ZOOLOGIA CABOVERDIANA

REVISTA DA SOCIEDADE CABOVERDIANA DE ZOOLOGIA

VOLUME 4 | NÚMERO 1

Abril de 2013

ZOOLOGIA CABOVERDIANA

REVISTA DA SOCIEDADE CABOVERDIANA DE ZOOLOGIA

Zoologia Caboverdiana is a peer-reviewed open-access journal that publishes original research articles as well as review articles and short notes in all areas of zoology and paleontology of the Cape Verde Islands. Articles may be written in English (with Portuguese summary) or Portuguese (with English summary). *Zoologia Caboverdiana* is published biannually, with issues in spring and autumn. For further information, contact the Editor.

Instructions for authors can be downloaded at www.scvz.org

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 e paleontologia das Ilhas de Cabo Verde. Os artigos podem ser submetidos em inglês (com um resumo em português) ou em português (com um resumo em inglês). *Zoologia Caboverdiana* tem periodicidade bianual, com edições na primavera e no outono. Para mais informações, deve contactar o Editor.

Normas para os autores podem ser obtidas em www.scvz.org

Front cover | Capa: Lesser starlet coral *Siderastrea radians* (Pallas, 1766), Baía das Gatas, São Vicente, 18 June 2011 (Cornelis Hazevoet).

 ISSN 2074-5737

Zoologia Caboverdiana 4 (1): 1-7
Available at www.scvz.org

Dragonflies (Insecta, Odonata) collected in the Cape Verde Islands, 1960-1989, including records of two taxa new to the archipelago

Andreas Martens[1], Nuno de Santos Loureiro[2] & Cornelis J. Hazevoet[3]

Keywords: Odonata, dragonflies, Cape Verde, distribution, seasonality, migrants

ABSTRACT

Dragonflies from the Cape Verde Islands, collected between 1960 and 1989 and kept in institutes in Portugal and Cape Verde, were studied. The Cape Verde collection at the Centro de Zoologia, Instituto de Investigação Científica Tropical, Lisbon, Portugal, includes eight species of dragonflies represented by 279 specimens collected in 1960-61 and 1969-72. The entomological collection at the Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA), São Jorge dos Orgãos, Republic of Cape Verde, includes four odonate species, represented by 27 specimens, collected in the years 1987 and 1989. *Anax tristis* Hagen and *A. rutherfordi* McLachlan, single male specimens of which were collected in Santo Antão, 27 October 1972, are new taxa for the archipelago. Both are tropical migrants of which the nearest known occurrence in continental Africa is more than 1,000 and 1,500 km, respectively, from the Cape Verde Islands. The two collections contain several specimens from new localities within the archipelago, particularly from the islands of Maio and Fogo. Current knowledge of flight season and island distribution are summarized and updated.

RESUMO

Neste artigo apresenta-se um estudo de libélulas capturadas nas ilhas de Cabo Verde entre 1960 e 1989, e conservadas em institutos em Portugal e Cabo Verde. A colecção de Cabo Verde existente no Centro de Zoologia, Instituto de Investigação Científica Tropical, Lisboa, Portugal, abarca oito espécies, representadas por 279 exemplares, capturados em 1960 e 1961, e entre 1969 e 1972. A colecção entomológica do Instituto Nacional de Investigação e Desenvolvimento Agrário, São Jorge dos Orgãos, República de Cabo Verde, contém quatro espécies de libélulas, representadas por 27 exemplares, capturados em 1987 e 1989. Dois exemplares, ambos machos, de *Anax tristis* Hagen e *A. rutherfordi* McLachlan foram capturados na ilha de Santo Antão a 27 de Outubro de 1972 e constituem novos taxa para o arquipélago. Ambas são tropicais, manifestam comportamentos migratórios conhecidos, e as ocorrências mais próximas, no continente africano, localizam-se respectivamente a mais de 1000 e 1500 km das ilhas caboverdianas. As duas colecções contribuem com novas localizações no arquipélago de Cabo Verde, especialmente nas ilhas do Maio e Fogo. Por fim, é revisto o actual estado de conhecimento sobre a época de voo e a distribuição inter-insular das diversas espécies de Odonata.

