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Zoologia Caboverdiana é uma revista científica com arbitragem científica (*peer-review*) e de acesso livre. Nela são publicados artigos de investigação original, artigos de síntese e notas breves sobre Zoologia, Paleontologia, Biogeografia, Etnozoologia e Conservação nas Ilhas de Cabo Verde. Também publicamos artigos originais ou de revisão de uma área geográfica mais ampla desde que debruçados sobre espécies que ocorrem no arquipélago de Cabo Verde.

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Nota editorial

Um Bom Ano novo recheado de ciência!

É com grande alegria, e imbuída do contagiante espírito Natalício que se vive na Macaronésia, que apresento o segundo número do sexto volume desta revista. Este número consolida o novo rumo traçado no início de 2016, que apostou na renovação do corpo editorial e na ampliação do âmbito da revista para novas áreas científicas. Consolida ainda a internacionalização da revista, apresentando artigos com autores de nacionalidade portuguesa, espanhola, escocesa e estado-unidense, marcando simultaneamente a importância da língua portuguesa e da participação activa dos estudantes, investigadores e naturalistas *fidj di téra*. Neste novo número, os artigos apresentam primeiramente o resumo nesta que é a língua oficial de Cabo Verde e só depois em inglês, para facilitar a disseminação da informação científica aqui publicada a nível nacional mas também pela comunidade de países de língua portuguesa.

Este número é constituído por uma nota breve, acerca da primeira observação de falsa-orca *Pseudorca crassidens* nas águas de Cabo Verde, e dois artigos originais, um deles descrevendo uma espécie nova para a ciência, mostrando assim uma melhoria de conteúdos relativamente ao anterior, constituído apenas por notas breves. Anuncio também com grande prazer que estes dois artigos são fruto das bolsas concedidas através do Fundo SCVZ das Desertas, criado inteiramente com a receita das vendas do livro *Cabo Verde – História Natural das ilhas Desertas/ The Natural History of the Desertas Islands – Santa Luzia, Branco and Raso.*

O primeiro artigo é resultante do projecto atribuído em 2016 à cabo-verdiana Kátia Santos, da Associação de Biólogos e Investigadores de Cabo Verde, e designado *Caracterização, distribuição e abundância da população de rabo-de-junco,* Phaethon aethereus *(Linnaeus 1758), no ilhéu Raso, Cabo Verde*, que foi concluído precisamente há um ano. A segunda bolsa atribuída a nacionais em 2016, associada a um projecto que foi concluído apenas em Outubro deste ano, terá brevemente resultados visíveis nesta revista. A primeira bolsa concedida a estrangeiros em 2016, à portuguesa Amanda Sousa, já viu os resultados do projecto associados à mesma publicados no número anterior deste volume e espero que o novo ano traga o ansiado manuscrito resultante da bolsa concedida ao Professor Mike Brooke da Universidade de Cambridge.

O segundo artigo é parcialmente consequência do projecto de Stiven Pires, apoiado pelo mesmo fundo no presente ano, que incide na *Identificação taxonómica e mapeamento das espécies de* Africonus *(Mollusca: Gastropoda) presentes na ilha de Santa Luzia, Cabo Verde* e que irá tentar confirmar as observações empíricas nessa ilha da nova espécie descrita por Tenório *et al.* neste número. O projecto financiado este ano a um estrangeiro, Eduardo Sampaio, está ainda em curso, pelo que só veremos os resultados publicados nesta revista no próximo ano, que desejo que seja recheado de oportunidades para realizar boa ciência. *Um Bom One de 2018!*

Doutora Raquel Vasconcelos
Editora-chefe da *Zoologia Caboverdiana*

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Editorial note

A good New Year filled with science!

It is with great joy and imbued with the contagious Christmas spirit lived in Macaronesia that I present the second issue of the sixth volume of this journal. This issue consolidates the new path tracked the beginning of 2016, which focused on the renewal of the editorial board and the broadening of the scope of the journal to new scientific areas. It also consolidates the internationalization of the journal, presenting articles authored by Portuguese, Spanish, Scottish, and North Americans, while highlighting the importance of the Portuguese language and of the active participation of Cabo Verdean students, researchers and naturalists (*fidj de téra*). In this new issue, the articles first present an abstract in the official language of Cabo Verde, to facilitate the dissemination of the published scientific information at a national level and also to the community of Portuguese-speaking countries, and only then in English.

This issue is constituted by one short note, about the first observation of false killer whales *Pseudorca crassidens* in Cabo Verdean waters, and two original articles, one of them describing a new species to science, showing thus an improvement of contents with respect to the previous one, only composed by short-notes. It also gives me great pleasure to announce that these two articles are outcomes of the awards granted through the SCVZ Desertas Fund, created entirely from sales revenue from the book *Cabo Verde – História Natural das ilhas Desertas/ The Natural History of the Desertas Islands – Santa Luzia, Branco and Raso.*

The first article results of a project granted to the Cabo Verdean Kátia Santos, of the *Associação de Biólogos e Investigadores de Cabo Verde* in 2016, entitled *Characterization, distribution and abundance of the red-billed tropicbird,* Phaethon aetherus *(Linnaeus 1758), in the Raso Islet, Cabo Verde*, and concluded precisely one year ago. The second grant awarded to nationals in 2016, associated to a project concluded only in October this year, will soon have visible outcomes in this journal. The first grant given to foreigns in 2016, to the Portuguese Amanda Sousa, already saw the upshots of the awarded project published in the previous issue of this volume, and I hope that the New Year will bring the longed manuscript resulting from the grant awarded to Professor Mike Brooke of Cambridge University.

The second article is partially an outcome of Stiven Pires' project, supported by the same fund this year, which focus on the *Taxonomical identification and mapping of* Africonus *species (Mollusca: Gastropoda) on Santa Luzia Island*, and that will try to check on that island the empirical observations of the new species described by Tenório *et al.* in this issue. The project financed this year to a foreign, Eduardo Sampaio, is still ongoing, so we will only see the results published in this journal the next year, which I wish to be filled with opportunities to conduct good science. *Um Bom One de 2018!*

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

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Artigo original | Original article

Analysis of population size and distribution of *Phaeton aethereus* (Linnaeus, 1758) on Raso Islet, Cabo Verde

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RESUMO

O tamanho populacional e a distribuição do *Phaethon aethereus* no ilhéu Raso foram estudados de Agosto a Dezembro de 2016. No total, recolheram-se dados de 42 variáveis biométricas de 38 adultos e quatro juvenis, e destes 41 indivíduos foram anilhados. Embora se tenham marcado alguns indivíduos em 2014, não se registou nenhuma recaptura. As médias das variáveis biométricas, obtidas para os diferentes segmentos do corpo e dos ovos, enquadram-se no intervalo de valores de *P. aethereus mesonauta* do Atlântico Norte tropical. Os dois maiores aglomerados de *P. aethereus* identificados no Raso encontram-se sobrepostos com colónias de alcatraz *Sula leucogaster*, o que permitiu uma contagem directa máxima de apenas 90 indivíduos. A existência de locais de difícil acesso permitiu a identificação e monitorização de apenas 117 ninhos. A população estimada a partir do número de ninhos foi de mais de 100 pares de indivíduos. Porém, sem que haja um censo anual é difícil estimar o tamanho populacional desta espécie. Portanto, para conhecer melhor a dinâmica populacional de *P. aethereus* no Raso recomenda-se estudos anuais.

