonymous, and registered on data sheets and randomly targeted 66 artisanal fishermen and 23 fishmongers from the main four harbours of the island (Fig. 1), as well as five cooks (as they frequently detect preyed turtle hatchlings when preparing fish) from some restaurants of Sal Rei. The questionnaires directed to fishermen were related to their fisheries and fishing areas while those directed at the fishmongers and cooks were related only to the potential predators. The abundance of nests per zones was obtained from Marco *et al.* (2012).

The morphological analysis of stomach contents of 334 potential predators of 17 different species (1–66 stomachs per species) was performed to verify the presence and relative frequency of loggerhead turtle hatchlings as estimates of the importance of hatchlings in their trophic ecology. Fish species were considered as predators if at least one hatchling was found in the stomachs (Fig. 2).

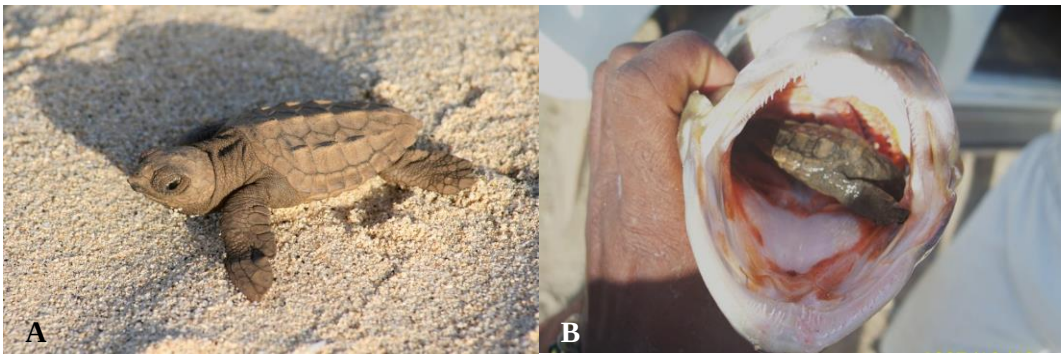

Fig. 2. Loggerhead turtle *Caretta caretta* hatchlings of Boavista, Cabo Verde. **A**) Hatchling found on the beach (photo by A. Marco) and **B**) captured by a fish predator (photo by S. Martins).

The experimental estimation of mortality rate in coastal waters was carried out on João Barrosa beach (Fig. 1). The experiment consisted of a follow-up of individual hatchlings swimming in the sea for 30 minutes and counting how many were captured by fish. Similar methodologies have been used in other studies (Türkecan & Yerli 2007, Reising *et al*. 2015, Thums *et al.* 2019, Oñate-Casado *et al.* 2021). The mortality rate for eight different scenarios was calculated taking into account two scenarios of distance from the shore to the end of the continental platform (6000 and 10000 m), two estimations of the swimming speed of hatchlings (5 and 12 m/min; O'Hara 1980; Wyneken & Salmon 1992), and two experimental estimations of capture rate based in the results of the experimental tests. The experimental capture rate (C) was calculated using the equation: C= Np/ N*100 (Np= number of predated hatchlings; N= number of total hatchlings). The estimate of mortality (M) in time and distance function was made through the equation: M= C*Ns (C= capture rate at different scenarios; Ns= number of surviving hatchlings in 30 min).

RESULTS

A total of 18 fish species were identified as potential predators of turtle hatchlings (Fig. 3). The interviews listed 13 potential predators (Table 1). The bluespotted seabass *Cephalopholis taeniops* was the most frequently mentioned (29.45% of the times) and the blue runner *Caranx crysos* was the second most cited (13.69% of the times). Most fishing areas identified by fishermen largely coincided with *C. caretta* nesting areas.

Seven out of 334 fish individuals corresponding to 18 different species had one loggerhead turtle hatchling in the stomach content. Three hatchlings were found in three bluespotted seabreams and the remaining four in a blue runner, a pigsnout grunt, a golden African snapper and a dusky grouper (Table 1). On average, 2.1% of all fishes had a hatchling on their stomach – 16.2% in demersal fishes and 0.8% in pelagic fishes (Table 1). The 85.7 % of captures of hatchlings were found in demersal species.