[1] Pädagogische Hochschule, Bismarckstraße 10, 76133 Karlsruhe, Germany; martens@ph-karlsruhe.de
[2] Centro de Biologia Ambiental – ADC, Universidade de Lisboa, and Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
[3] Centro de Zoologia, Instituto de Investigação Científica Tropical - Jardim Botânico Tropical, Rua da Junqueira 14, 1300-343 Lisboa, Portugal

INTRODUCTION

During the past decade, knowledge of the Odonata of the Cape Verde Islands has increased significantly. During the late 19th and early 20th century, a small number of publications dealt with Cape Verde dragonflies (Calvert 1894, Kirby 1897, Martin 1908), but, except for a short note by Lobin (1982), nothing was published on these insects during the remainder of the 20th century. Since 2008, a series of papers (Aistleitner *et al*. 2008, Vieira 2008, Martens 2010, Martens & Hazevoet 2010, Bußmann 2012, Loureiro *et al.* 2013) has significantly improved knowledge of habitats, seasonality and island distribution of Cape Verde Odonata.

The collections at the Centro de Zoologia, Instituto de Investigação Científica Tropical, Lisbon, Portugal, include Cape Verde odonate specimens collected during the years 1960-61 and 1969-72. The collections at the Instituto Nacional de Investigação e Desenvolvimento Agrário, São Jorge dos Orgãos, Santiago, Republic of Cape Verde, contain odonate specimens collected in 1987 and 1989. Here, we present new data on distribution and seasonality of Cape Verde odonates based on specimens in these collections.

MATERIAL AND METHODS

The material in the collection of the Centro de Zoologia, Instituto de Investigação Científica Tropical (CdZ-IICT), consists of two series with independent registration numbers. One series was collected in February 1960 and from November 1960 to March 1961 by Alberto Coutinho Saraiva for the Missão de Estudos Agronómicos do Ultramar (and later transferred to the Centro de Zoologia), while the other resulted from the Missão de Estudos Zoológicos do Ultramar and was collected by Lívio Ernesto Dias Paulos, technician at the Centro de Zoologia, from August to November 1969, in October 1970 and in October and November 1972. The material consists of pinned adult odonates in six insect cases. It has been preserved under rather good conditions and has not been studied before. During work on the collection in August 2012, all specimens could be identified to the species level.

The entomological collection of the Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA) includes a large number of insects. The collection was initiated by Dutch entomologist Antonius van Harten, who worked at INIDA for the German GTZ Cape Verde Integrated Pest Management Project from 1982 to 1990. Odonata constitute only a small part of the collection. The pinned specimens are kept under reasonable conditions in two insect cases.

Each of the specimens in both collections have a metadata label fixed on the pin. Label data include locality, island and date of capture. The IICT collections have a register containing additional data. The INIDA collection does not have supplementary data, but additional data were kindly provided by the collector.

The geographical coordinates given in the list of collecting localities are based on the 1:25,000 topographical maps published during the 1960s by the Serviço Cartográfico do Exército, Portugal, on Google Earth imagery, and on the online cartography and aerial photography provided by the Sistema de Informação Territorial de Cabo Verde (http://visor.sit.gov.cv). Sometimes, when names of collecting localities could not be found in the topographical maps, we asked people in Cape Verde to identify them. Although spelling of some collecting localities was erroneous, we were able to identify most by phonetic similarity.

COLLECTING LOCALITIES

CdZ-IICT (Lisbon, Portugal), Entomological Collections. Coll. Alberto Coutinho Saraiva: 1-xi-1960 to 25-vii-1961; Lívio Ernesto Dias Paulos: 13-viii-1969 to 28-xi-1972. Original record numbers are given in square brackets.