Palavras-chave: rabo-de-junco, medidas biométricas, fenologia de reprodução

ABSTRACT

The population size and distribution of *Phaethon aethereus* on Raso Islet was studied from August to December 2016. In total, 42 biometric measures were collected from 38 adults and four juveniles. No recapture was identified although some individuals were ringed in 2014. The means of biometrics variables obtained for the different body segments and eggs were within the ranges of *P. aethereus mesonauta* from tropical North Atlantic. The two largest agglomerations of *P. aethereus* identified on Raso were overlapping colonies of brown boobies *Sula leucogaster* which allowed the maximum direct count of only 90 individuals. The inaccessibility of some breeding areas conditioned the identification and monitoring of just 117 nests. Thus, we estimate the population by the number of nests in more than 100 pairs. However, without an annual census, it is difficult to estimate the population size of this species. So, annual studies are recommended to better understand the population dynamics of *P. aethereus* on Raso.

Keywords: red-billed tropicbird, biometric measures, breeding phenology

INTRODUCTION

The red-billed tropicbird, *Phaethon aethereus* (Linnaeus, 1758), is a seabird with a distribution extending along the tropical and subtropical waters of the Atlantic oceans, northern Indian and eastern Pacific, which nests on cliffs. The spawning cycle of the species is about 11 months, laying one egg only which is incubated for 42 days (Castillo-Guerrero *et al*. 2011, BirdLife International 2013). Although it has a wide distribution area, the global population is estimated at less than 8000 breeding pairs (Lee & Walsh-McGehee 2000) and it is suspected to be declining due to predation, marine pollution and habitat destruction (BirdLife International 2013).

In the Cabo Verde Archipelago, colonies of red-billed tropicbirds were confirmed on the islands of Sal, Boavista, Santiago, Brava and Santo Antão, and on the islets of Raso and Rombo (Hazevoet 1995, Clarke 2006). Also, it has been observed on Passáros Islet, off São Vicente (Hazevoet 2010), on Fogo Island (Barone & Hering 2010) and recently Martins *et al*. (2017) described a new breed site on São Nicolau Island and they reported two locations on the coast of São Vicente. Locally, the red-billed tropicbird population has been declining (Hazevoet 1994) due to harvesting of adults and chicks, theft of eggs and in total it does not exceed 160 couples (INIDA 2007). This is the reason why, in the National Red List, this species is classified as Critically Endangered on the islands of Boavista and Sal, and Endangered on Santiago and Brava islands, and Raso and Rombo islets (Hazevoet *et al.* 1996). There is on Raso one of the largest colonies in the country, but also is where human predation was higher (Hazevoet 2010). However, there are no studies that specifically addressed this species. Presently, all the scarce data about *P. aethereus* was collected taking advantage of campaigns with other seabirds performed on Raso in 2014 and 2015 (Geraldes *et al*. 2016).

Thus, in order to know the population size and the distribution of the species on Raso, and to complement and improve the work already begun, local prospects were carried out for identifying its nests, the presence of adults, incubating adults, juveniles, chicks and nests. Therefore we aim to estimate the number of couples, collect biometric data and respective ringing of captured specimens.

MATERIAL AND METHODS

The Raso Islet is situated at northeast of the Cabo Verde Archipelago (Fig. 1A), west of São Nicolau Island, between the parallels 16º 36 'and 16º 37'N and the meridians 24º 34' and 24º 36'W. With circa 7 km^2, it is considered the largest islet of the archipelago. It is a very arid islet but it has great biodiversity, mainly in terms of seabirds and it is part of a Natural Reserve of Santa Luzia, Branco and Raso (Vasconcelos e*t al.* 2015).

The monitoring work was carried out on Raso from August to December 2016. We collected data on nests contents, classified as single adult, chick, egg or empty, and biometric measurements of captured adults. The length of the head, body and wings was measured in millimeters with a ruler. The length of the bill and tarsus, and the maximum width and height of the eggs were taken with a calliper. The weight was taken in grams with a bascule. The captured individuals were ringed in case of absence of any previous identification. Each nest was marked with white ink on the soil using as code the first letter of the name of the species plus the sample number (ex: PA12), and its respective location was recorded on a portable Global Positioning System (GPS) device. All information was organized into a database. Graphs were drawn for the different development stages and the contents of the identified nests using EXCEL. We used the direct counting method to estimate the population size and the number of nests. The coordinates were introduced in GPSVisualizer (http://www.gpsvisualizer.com/) to map the distribution of the identified nests.

Fig 1. Study area. **A**) Geographical location of Raso Islet in the Cabo Verde Archipelago and **B**) location of *Phaethon aethereus* nests on Raso Islet in 2016, with areas of greater density marked with a red circle, and the centroid of the islet marked with an X (latitude: 16.61791, longitude: -24.5877, coordinates in decimal degrees, datum WGS84).

RESULTS AND DISCUSSION

In total, data from 42 biometric variables were collected. We have measured 38 adults and four juveniles, and 41 of those individuals were ringed. Of the ringed individuals, no recapture was registered although Geraldes *et al*. (2016) had ringed some individuals in 2014.

Biometric measures obtained from the body segments in adults and their eggs were within the ranges of *P. aethereus mesonauta* of the tropical North Atlantic (Table 1). This corresponds to the subspecies that reproduces on Cabo Verde (Cramps & Simmons 1977, Furness & Monteiro 1995). The mean values obtained by Furness & Monteiro (1995) of 56.6 by 43.4 mm on the first record of *P. aethereus* posture in the Azores, are also within the length and width range of the eggs we have measured for the same species on Raso.

Table 1. Biometric variables measured on adult and egg individuals of *Phaethon aethereus* on Raso Islet (mean ± standard deviation, SD). The length and height variables were measured in millimeters and the weight in grams**.** N stands for the number of samples; Max and Min for maximum and minimum values, respectively.