Of the 34 monitored hatchlings, one was clearly predated and a second disappeared. Two capture rates were obtained in the first 30 minutes (1/33= 3% and 2/34= 5.9%, if the disappeared hatchling is considered as predated or excluded, respectively. Using these values of experimental hatchling mortality rate, we estimated an average mortality for eight different scenarios of 73.9%, ranging from 40.4 to 98.3% (Table 2).

Fig. 3. Most common potential predators of loggerhead turtle hatchlings in Boavista waters (all photos by A. Louro except mentioned otherwise). **A)** Bluespotted sea bass *Cephalopholis taeniops*, **B)** golden African snapper *Lutjanus fulgens*, **C)** Atlantic emperor *Lethrinus atlanticus*, **D)** brown moray *Gymnothorax unicolor*, **E)** blacktip shark *Carcharhinus limbatus*, **F)** smoothhound *Mustelus mustelus*, **G)** dusky grouper *Epinephelus marginatus* (photo by S. Martins), **H)** island grouper *Mycteroperca fusca*, **I)** yellowfin tuna *Thunnus albacares* (photo by E. P. Lopes), **J)** blue runner *Caranx crysos*, **K)** black jack *Caranx lugubris*, **L)** common dolphinfish *Coryphaena hippurus* (photo by E. P. Lopes), **M)** greater amberjack *Seriola dumerili* (photo by E. P. Lopes), and **N)** wahoo *Acanthocybium solandri* (photo by R. Freitas).

Table 1. Group, common and scientific names of the studied potential fish predators of loggerhead turtle hatchlings. The absolute (Nf) and relative (%f) frequency of individuals of each fish species is mentioned in the surveys and dissected. The number (Nh) and proportion (%h) of individuals of each dissected fish species with loggerhead turtle hatchlings found in their digestive system is also given.

Group	Potential predator		Surveys		Dissections			
	Common name	**Scientific name**	**Nf**	**%f**	**Nf**	**%f**	**Nh**	**%h**
Demersal	bluespotted sea bass	*Cephalopholis taeniops*	43	29.5	74	22.2	3	4.1
	golden African snapper	*Lutjanus fulgens*	1	0.7	62	18.6	1	1.6
	Atlantic emperor	*Lethrinus atlanticus*	2	1.4	18	5.4	0	0.0
	brown moray	*Gymnothorax unicolor*	7	4.8	10	3.0	0	0.0
	sharks and rays	*Elasmobranchii*	19	13.0	9	2.7	0	0.0
	dusky grouper	*Epinephelus marginatus*	16	10.9	7	2.1	1	14.3
	pigsnout grunt	*Pomadasys rogerii*	0	0.0	5	1.5	1	0.0
	Bermuda chub	*Kyphosus sectatrix*	0	0.0	1	0.3	0	0.0
	island grouper	*Mycteroperca fusca*	7	4.8	1	0.3	0	0.0
Pelagic	yellowfin tuna	*Thunnus albacares*	9	6.2	66	19.8	0	0.0
	blue runner	*Carans crysos*	20	13.7	36	10.8	1	13.9
	black jack	*Caranx lugubris*	1	0.7	0	0.0	0	0.0
	common dolphinfish	*Coryphaena hippurus*	15	10.3	16	4.8	0	0.0
	amberjack	*Seriola* spp.	4	2.7	15	4.5	0	0.0
	wahoo	*Acanthocybium solandri*	2	1.4	10	3.0	0	0.0
	yellowmouth barracuda	*Sphyraena viridensis*	0	0.0	2	0.6	0	0.0
	rainbow runner	*Elagatis bipinnulata*	0	0.0	1	0.3	0	0.0
	bluefish	*Pomatomus saltatrix*	0	0.0	1	0.3	0	0.0
All			146	100	334	100	7	2.1

Table 2. Estimation of mortality rate (M) of *Caretta caretta* hatchlings using an experimental study of predation rate and eight ecological scenarios. Different scenarios (Scenario) are the result of combining two capture rates (C) measured in experimental trials conducted during 30 minutes, two estimated mean hatchling swimming speed (Speed) based on personal observations, and two scenarios of distance (Distance) of platform from the shore where predation is more likely.