SANTO ANTÃO
(1) Ponta do Sol, Chã: 17º11'56"N, 25º05'24"W, 17-iii-1961 [85]
(2) Ribeira Grande, Chã das Pedras: 17º08'08"N, 25º06'44"W, 19-ii-1961 [90]
(3) Ribeira do Paúl: 17º08'20"N, 25º01'36"W, (a) 22-iii-1961, (b) 23-iii-1961 [206, 93]
(4) Ribeira da Torre, Xôxô: 17º08'26"N, 25º04'04"W, 18-iii-1961 [205]
(5) Ribeira das Patas, Lajedo: 17º01'18"N, 25º09'59"W, 26-iii-1961 [208, 607]
(6) Ribeira da Torre: 17º09'17"N, 25º04'17"W, (a) 21-iii-1961, (b) 28-x-1972 [316, 3758]
(7) Ribeira do Cachaço: 17º03'02"N, 25º11'57"W, 20-x-1972 [3754]
(8) Ribeira das Fontainhas, Ponta do Sol: 17º11'20"N, 25º06'18"W, 27-x-1972 [3757]
(9) Paúl: 17º08'58"N, 25º00'57"W, 13-xi-1972 [3769]

SÃO VICENTE
(10) Ribeiras de Julião e do Seixal: 16º51'23"N, 24º58'51"W, 14-iii-1961 [281, 283]
(11) Baía das Gatas: 16º53'59"N, 24º54'59"W, 28-xi-1972 [3775]

SÃO NICOLAU
(12) Ribeira de Maiama: 16º36'00"N, 24º17'07"W, 19-x-1970 [3630]
(13) Vila da Ribeira Brava: 16º37'02"N, 24º17'28"W, 21-x-1970 [3655]
(14) Caldeira: 16º36'15"N, 24º11'23"W, 29-x-1970 [3675]

MAIO
(15) Vila do Maio: 15º08'17"N, 23º12'39"W, (a) 12-xi-1960, (b) 20-viii-1969 [198, 3569]
(16) Morro, near the sea: 15º10'50"N, 23º13'52"W, 1-xi-1960 [271]
(17) Monte Penoso: 15º13'38"N, 23º07'26"W, 5-xi-1960 [272]
(18) between Chico Vaz and Figueira da Horta: 15º09'43"N, 23º09'19"W, 20-xi-1960 [320]
(19) Lagoa: 15º07'48"N, 23º09'04"W, 13-viii-1969 [3561]
(20) Monte Batalha: 15º12'11"N, 23º11'03"W, 20-viii-1969 [3570]

SANTIAGO
(21) Posto Agrícola de São Jorge dos Orgãos: 15º03'12"N, 23º36'15"W, (a) 11-xii-1960, (b) 17-xii-1960, (c) 19-xii-1960, (d) 21-xii-1960, (e) 20-ix-1969 [242, 91, 243, 230, 3589]
(22) Vale Cachopo, São Francisco: 15º00'02"N, 23º30'15"W, 6-vii-1961 [151]
(23) Achada Mato, São Francisco: 14º56'52"N, 23º29'40"W, (a) 17-vii-1961, (b) 19-vii-1961 [160, 174]
(24) Mulher Branca, São Francisco: 14º55'02"N, 23º29'09"W, (a) 2-vii-1961, (b) 12-vii-1961 (c) 19-vii-1961, (d) 21-vii-1961, (e) 25-vii-1961 [186, 179, 170, 163, 171]
(25) Matão: 14º56'60"N, 23º34'15"W, (a) 13-vii-1961, (b) 14-vii-1961 [185, 168]
(26) Achada da Aguada, São Francisco: 14º57'57"N, 23º29'00"W, 18-vii-1961 [175]
(27) Cidade Velha: 14º55'05"N, 23º36'06"W, 2-i-1961 [231]
(28) Pedra Badejo, Santa Cruz: 15º07'43"N, 23º32'02"W, 6-i-1961 [245]
(29) Ribeira da Longueira, São Jorge dos Orgãos: 15º02'54"N, 23º37'11"W, 31-xii-1960 [286, 349]
(30) Trindade: 14º57'33"N, 23º33'47"W, 4-ii-1961 [290]
(31) Ribeira de Sedeguma, Chão Moreno: 15º06'07"N, 23º41'09"W, 3-ix-1969 [3576]
(32) Achada do Rincão: 15º04'15"N, 23º46'10"W, 4-ix-1969 [3577]
(33) Boa Entrada: 15º06'59"N, 23º40'08"W, 8-ix-1969 [3582]
(34) Santa Catarina: 15º06'56"N, 23º40'37"W, 17-ix-1969 [3586]
(35) Entre Picos: 15º06'47"N, 23º39'10"W, 22-ix-1969 [3591]
(36) Assomada: 15º05'32"N, 23º39'17"W, 4-x-1969 [3602]