Variables	**N**	**Mean ± SD**	**Max**	**Min**
Head Length	37	121 ± 3	127	111
Body Length	38	167 ± 13	196	151
Wing Length	37	313 ± 28	334	223
Tarsus Length	38	31 ± 1	33	28
Tail Length	34	518 ± 96	679	195
Bill Length	38	65 ± 3	71	56
Bill Width	38	12 ± 1	15	8
Bill Height	38	22 ± 1	24	20
Weight	37	652 ± 51	750	560
Egg Height	11	55 ± 10	65	42
Egg Width	11	49 ± 7	58	43

It was not possible to check differences relative to the sex of the individuals. Even though according to Nunes *et al.* (2013) males are relatively larger and have relatively bills, wing cords and tails larger than females, in the current study it was not possible to see this pattern. So, we consider that sexual dimorphism in this population is apparently very limited.

We counted on Raso 117 accessible or visible nests. The areas with the highest density correspond to the southern areas of the islet and those of lower density to the comparatively more inaccessible north/ northeast areas (Fig. 1B). This difference in densities is a result of biased sampling as the latter areas of the islet were not sampled due to the existence of steep and unsafe cliffs.

The two main agglomerations of *P. aethereus* on the southern areas of the islet overlapped with the mains colonies of brown boobies *Sula leucogaster*.

In 33.3% of the identified nests it was not possible to know its content. Those corresponded to inaccessible or very deep nests. In the accessible nests, 28.2% were empty, perhaps abandoned but containing signs of previous occupancy, 13.7% had one adult with an egg, 11.1% single adult, perhaps preparing for spawning or in incubation, and only 0.9% of the nest contained an adult with a juvenile (Fig. 2). Of the occupied nests, we have verified during data collection the occurrence of 40% and 20% mortality of chicks and juveniles inside the nests, respectively, and 11.1% of broken eggs. This mortality appeared to be natural and it may have been caused by the movement of the parents during the entry or exit of the nests or possibly also due predation by the giant wall gecko *Tarentola gigas*, as individuals of this specie have already been observed preying eggs and chicks of other seabirds on Raso, such as the Cape Verde shearwater *Calonetris edwardsii* (Hazevoet 1995). Hence, for conclusive information studies to evaluate the diet of *T. gigas* and the interaction with *P. aethereus* are recommended.

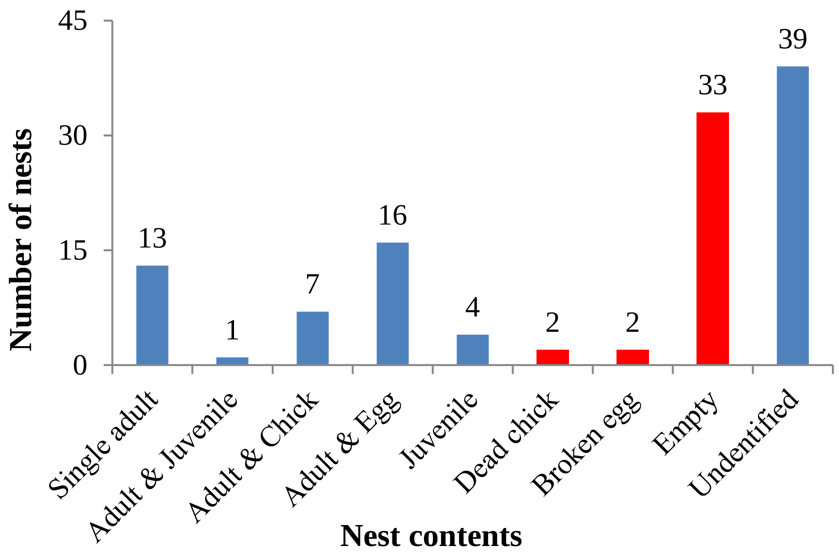

Fig 2. Representative graph of the contents of the nests of *P. aethereus* on Raso islet.

In Cabo Verde, the threats that may lead the mortality of red-billed tropicbird population are related to habitat destruction, human predation at nesting sites of adults, juveniles and eggs and of adults at sea for food purposes (INIDA 2007). Over the years, human predation has had an extremely negative impact on the populations of seabirds on Raso. Currently, although the mortality of seabirds by human action has decreased, thanks to the presence of the Biosfera I team and the awareness policy with fishermen, an effective effort is needed to increase vigilance by the government in order to reduce human interference in this islet (Almeida 2014). Due to the lack of an effective surveillance system and the depletion of fishery resources elsewhere, in 2015 Raso Islet had an increase in the number of fishermen (Geraldes *et al.* 2016). This may threat seabird species in this area by increasing direct and indirect mortality, through introducing of litter in the nests and increasing the likelihood of invasive species such as rats to enter the islet.

Regarding the population size of *P. aethereus* on Raso, we estimated more than 100 pairs of individuals based on the number of nests. The maximum direct count was only 90 individuals, but maybe this is due to the presence of a large number of red-billed tropicbird specimens next to the brown boobies, which made the counts very difficult. These results are close to the numbers indicated by Geraldes *et al.* (2016) that registered 88 specimens in 2014 by direct counts. The same authors registered by direct prospection 70 active nests, of which 54 were occupied, and an estimated reproductive population of 50 to 100 pairs in 2015.

According to Lee & Walsh-McGehee (2000), it is difficult to estimate the size of tropical bird populations, as is the case of *P. aethereus*, mainly due to problems that include inability to access colonies or observation points, ideal time of visit, the variability of behaviour and number of individuals in each colony, since birds are not always present in the nests and the intervals between the change of incubation partners or feeding of the young can last several days. Population estimation through detection of individuals in their nest/ borrow or clear signs of former usage as a nesting site (e.g. feces, feathers) appears to be complicated for the red-billed tropicbird on Raso Islet due to the existence of inaccessible cliffs and the coexistence of mixed seabird colonies. Indeed red-billed tropicbird colonies were found to spatially overlap with those from *S. leucogaster*, *C. edwardsii*, Cabo Verde little shearwater *Puffinus assimilis boydi*, Bulwer´s petrel *Bulweria bulwerii* and Madeiran storm-petrel *Oceanodroma castro* (Almeida 2014).

All the factors above can cause underestimation or overestimation of the population size, so it is important that they all be considered when estimating the size of the breeding population. Also for *P. aethereus* the determination of its reproductive population makes it even more difficult without an annual census because it reproduces throughout the year (Geraldes *et al.* 2016).