Scenario	C (%)	Speed (m/min)	Distance (m)	M (%)
1	3.0	5	6000	70.4
2	5.9	5	6000	91.2
3	3.0	5	10,000	87.0
4	5.9	5	10,000	98.3
5	3.0	12	6000	40.4
6	5.9	12	6000	64.4
7	3.0	12	10,000	57.9
8	5.9	12	10,000	81.8

DISCUSSION

In this study, a small portion of fish that were listed as potential predators of *C. caretta* hatchlings around Boavista Island, were proven to be actual predators. These predators belong to the Serranidae, Carangidae, Lutjanidae, Muraenidae and Scombridae families and Elasmobranchii subclass. Species of these families are described as predators of sea turtle hatchlings in other countries in previous studies. For example, Gyuris (1994)

referred serranids, followed by lutjanids and elasmobranchids as the most observed predators in Australia for green turtle hatchlings. Stewart & Wyneken (2004) previously listed a Carangidae species proved to be a predator on Boavista (*Caranx crysos*) as a predator to loggerhead turtle hatchlings in Florida (USA).

The number of stomach samples was low for some species, which may result on a biased low-frequency value of hatchlings in the stomachs of some predators. Thus, sample sizes for some of these species should be increased in future studies. For example, the blacktip shark *Carcharhinus limbatus* (Valenciennes 1839) and the smoothhound *Mustelus mustelus* (L., 1758), even though no hatchlings have been found inside their stomachs, are potentially one of the largest turtle predators following previous studies (Bashir *et al.* 2020). The juveniles of these predator species are abundant in the shallow waters near the nesting beaches of Boavista (S. Martins, pers. obs.). According to Bashir *et al.* (2020), there is often predation of turtle hatchlings near beaches by juvenile sharks that roam around. In addition, the depth and distance of the fishing areas concerning the turtle nesting areas are two factors that may be the cause of low frequencies of hatchlings in fish's stomachs that were brought from local fish markets. According to fishermen, fishing activity usually takes place at more than 10 m deep and the most frequented fishing banks are far from the eastern area of Boavista (Monteiro *et al.* 2008). According to Oñate-Casado *et al.* (2021), as the distance from the coast and depth increases, the risk of turtle predation decreases and the chances of survival increase.

The mortality was estimated at João Barrosa beach, so it is only applicable to ecologically similar areas to the south/ southeast of the island. This is due to the high coastal diversity of Boavista which does not allow generalizing this rate to the whole island. The abundance of marine predators on Boavista and the high density of hatchlings may be the main explanations for the high mortality as both are directly related to predation levels in an area (Pilcher *et al.* 2000, Reising *et al.* 2015). The average mortality rate of hatchlings in different rookeries is highly variable. The results found in Boavista are very different compared to most of the other studies. Mortality rate for loggerhead hatchlings in the first 15 min in the water was 5–26% in Florida (Wyneken *et al.* 2000, Stewart & Wyneken 2004, Whelan & Wyneken 2007). In Australia, mortality in the first hours in the water was 72% for flatback turtle hatchling (Thums *et al.* 2019) and 31% for green turtle hatchlings in the first 15–60 min (Gyuris 1994). The 46.7% of olive ridley hatchlings were predated in the first 2 hours in Pacific Honduras (Pilcher *et al.* 2000). The 57% of hawksbill hatchlings were predated in the water in the first 30 min into the water in Antigua (Reising *et al.* 2015).