FOGO
(37) Monte Barro: 14º53'51"N, 24º28'49"W, 27-ii-1961 [71]
(38) Vila de São Filipe: 14º53'47"N, 24º30'00"W, 2-iii-1961 [348]
(39) Santuário de Nª Srª do Socorro: 14º51'14"N, 24º27'11"W, 4-xi-1969 [3619]

BRAVA
(40) Ribeira da Furna: 14º53'09"N, 24º41'05"W, 10-x-1969 [3604]
(41) Vinagre: 14º52'11"N, 24º40'55"W, 14-x-1969 [3609]

INIDA (São Jorge dos Orgãos, Republic of Cape Verde), Entomological Collections. Coll. Antonius van Harten.

SANTIAGO
(42) Santa Cruz: 15º08'03"N, 23º33'44"W, 19-viii-1987
(43) Serrado: 15º04'15"N, 23º34'34"W, 11-xi-1987
(44) São Jorge dos Orgãos: 15º03'12"N, 23º36'15"W, 4-vii-1989 [same coordinates as locality (21)

SPECIMENS COLLECTED

Anax imperator Leach, 1815
SANTO ANTÃO: (8) 1M 1F.
MAIO: (18) 1F [first record for the island].
SANTIAGO: (29) 3M [first record for the island]; (32) 1M; (44) 1M.
FOGO: (37) 1M [first record for the island].

Anax rutherfordi McLachlan, 1883
SANTO ANTÃO: (8) 1M [first record for the Cape Verde Islands] (Fig. 1).

Anax tristis Hagen, 1867
SANTO ANTÃO: (8) 1M [first record for the Cape Verde Islands].

Crocothemis erythraea (Brullé, 1832)
SANTO ANTÃO: (2) 6M 2F; (3a) 2M; (4) 1M; (5) 2M; (6a) 4M; (6b) 4M 1F; (7) 3M 1F; (8) 2M; (9) 1M 1F.
SÃO VICENTE: (10) 1M; (11) 1M 2F.
SÃO NICOLAU: (12) 4M; (13) 1M; (14) 1M.
MAIO: (17) 1F [first record for the island]; (15b) 7M; (18) 2M; (19) 2M; (20) 4M 1F.
SANTIAGO: (22) 2M; (23b) 3M; (24b) 2M; (24d) 2M; (24e) 1M; (25b) 2M 1F; (26) 1M; (28) 1M; (29) 7M; (30) 1M; (31) 1M; (32) 1M; (33) 2M.
FOGO: (38) 3M.
BRAVA: (41) 1M 1F.

Orthetrum trinacria (Selys, 1841)
SANTO ANTÃO: (2) 1M; (3b) 1M.
SÃO NICOLAU: (13) 1M; (14) 1F.
MAIO: (18) 1M [first record for the island]; (15a) 1M; (16) 1F; (17) 1M.
SANTIAGO: (24c) 2M 2F; (27) 1F; (29) 1M; (30) 3M 1F; (32) 3M 1F; (42) 2M; (44) 1M.

Pantala flavescens (Fabricius, 1798)
MAIO: (18) 1M [first record for the island].
SANTIAGO: (21b) 1F; (33) 1M; (36) 1M; (43) 1M.
BRAVA: (41) 2M.

Trithemis annulata (Palisot de Beauvois, 1807)
SANTO ANTÃO: (1) 2M; (2) 5M; (3a) 1M; (3b) 1M; (4) 4M; (5) 1M; (6a) 1M; (8) 4M; (9) 1M 8F.
SÃO VICENTE: (10) 2M; (11) 2M 4F.
MAIO: (18) 5M 1F [first record for the island]; (15b) 3M; (20) 6M.
SANTIAGO: (21a) 2M; (21c) 1M; (21d) 2M 1F; (22) 1M; (23a) 2M 1F; (23b) 1M; (24a) 1M; (24b) 4M 1F; (24c) 2M; (24d) 1M; (24e) 1M; (25a) 2M; (25b) 1M; (27) 1M; (28) 1M; (29) 27M 3F; (30) 7M; (33) 1M; (34) 1M; (35) 1M; (42) 5M; (43) 17M.
FOGO: (37) 1M [first record for the island].
BRAVA: (40) 2M.