CONCLUDING REMARKS

According to INIDA (2007), 33.3% of the red-billed tropicbird population is located in Integral Reserves and 11.1% in Natural Parks, which can confer great advantages for future research. This work refers to data from a protected area, thus it is important for the scientific community since there is little available information for this species, and still serves as the basis for future conservation projects. In this regard, to better understand its dynamics and population size, both on Raso and throughout the archipelago, studies involving annual data of *P. aethereus* are recommended.

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Artigo original | Original article

DNA sequences disclose a new species of *Africonus* cone snail from São Vicente (Gastropoda: Conidae)

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RESUMO

A sequenciação de genomas mitocondriais completos de espécies de búzios do (sub)género *Africonus*, endémicos de Cabo Verde, permitiu reconstruir as relações filogenéticas entre estas e delimitar e validar o estatuto taxonómico das mesmas. Embora hoje se saiba que muitas espécies descritas são na verdade sinonímias, existem ainda algumas que apresentam divergências nas sequências de ADN suficientemente robustas para merecerem o estatuto de espécie. Este é o caso de algumas populações encontradas na ilha de São Vicente que aqui é descrita como uma nova espécie. A nova espécie assemelha-se na morfologia da concha a *Africonus miruchae* (Röckel, Rolán & Monteiro, 1980), espécie endémica da ilha do Sal, e no seu relacionamento filogenético com *Africonus denizi* Afonso & Tenorio, 2011, endémica de São Vicente. As três espécies apresentam ainda diferenças significativas na morfologia radular.

Palavras-chave: molusco, genoma mitocondrial, endemismo

ABSTRACT

The sequencing of complete mitochondrial genomes of cone species belonging to the (sub)genus *Africonus*, which is endemic to Cabo Verde, has allowed the reconstruction of phylogenetic relationships among these species, as well as delimitation and validation of their taxonomic status. While several species were found to be synonyms, some populations had enough DNA sequence divergence to merit the species status. This is the case of some populations inhabiting São Vicente, which are hereby described as a new species. The new species shares similarity in shell morphology to *Africonus miruchae* (Röckel, Rolán & Monteiro, 1980), endemic to Sal, due to convergence, and with *Africonus denizi* Afonso & Tenorio, 2011, endemic to São Vicente, due to close phylogenetic relationship. Additionally, the three species have significant differences in radular morphology.

Keywords: mollusc, mitochondrial genome, endemism

INTRODUCTION

The Cabo Verde Archipelago is renowned for the high number of endemic cone snail species (Rolán 1990, Monteiro *et al.* 2004, Cunha *et al.* 2005, Duda & Rolán 2005, Peters *et al.* 2016). Distributed in only 4000 km^2, the 92 endemic cone snail species represent 9% of the species diversity of the group (Tucker & Tenorio 2013). However, many of the Cabo Verdean cone snail populations require a strict delimitation of their specific status (Abalde *et al*. 2017). Taxonomic identification of cone snails has relied mostly on morphological characters of the shell, such as shape, colour and banding patterns. Yet, these traits are prone to homoplasy leading to under- and overestimations of the real number of species when convergence and local population variability, respectively, are not taken into account (Abalde *et al.* 2017).

Since 2013, we have been conducting a systematic sampling of cone snail populations across the archipelago, gathering material for further comparative studies. The ultimate goal is to reconstruct a statistically robust phylogenetic framework and to integrate it with morphological, ecological, life history, and biogeographical data in order to unravel the evolutionary processes that originated the astonishing diversity of cone snails in this region. First, a robust phylogeny including most of the currently accepted species was recently reconstructed and their taxonomy revised (Abalde *et al.* 2017). DNA sequence divergences below or above a given threshold allowed us postulating synonyms or confirming valid species, respectively (Abalde *et al.* 2017). Additionally, some populations, with sequence divergences above the threshold, were proposed as candidate species. Here, we describe a new species based on two populations previously reported from São Vicente Island (Röckel *et al.* 1980, Rolán 2005), which are morphologically close to *Africonus miruchae* (Röckel, Rolán & Monteiro, 1980) from Sal Island and phylogenetically to *Africonus denizi* Afonso & Tenorio, 2011 from São Vicente.

MATERIAL AND METHODS

Taxonomy follows Tucker & Tenorio (2009, 2013). A map of the localities of the studied specimens was generated using GeoMapApp (http://www.geomapapp.org) (Fig.1). We describe shell morphology using the terminology by Röckel et al. (1995). Adult shells were measured by MJT with digital callipers. The following metric variables were used to describe shell morphometry: SL, maximum shell length; MD, maximum diameter; AH, aperture height; MDH, height of maximum diameter; SH, spire height; RD, relative diameter (MD/AH); MDP, relative position of the maximum diameter (MDH/AH); RSH, relative spire height (SH/SL).

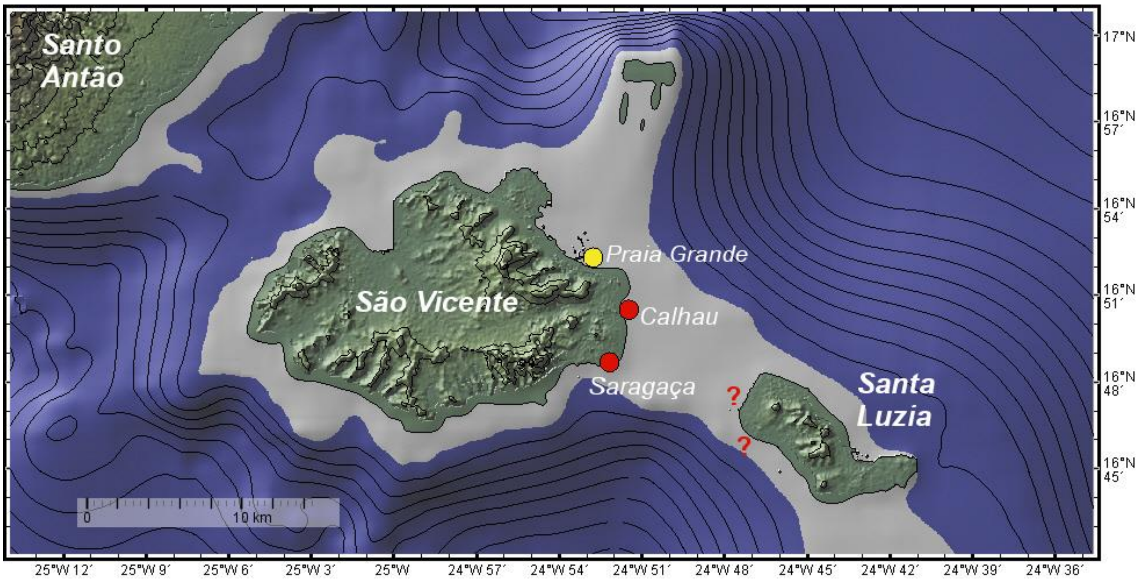

Fig. 1. Map of the localities of the examined specimens of *Africonus* on São Vicente Island. Red dots indicate the locations where specimens of the new species were collected (check Table 1 for further details) and red question marks where the species may also occur. Yellow dots indicate the type locality of *Africonus denizi*. The bathymetric levels are represented by curved lines. Grey areas indicate depths of less than 50 m.