In the stomach contents, a maximum of one hatchling was found by individual predator. This may be due to the strategy of hatchlings dispersion after born or the ambush predator's behaviour. According to Scott *et al*. (2014), hatchlings always swim alone, which make it harder for predator to catch more than one individual simultaneously. The low frequencies of occurrence of hatchlings on fish stomachs suggest that are occasional preys in the fish diet. The fact that hatchlings are available for only a maximum of four months per year (Marco *et al*. 2012) may be an important factor to explain why fishes are generalists, especially predators far from the nesting zone. Previous similar studies in Florida showed that only 11 of 217 fishes had a loggerhead turtle hatchling in their stomach (Stewart & Wyneken 2004).

Characterizing predation of hatchlings in coastal waters remain challenging for researchers, as the methods for estimating predation are not very efficient (Stewart & Wyneken 2004). Estimates require assumptions to be made, integrating a large amount of data from fisheries and predators. The present study provides an estimate of the mortality of hatchlings in one beach on Boavista, but the overall estimate for the

entire island was not possible due to the lack of crucial information such as abundance and distribution of predators. For this reason, it is recommended to replicate the study in different parts of the island to have further data for spatial and temporal comparisons. We also advise sampling fish predator's guts in waters close to the turtle nesting beaches to further study their impact.

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Nota breve | Short note

Reptile monitoring on the natural reserve of Santa Luzia Island

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Keywords: Desertas Islands, Cabo Verde, *Chioninia stangeri*, *Tarentola raziana*

The natural reserve of Santa Luzia is presently home to three terrestrial reptile species, endemic to Cabo Verde (Vasconcelos 2015): Bouvier's leaf-toed gecko *Hemidactylus bouvieri* (Bocourt, 1870), Raso wall gecko *Tarentola raziana* Schleich, 1984, and Stanger' skink *Chioninia stangeri* (Gray 1845). In the national red list, these species were classified as Critically Endangered, Endangered and Low Risk, respectively (Schleich 1996), and internationally as threatened or near-threatened (Vasconcelos 2013a, b, c). Previous studies focused mostly on their occurrence, identification and ecology (Schleich 1984, 1987, Vasconcelos *et al.* 2012, 2013), but not on local density estimation. Monitoring species abundance on Santa Luzia may be essential to evaluate the effectiveness of conservation initiatives (Barrows *et al*. 2005). Thus, we aimed to estimate the density of reptile populations on Santa Luzia.

From 25 July to 2 August 2018 we surveyed by day (6 am–6 pm) three random 100m-transects per 1 Km^2 UTM cell throughout the island except in the smaller cells bordering the ocean (check Fig. 1). We checked all favourable refugia and GPS-located all individuals found across 45 cells and 101 transects (Fig. 1).

We found only two of the three reptile species reported to the island: *C. stangeri* skinks and *T. raziana* geckos, both well distributed throughout the island. However, the dune areas south of the island showed very low densities of these species (averages per transects: 1.08±0.32 skinks; 1.12±0.45 geckos).

We found 777 skinks in 86% of transects (1–32 individuals per transect; average= 7.7±0.71), mostly in the northern and central zones (Fig. 1A). We found 968 *T. raziana* geckos (1–73 individuals per transect; average= 9.6±1.34) on 75% of transects, mostly in the north (Fig. 1B).