Zygonyx torridus (Kirby, 1889)
SANTIAGO: (27) 1M [first record for the island]; (21e) 1M; (24b) 1M; (31) 1M.
FOGO: (39) 1M [first record for the island].

Fig. 1. Anal appendages of male *Anax rutherfordi*, collected Santo Antão, 27-x-1972 (collecting locality 8).

	StA	SV	SN	Sa	BV	Ma	ST	Fo	Br
Lestes pallidus		+		+	+				
Ischnura senegalensis		+			+				
Pseudagrion glaucescens		+							
Anax ephippiger	+				+	+			
Anax imperator	+	+			+	+	+	+	
Anax rutherfordi	+								
Anax tristis	+								
Brachythemis leucosticta		+							
Crocothemis erythraea	+	+	+	+	+	+	+	+	+
Orthetrum trinacria	+	+	+		+	+	+		+
Pantala flavescens	+	+			+	+	+	+	+
Sympetrum fonscolombii	+	+	+	+	+		+		
Tramea limbata					+				
Trithemis annulata	+	+	+		+	+	+	+	+
Trithemis arteriosa									
Zygonyx torridus	+		+				+	+	+

Table 1. Known distribution of Odonata in the Cape Verde Islands. StA: Santo Antão; SV: São Vicente; SN: São Nicolau; Sa: Sal; BV: Boa Vista; Ma: Maio; ST: Santiago; Fo: Fogo; Br: Brava. New records marked yellow. Data from Calvert (1894), Kirby (1897), Lobin (1982), Aistleitner *et al*. (2008), Vieira (2008), Martens (2010), Martens & Hazevoet (2010), Bußmann (2012), Loureiro *et al*. (2013), and this study. Occurrence of *Trithemis arteriosa* based on a specimen in the Genova museum for which no island locality was given (cf. Martin 1908).

DISCUSSION

The odonate collections reported here fill a significant temporal gap in the Odonata data of the Cape Verde Islands, bringing the number of odonate species known from the islands to 16. We interpret the two new species for Cape Verde, *Anax tristis* and *A. rutherfordi*, as migrants which may not permanently reside and reproduce in the islands. Both specimens were collected at the same locality and date and may have been driven westward from continental Africa by air currents or strong winds. Numerous records of desert locusts in the Cape Verde Islands, as well as further westward over the Atlantic Ocean (e.g. Waloff 1966, Weidner 1969), support this hypothesis.

The range of *A. tristis* includes large parts of sub-Saharan Africa. The species is known as a tropical migrant and it has been reported from a vessel at sea off Angola (Schneider 1982) and from the Indian Ocean islands of Aldabra (Campion 1913) and Réunion (Martiré 2010). The record nearest to Cape Verde is from coastal The Gambia (Prendergast 1998), a distance of *ca.* 1,000 km.

The reddish *Anax* specimen in the IICT collection differs from *Anax speratus* Hagen, 1867 - known to us from Namibian specimens - in having a significant longer epiproct (Fig. 1; K.D. Dijkstra *pers. comm.*). The nearest known locality of a reddish *speratus*-like form, described as *Anax rutherfordi*, is from Sierra Leone (McLachlan 1883), a distance of more than 1,500 km from the Cape Verde Islands. Whereas *A. speratus* is primarily a southern and eastern African taxon, the range of *A. rutherfordi* appears to be restricted to West Africa. Apart from Sierra Leone, it has also been recorded from Togo (Karsch 1893).