We describe radular morphology using the terminology of Tucker & Tenorio (2009), and variables described in Kohn et al. (1999). Shells containing the dried animal inside were digested in concentrated aqueous KOH for 24h. Released radulas were mounted on a slide using Aquatex (Merck) Mounting Medium, and examined under a microscope. The following metric variables, measured by MJT and ER, were used to describe radular morphometry: SL/TL, shell length/radular tooth length; TL/APL, radular tooth size/anterior portion length; 100BL/APL, 100x blade length/anterior portion length.

Specimens were deposited in several, museums and private collections: MNCN Museo Nacional de Ciencias Naturales, Madrid, Spain; MHNS, Museo de Historia Natural de la Universidad de Santiago de Compostela, Spain; MNHN, Muséum National d'Histoire Naturelle, Paris, France; UCV, reference collection of the University of Cabo Verde; MJT, Manuel J. Tenorio's reference collection, Jerez, Spain. A list of all individuals included in the morphological analyses with their taxonomic identifications, specimen codes, repository institution, voucher references, dimensions, and geographical location data is presented (Table 1).

Table 1. Listing of individuals included in the morphological analyses with their taxonomic identifications, voucher code (with the repository institution and specimen codes), shell dimensions (SL, maximum shell length; MD, maximum diameter), and geographical locations (check Fig. 1).

Species	Type/ Code	Voucher code		SL x MD (mm)	Locality
		Institution	Specimen		
A. freitasi sp. nov.	holotype	MNCN	15.05/200008	13.7 x 7.3	Baía do Calhau, São Vicente
	paratype 1	MNCN	15.05/78562	15.9 x 9.6	same data as the holotype
	paratype 2	MNCN	15.05/200010	15.5 x 9.2	same data as the holotype
	paratype 3	MNCN	15.05/78563	13.4 x 8.2	same data as the holotype
	paratype 4	MNCN	15.05/200012	12.9 x 7.3	Baía de Saragaça, São Vicente
	paratype 5	MNCN	15.05/200013	12.4 x 7.2	same data as the paratype 4
	paratype 6	MNCN	15.05/200014	12.4 x 7.1	same data as the paratype 4
	paratype 7	MHNS	100632	12.5 x 7.1	same data as the paratype 4
	paratype 8	MHNS	100633	10.8 x 5.6	same data as the paratype 4
	paratype 9	MNHN	IM-2014-6870	11.3 x 6.3	same data as the paratype 4
	paratype 10	MNHN	IM-2014-6870	12.3 x 7.2	same data as the paratype 4
	paratype 11	UCV	2017/00002	11.6 x 6.2	same data as the paratype 4
	paratype 12	UCV	2017/00003	10.8 x 5.6	same data as the holotype
A. denizi	Holotype	MNCN	15.05/60000	11.6 x 6.3	Praia Grande, São Vicente
A. miruchae		MJT	–	12.9 x 7.2	Terrinha Fina, North of Sal Island

Nucleotide sequences of 13 mitochondrial protein-coding and two rRNA genes from Abalde *et al.* (2017) were aligned using Translator X (Abascal *et al.* 2010) and MAFFT v7 (Katoh & Standley 2013), respectively. Uncorrected *p* distances were estimated using MEGA (Kumar *et al.* 2016). Phylogenetic relationships were inferred using maximum likelihood (ML) and Bayesian inference (BI). For ML, we used RAxML v8.1.16 (Stamatakis 2006) with the rapid hill-climbing algorithm and 10,000 bootstrap pseudoreplicates (BP). For BI, we used MrBayes v3.1.2 (Ronquist & Huelsenbeck 2003), running 10 million generations, sampling every 1000 generations, and discarding the first 25% generations as burn-in. Best partition schemes and best-fit substitution models were identified using PartitionFinder2 (Lanfear *et al.* 2017).

RESULTS

The results of the morphological and molecular analyses are presented in Table 2 and Fig. 2, respectively. Individuals from Calhau and Saragaça populations are described as a new species from São Vicente given their distinctiveness in several morphological traits (shell size, shell pattern and radular features), and their mitochondrial genome sequence divergences (Fig. 2).

Table 2. Shell morphology variables (SL, maximum shell length; MD, maximum diameter; AH, aperture height; MDH, MD height; SH, spire height) and shell morphometric ratios (RD, relative diameter; MDP, relative MD position; RSH, relative SH), used to compare *A. freitasi* sp. nov., *A. denizi* and *A. miruchae*. The minimum, maximum and average values of each variable for each species are also given.