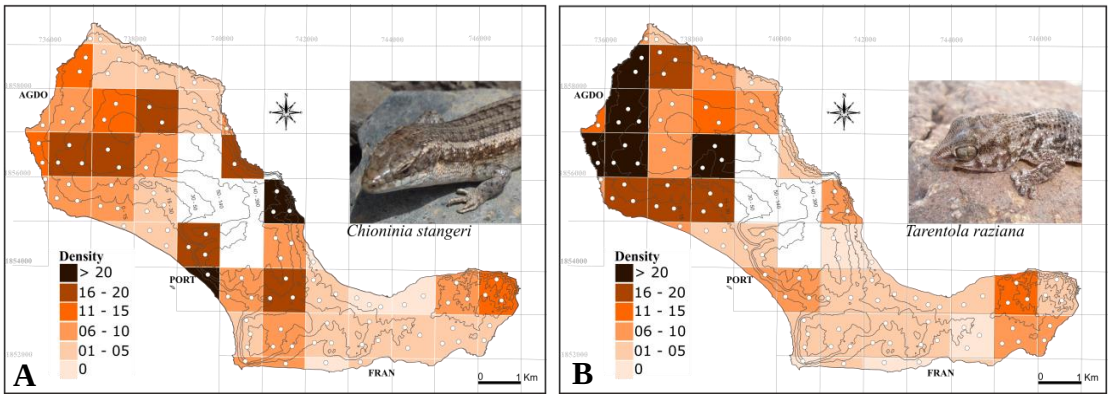

Fig.1. Map of Santa Luzia Island with average densities (individuals per transect and per cell) of two reptile species: **A)** *C. stangeri* (photo by E. Lopes) and **B)** *T. raziana* (photo by K. Delgado). The isolines represent equal elevations, the blank cells unsampled areas, and white dots points of the transects. The three fishermen's camp are mapped: Água Doce (AGADO), Portinho (PORT), and Francisca (FRAN).

Three important points on the island (Portinho, Água Doce, and Francisca) had high densities of both species, probably because they offer more refugees and/ or trophic resources. These areas are the most visited by fishermen (Melo *et al.* 2015), and are thus commensally used by the animals for food, water and artificial refuges. The dune areas showed much lower densities, unlike the rocky areas, due to the scarcity of refuges, similarly to what was previously observed (Geraldes & Melo 2016). Densities were very low or zero in some cells due to lower habitat suitability and/ or detectability. Skinks usually hide in burrows that can be deep, making them hard to spot, and geckos can use deep crevices. The number of individuals found may also change over the time of the day, season, year, or climate conditions (Dickman *et al.* 1999). As sampling was peformed during times of little rainfall, both species densities were considerable low. We recommend repeating this survey to detect seasonal/ annual variations. For monitoring the rare *Hemidactylus bouvieri*, extensive monitoring in mountainous and humid areas is also recommended.

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Nota breve | Short note

Nest site competition between birds of prey on Maio Island, Cabo Verde

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Keywords: coexistence, *Falco (tinnunculus) alexandri*, interspecific interference competition, territoriality, *Tyto alba detorta*

Birds of prey are essential predators for maintaining the balance of the ecosystems in which they occur (Kullberg & Ekman 2000). The coexistence of different species of birds of prey in the same ecosystem is possible and common, because of differentiation in diet, habitat, behaviour and morphology, etc. (Jaksié *et al.* 1981). However, interaction between species can be agonistic, competing for nesting sites, shelter or food (Korpimäki 1987, Hakkarainen & Korpimaki 1996). Interference competition has been observed among several birds of prey (Sergio & Hiraldo 2008). The study of interspecific competition provides a better understanding of community functioning, and ecological relationships (Kullberg & Ekman 2000). Cabo Verde is on the BirdLife International list of Endemic Bird Areas (Stattersfield *et al.* 1998). Knowledge on Cabo Verde seabirds has increased considerably in recent decades, due to conservation and research projects, however, relatively less is known about terrestrial avifauna (Ontiveros 2005). Here we describe in detail the nest-site interference competition between two endemic taxa, the common kestrel *Falco (tinnunculus) alexandri* and the barn owl *Tyto alba detorta*.