	Shell morphology (mm)					Shell ratios		
Species	**SL**	**MD**	**AH**	**MDH**	**SH**	**RD**	**MDP**	**RSH**
A. freitasi sp.nov	13.7	7.3	11.0	8.7	2.7	0.66	0.79	0.19
	15.9	9.6	13.7	10.4	2.2	0.70	0.75	0.14
	15.5	9.2	13.1	10.3	2.4	0.70	0.79	0.15
	13.4	8.2	11.5	8.7	1.9	0.71	0.76	0.14
	12.9	7.3	10.8	8.3	2.1	0.67	0.76	0.16
	12.4	7.2	10.7	8.3	1.7	0.68	0.78	0.14
	12.4	7.1	10.3	7.7	2.1	0.69	0.75	0.17
	12.5	7.1	10.9	8.6	1.6	0.65	0.79	0.13
	10.8	5.6	9.4	7.3	1.4	0.60	0.78	0.13
	11.3	6.3	9.4	6.9	1.9	0.67	0.74	0.17
	12.3	7.2	10.5	8.4	1.8	0.69	0.80	0.15
	11.6	6.2	9.2	7.0	2.4	0.67	0.76	0.20
	10.8	5.6	8.8	6.9	2.0	0.64	0.79	0.19
Minimum	**10.8**	**5.6**	**8.8**	**6.9**	**1.4**	**0.60**	**0.74**	**0.13**
Maximum	**15.9**	**9.6**	**13.7**	**10.4**	**2.7**	**0.71**	**0.80**	**0.20**
Average	**12.7**	**7.2**	**10.7**	**8.3**	**2.0**	**0.67**	**0.77**	**0.16**
A. denizi	13.3	7.5	11.2	9.0	2.1	0.67	0.81	0.16
	13.3	7.3	11.0	8.6	2.3	0.66	0.78	0.17
	13.8	7.5	11.2	8.8	2.6	0.67	0.78	0.19
	12.4	6.9	10.5	8.2	1.9	0.66	0.78	0.15
	11.8	6.5	9.7	7.7	2.1	0.67	0.80	0.18
	10.7	5.9	8.8	7.0	1.9	0.67	0.79	0.18
	11.8	6.6	10.0	8.0	1.8	0.66	0.80	0.15
	11.6	6.3	9.7	7.7	1.9	0.65	0.79	0.16
	9.9	5.6	8.2	6.4	1.7	0.68	0.78	0.17
	9.5	5.3	7.9	6.1	1.6	0.67	0.78	0.17
	11.0	6.0	8.8	6.9	2.2	0.69	0.78	0.20
	13.0	7.2	10.6	8.4	2.4	0.68	0.79	0.19
	11.4	6.5	9.5	7.8	1.9	0.68	0.81	0.16
	10.7	5.9	8.6	6.9	2.2	0.69	0.81	0.20
Minimum	**9.5**	**5.3**	**7.9**	**6.1**	**1.6**	**0.65**	**0.78**	**0.15**
Maximum	**13.8**	**7.5**	**11.2**	**9.0**	**2.6**	**0.69**	**0.81**	**0.20**
Average	**11.7**	**6.5**	**9.7**	**7.7**	**2.0**	**0.67**	**0.79**	**0.17**
A. miruchae	10.7	6.3	8.8	6.7	1.8	0.72	0.77	0.17
	13.1	7.5	10.6	8.9	2.4	0.71	0.84	0.19
	12.0	6.8	9.2	7.2	2.8	0.74	0.79	0.23
	12.4	7.5	10.0	7.7	2.3	0.74	0.76	0.19
	11.6	7.1	9.1	7.4	2.5	0.78	0.81	0.22
	14.7	8.1	11.7	9.2	3.0	0.69	0.79	0.20
	11.4	7.1	9.2	7.3	2.1	0.77	0.79	0.19
	12.6	7.2	10.6	8.4	2.0	0.68	0.80	0.16
	12.6	7.0	10.1	8.2	2.4	0.69	0.81	0.20
	13.0	7.6	10.1	8.3	2.8	0.75	0.82	0.22
	12.7	7.2	9.9	8.0	2.8	0.73	0.81	0.22
	11.1	6.4	8.6	6.6	2.5	0.75	0.76	0.22
	11.8	7.3	9.6	7.4	2.2	0.76	0.78	0.19
	11.3	6.7	8.7	7.5	2.6	0.76	0.86	0.23
	11.4	6.6	9.3	7.5	2.1	0.71	0.81	0.18
Minimum	**10.7**	**6.3**	**8.6**	**6.6**	**1.8**	**0.68**	**0.76**	**0.16**
Maximum	**14.7**	**8.1**	**11.7**	**9.2**	**3.0**	**0.78**	**0.86**	**0.23**
Average	**12.1**	**7.1**	**9.7**	**7.8**	**2.4**	**0.73**	**0.80**	**0.20**

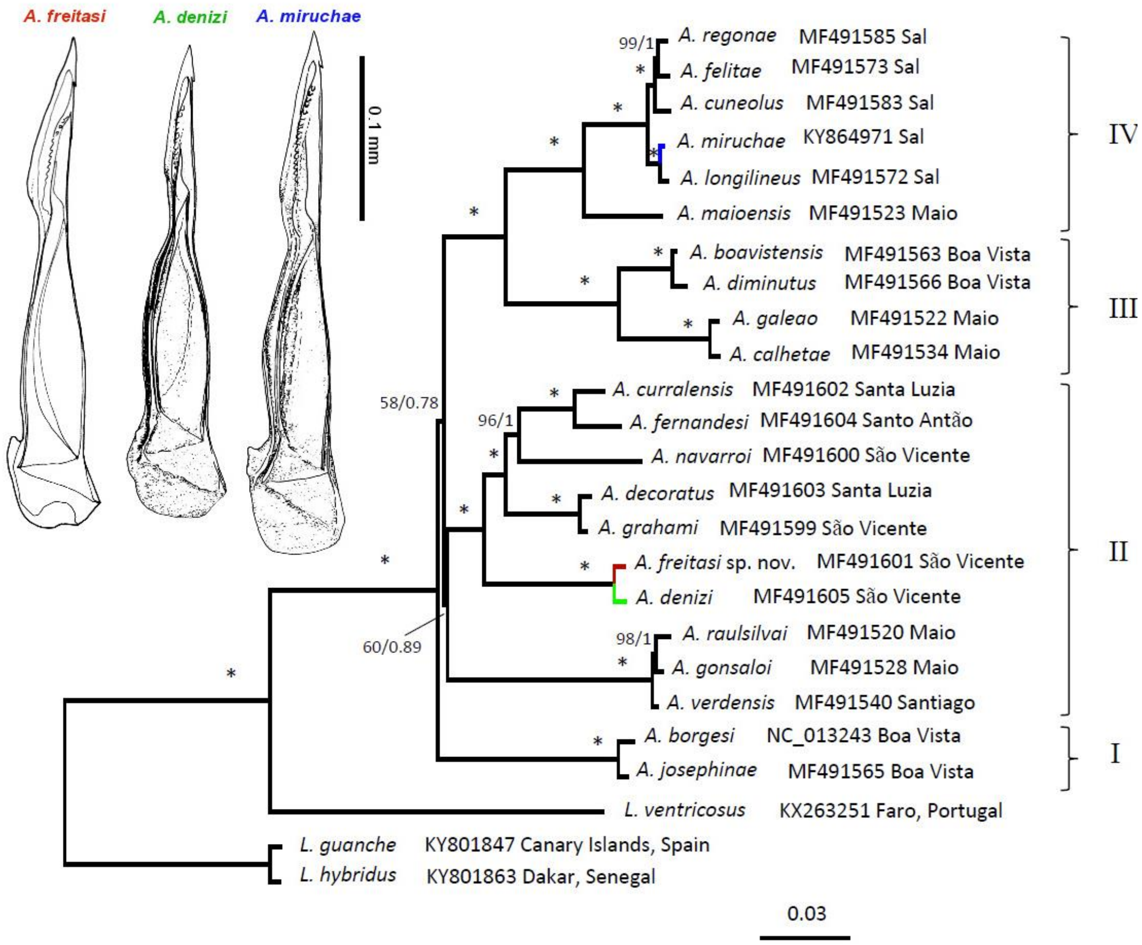

Fig. 2. Phylogeny of *Africonus* from Cabo Verde based on nearly-complete mitochondrial genomes (concatenated protein coding plus rRNA genes analysed at the nucleotide level). Numbers at nodes are statistical support values for ML (bootstrap proportions)/ BI (Bayesian posterior probabilities). An asterisk indicates maximal ML and BI statistical support. Scale bar indicates substitutions/site. Four major lineages (I– IV) were recovered. GenBank accession numbers of the mitochondrial genomes and island distribution are indicated. Cone snails from Senegal and Canary Islands were used as outgroups. The radular teeth of *Africonus freitasi* sp. nov., *A. denizi*, and *A. miruchae* are also represented, all at the same scale.