The nest, initially occupied by the common kestrel, was located in the Southwest of Maio (15º11'16.2"N, 23º6'7.2"W; Fig. 1). It was installed in a natural cavity at 14.7m height of a sedimentary slope (Fig. 2A). It was daily monitored between September 19 and October 19 2022, using a camera with an infrared sensor (SOLOGNAC-BG500) and a telescope (OPTICRON-MM4-60-ED) set at 400m of distance. Three eggs were incubated alternately by two adults (Fig. 2B). Additionally, two cameras with bait (fish) were installed 300m around the nest to check for predators (cats). A barn owl pair occupied

the nest when the kestrels were absent on the twelfth observation day (Fig. 2C, D). The owls threw the kestrels' eggs out of the nest. The kestrels executed rapid swooping attack flights, accompanied by vocalisations and approaches to the entrance of the nest where the owls remained. The kestrels abandoned the nest definitively, seven days after successive confrontations. The pair of owls continued to occupy the nest. No cats were detected in the nest surroundings.

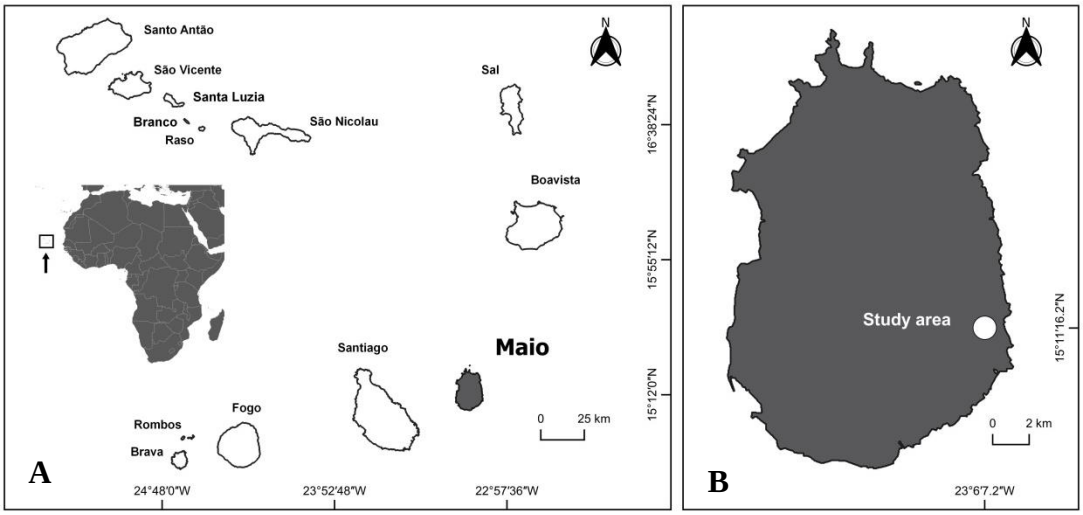

Fig.1. Study area. Maps showing the **A)** location of Cabo Verde on the west coast of Africa, the Cabo Verde Archipelago, **B)** Maio Island and the study area (marked in white).

Fig. 2. Nest location and results from nest observations (photos by FMB's nature wardens). **A)** Sedimentary slope in the bed of a stream where the nest disputed between the two birds of prey was located. **B)** Nest with eggs incubated by a pair of common kestrel *Falco (tinnunculus) alexandri*. **C)** Invasion and **D)** occupation of the nest by a pair of barn owls *Tyto alba detorta*.

It has been shown that these birds of prey also compete for nesting sites in Cabo Verde, in this case with advantage for the barn owl. Interference competition for nesting sites among birds of prey is a well-known phenomenon (Zuberogoitia *et al.* 2005, Preusch & Edelmann 2010) particularly common when suitable nesting sites are in short supply (Forero *et al*. 1996, Hakkarainen & Korpimaki 1996). In this case, the larger body size of the barn owl seems to provide dominance against the common kestrel. We suggest that the characterization and study of the availability of nesting sites and the nesting success of the different resident raptors on the island of Maio should follow. This information can provide indication if the breeding success of the common kestrel is limited by interference competition for nest sites.

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Capa | Front cover

Francelho/Filili *Falco (tinnunculus) alexandri* fotografado na ilha do Maio, 27 de Setembro 2022 | Common kestrel *Falco (tinnunculus) alexandri* photographed on Maio Island, 27 September 2022 (fotografia de | photo by FMB's nature wardens).

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