Africonus freitasi sp. nov.

(Table 1 and 2, Figs. 1– 3)

Conus miruchae Röckel *et al.*, 1980: p. 91 (not *Conus miruchae* Röckel *et al.*, 1980);

Conus sp. Rolán, 2005: plate 50

Type material: holotype and 12 paratypes. The holotype is deposited at MNCN under the number 15.05/200008 (Table 1), and Zoobank registration number: urn:lsid:zoobank.org: act: A322AA12-A3FA-45E7-91BD-1DD8E61E4 C12.

Material examined: a total of 52 specimens, collected on São Vicente Island during several expeditions.

Type locality: Calhau, São Vicente Island, Cabo Verde (16°51.116'N, 24°51.983'W).

Distribution and habitat: the species was found on São Vicente Island, Cabo Verde, in Calhau and Saragaça (Fig. 1). Specimens were collected during low tide or by snorkel in shallow water (0.5–1m), often found in crevices of black volcanic rocks. The report of specimens on Santa Luzia Island (Curral and Água Doce) requires confirmation (Fig. 1).

Fig. 3. A–K) *Africonus freitasi* sp. nov.; **A1–2)** lateral and operculum sides of holotype; **B)** paratype 1; **C)** paratype 2; **D)** paratype 3; **E1–2)** lateral and operculum sides of paratype 4; **F)** paratype 5; **G)** paratype 6; **H)** paratype 7; **I)** paratype 8; **J)** paratype 9; **K)** operculum side of paratype 12; **L)** *Africonus denizi*, holotype; **M)** *Africonus miruchae*. Check Table 1 for further details.

Etymology: the species is named after Rui Freitas, marine biologist and professor at Faculdade de Engenharia e Ciências do Mar, University of Cabo Verde. Rui has conducted extensive research on the littoral ichthyofauna of Cabo Verde Islands and has provided over the years great support to our sampling, which ultimately led to the discovery of the new species.

Diagnosis: *Africonus* characterized by the following combination of morphological characters: shell very small; ventricosely conical to broadly ovate; spire black with white blotches; last whorl black, dark brown or dark olive green with white blotches in spiral bands; radular tooth with 10–15 denticles in the serration not reaching the apical portion; small base with a spur. Additionally, phylogenetic analyses clearly indicate that *A. freitasi* and *A. denizi* are genetically well-differentiated sister taxa with a genetic *p*-distance of 0.4% in the mitochondrial genome.

Description of the shell: morphometric data are presented in Table 2. Shell always very worn and eroded, even for live specimens. Shell very small, broadly and ventricosely conical to broadly ovate in profile. Spire moderate, most often eroded, of straight profile. Teleoconch whorls flat or slightly convex with fine cords. Shoulder rounded. Last whorl sides straight or slightly convex. Spire black with white blotches. Body whorl smooth except for 6–10 spiral grooves present on the basal third of the body whorl. Ground colour of the last whorl black, dark brown or dark olive green. Pattern consisting of white blotches arranged in spiral bands distributed on the shoulder and spire, around the mid-body, and near the base. There is a narrower band of white blotches present below the shoulder. Inside of the outer lip dark brown with two lighter bands. Colour becoming lighter towards the interior of the aperture, which is bluish white deep within. Shells examined very homogeneous in size and pattern, but variable in ground colour (Fig. 3). Periostracum very thin, yellow and translucent. Operculum small.

Living animal and radula: adult animal completely black. Radula studied from five specimens, including paratype 2 (Fig. 2). Between 40–55 teeth in radular sac. Radular tooth of medium relative size (SL/TL = 40–44), narrow and slender, with an almost indistinct apical barb. Anterior section shorter than the posterior section of the tooth (TL/APL = 2.4–2.6). Waist evident but not very pronounced. Blade rounded and not very pronounced, covering most of the anterior section (100BL/APL = 75–83%). Serration with 10–15 denticles, which do not reach the apical portion, arranged in one row ending in a small terminating cusp. Base small, with a spur.

Differential diagnosis: *A. freitasi* sp. nov. (Fig. 3A–K) is similar to *A. denizi* (Fig. 3L) and *A. miruchae* (Fig. 3M) in shell morphology, and in fact it has been confused with these taxa in the past (Röckel *et al.* 1980; Peters *et al*. 2016). However, some subtle differences are observed. *A. denizi* has a predominantly white spire with alternating dark brown axial blotches instead of black with white blotches. Last whorl in *A. denizi* is olive-green to light olive-green, normally patterned with three interrupted spiral bands formed by white blotches tinged with brown to dark brown markings. In *A. freitasi* sp. nov., the ground colour is black or very dark olive green, although the pattern of white blotches might occasionally resemble that of *A. denizi*. The animal in *A. denizi* is dark reddish-grey, but black in the case of *A. freitasi* sp. nov. The two species seem to be allopatric in distribution: *A. denizi* has only been found in São Vicente at Praia Grande, a large, sandy bay north of Calhau, where *A. freitasi* sp. nov. does not occur. The radular teeth of these two species are similar (Fig. 2), but the basal spur is much more prominent and developed in the case of *A. freitasi* sp. nov. The shell of *A. miruchae* is remarkably similar to that of *A. freitasi* sp. nov, The latter has a more elongated shape (RD 0.60–0.71 versus 0.68–0.78 in *A. miruchae*). These two species also differ in radular characters: *A. miruchae* has more denticles in the serration (15–22) reaching the apical portion of the tooth, whereas *A. freitasi* sp. nov. has only 10 to 15 denticles which do not reach the apical portion (Fig. 2).

Phylogeny: The analysed species of *Africonus* were grouped into four main lineages with high statistical support (Fig. 3). *A. miruchae* was placed within lineage IV with other species from Sal Island. *A. denizi* and *A. freitasi* are sister group species placed within lineage II in a clade that also contains species from Santo Antão, São Vicente, and Santa Luzia.

DISCUSSION

Phylogenetic analyses show that *A. freitasi* sp. nov., *A. denizi*, and *A. miruchae* are distinct species despite their partial similarity in shell morphology. The reconstructed phylogenies placed *A. freitasi* sp. nov. sister to *A. denizi*, whereas *A. miruchae* was recovered in a distant clade (Fig. 2). This result reflects the biogeography of these species as *A. freitasi* sp. nov. and *A. denizi* are both found on São Vicente, whereas *A. miruchae* is endemic to Sal. The uncorrected *p*-distance between *A. freitasi* sp. nov. and *A. denizi* was 0.4%, just above the established threshold for species delimitation and validation in this hyperdiverse group (see Abalde *et al.* 2017). The phenotypic resemblance of the shell of *A. freitasi* sp. nov. and *A. miruchae* is possibly the result of convergence given their separate placement in the reconstructed phylogeny and their disjoint distribution in different islands whereas similarity between *A. freitasi* sp. nov. and *A. denizi* may reflects their close phylogenetic relationship (sharing a relatively recent last common ancestor). Nonetheless, the results here obtained should be further corroborated with nuclear sequence data. An interesting evolutionary pattern derived from the phylogeny is that Windward Islands at the northwest tip of the Cabo Verde Archipelago have fewer endemic cone species but of older origin (longer branches in the tree) when compared to geologically older islands as Sal, Boavista and Maio, which hold younger radiations. This pattern may reflect the fewer available niches (intertidal and subtidal rocky shores) in Santo Antão, São Vicente, and Santa Luzia. *A. freitasi* sp. nov. is not an uncommon species in its distribution area, although it is easily overlooked due to its small size. Its conservation status should be evaluated.

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Nota breve | Short note

First record of a live false killer whale *Pseudorca crassidens* (Owen, 1846) in Cabo Verdean waters

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Keywords: cetaceans, marine mammals, melon-headed whale, blackfish, sightings, Brava

Despite the limited research on cetaceans in Cabo Verde waters, 23 species have been documented (Hazevoet & Wenzel 2000, Hazevoet *et al.* 2010, Koenen *et al.* 2013, Berrow *et al.* 2015). The presence of several species is known only from strandings, such as the false killer whale, which has beached dead twice on Boavista in the 1980s–1990s, and again in 2007 (Hazevoet *et al.* 2010, Koenen *et al.* 2013). This is a CITES species, and Data Deficient according to IUCN (Taylor *et al.* 2008).

While passaging from Lisbon, Portugal to Puerto Natales, Chile, a watch was kept almost continuously during daylight from the bridge (12 m above sea level) of a 102 m long expedition cruise ship. During 25 days, mostly in international waters over the abyssal plain, 19 cetacean species were identified. The 12 and 14 October 2017 were spent within the Cabo Verdean Economic Exclusion Zone (EEZ). Although sea conditions were moderate (Beaufort sea state 4), five sightings of five cetaceans species were recorded: short-finned pilot whale *Globicephala macrorhynchus*, melon-headed whale *Peponocephala electra*, false killer whale *Pseudorca crassidens*, and pantropical spotted dolphin *Stenella attenuata* (Table 1). Photographs were used to confirm species identification (Fig. 1). A single beaked whale was also seen, and while not identifiable to species level, the profile, very small body size and pale grey colour was consistent with Gervais' beaked whale *Mesoplodon europaeus*.

Table 1. Date, time, location (coordinates in decimal degrees, datum WGS84), and estimates of group size (N) of cetacean sightings (common name and scientific name are given) in Cabo Verdean waters in 2017. (?) stands for an unconfirmed species identification.

Date	Time	Latitude	Longitude	Common name	Scientific name	N
12/10	11:00	19.503	-23.098	beaked whale	*Mesoplodon europaeus* (?)	1
14/10	07:00	14.135	-25.843	short-finned pilot whale	*Globicephala macrorhynchus*	30
14/10	08:15	14.059	-25.842	melon-headed whale	*Peponocephala electra*	40
14/10	08:45	13.976	-25.873	false killer whale	*Pseudorca crassidens*	2
14/10	17:00	12.099	-26.389	pantropical spotted dolphin	*Stenella attenuata*	100

Fig. 1. Cetaceans seen circa 60 nautical miles (111 km) Southwest of Brava (photos by Conor Ryan). **A)** False killer whale *Pseudorca crassidens*. **B)** A group of melon-headed whales *Peponocephala electra*.

About 60 nautical miles (nm), circa 111 km southwest of Brava, three cetacean species (never mixed) were identified in under three hours (i.e. over 36 nm of survey): short-finned pilot whale, melon-headed whale, and false killer whale. Such species richness, over a comparable distance, was observed nowhere elsewhere on the 6400 nm passage. The two false killer whales approached the ship from abeam and surfed in its wake (Fig. 1A). This is the first confirmed at sea record of false killer whale for Cabo Verde, although has been considered native in these waters (Odell & McClune 1999, Taylor *et al.* 2008).

The record of melon-headed whales (Fig. 1B) is the seventh at sea sighting in Cabo Verde, after sightings on Boavista, Sal, São Nicolau, Santa Luzia, São Vicente and Brava (Hazevoet *et al.* 2010, Berrow *et al.* 2014). Short-finned pilot whales and pantropical spotted dolphins are both among the most frequently recorded cetacean species in the archipelago (Hazevoet & Wenzel 2000, Berrow *et al.* 2006, Berrow *et al.* 2015).

Although brief and opportunistic, our survey provides valuable information on cetaceans within offshore Cabo Verdean EEZ waters. Cetacean surveys in these waters have focused on inshore or inter-island waters, as the primary focus has been on humpback whales *Megaptera novaeangliae* (Hazevoet & Wenzel 2000, Wenzel *et al.* 2009, Ryan *et al.* 2013). Further survey effort offshore using 'vessels of opportunity' (e.g. Correia *et al.* 2016) or by static acoustic monitoring is recommended to improve baseline knowledge of species presence and distribution.

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SOCIEDADE CABOVERDIANA DE ZOOLOGIA

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Capa | Front cover

Africonus freitasi sp. nov. (Gastropoda: Conidae), São Vicente Cabo Verde, (fotografia de | photo by: Manuel J. Tenorio).

Índice | Contents

ISS 2074-5737

Sociedade Caboverdiana de Zoologia