The first records for the islands of Maio, Fogo and Santiago reported herein are of species well-known from other Cape Verde islands. As a result, distribution of odonates among the islands

becomes steadily better known and we suggest that the odonate fauna of Cape Verde may not differ significantly between different islands (Table 1). However, the recent construction of large watersheds in the islands of Santiago, São Nicolau and Santo Antão – with standing fresh water present throughout the year – may affect future odonate distribution in these islands.

The lack of any record of a zygopteran in the two collections discussed here is of special interest. The number of records of the damselflies *Ischnura senegalensis* (Rambur, 1842) and *Lestes pallidus* Rambur, 1842 in Cape Verde is very small (Aistleitner *et al.* 2008). This may be due to both species not being permanent residents, but only incidental migrant visitors in the archipelago. Temporal distribution of odonates in the Cape Verde Islands (Table 2) suggests, that resident species are on the wing throughout the year.

	J	F	M	A	M	J	J	A	S	O	N	D
Lestes pallidus												
Ischnura senegalensis												
Anax ephippiger												
Anax imperator												
Anax rutherfordi												
Anax tristis												
Crocothemis erythraea												
Orthetrum trinacria												
Pantala flavescens												
Sympetrum fonscolombii												
Tramea limbata												
Trithemis annulata												
Zygonyx torridus												

Table 2. Known flight season of 13 Odonata species from the Cape Verde Islands (grey fields; new data in yellow). Data from Lobin (1982), Aistleitner *et al*. (2008), Vieira (2008), Martens (2010), Martens & Hazevoet (2010), Bußmann (2012), Loureiro *et al.* 2013, and this study. No seasonal data are available for the >100 year old records of *Brachythemis leucosticta*, *Pseudagrion glaucescens* and *Trithemis arteriosa* (cf. Calvert 1894, Martin 1908).

ACKNOWLEDGEMENTS

The authors are much indebted to Dr Luis Mendes (IICT) for his help, interest and hospitality during their study of collections under his care. NSL wishes to thank Ana Veiga (Direcção-Geral do Ambiente, Praia), Aline Rendall, Gilberto Silva and Manuela Furtado (INIDA) and Antonius van Harten for their help. He also thanks Ermelindo Gomes and Aldair Correia for their help during his study of INIDA's entomological collections. Dr Klaas-Douwe Dijkstra critically read the manuscript and shared his views on the taxonomy of the *Anax speratus*-complex.

REFERENCES

Aistleitner, E., W. Barkemeyer, G. Lehmann & A. Martens, 2008. A checklist of the Odonata of the Cape Verde Islands. Mitteilungen des internationalen entomologischen Vereins 33: 45-57.

Bußmann, M., 2012. Libellen auf Boa Vista, Kapverdische Inseln (Odonata). Libellula 31: 61-75.

Calvert, P.P., 1894. Order Pseudoneuroptera. In: C.V. Riley (ed.), Scientific results of the U.S. Eclipse Expedition to West Africa, 1889-'90. Report upon the Insecta, Arachnida, and Myriopoda. Proceedings of the United States National Museum 16 (for 1893): 582-586.

Campion, H., 1913. Reports of the Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr. J. Stanley Gardiner, M.A., Vol. IV. No. XXVII – Odonata. Transactions of the Linnean Society of London, Ser. 2 – Zoology, 15: 435-446.

Karsch, F., 1893. Die Insecten der Berglandschaft Adeli im Hinterlande von Togo (Westafrika). Libellen – Odonata – von Adeli. Berliner entomologische Zeitschrift 38: 17-48, pls I-IV.

Kirby, W.F., 1897. List of the Neuroptera collected by Mr. E.E. Austen on the Amazons etc. during the recent expedition of Messrs. Siemens Bros. Cable S.S. 'Faraday', with descriptions of several new species of Odonata (Dragonflies). Annals and Magazine of Natural History (Ser. 6) 19: 598-617 + pls XII-XIII.

Lobin, W., 1982. Libellen (Insecta, Odonata) von den Kapverdischen Inseln. Courier Forschungsinstitut Senckenberg 52: 255-256.

Loureiro, N.S., C. Brochard, A. Correia & E. van der Ploeg, 2013. *Orthetrum trinacria* exuviae (Odonata: Libellulidae) from Santiago Island, Cape Verde: morphology, sexual size dimorphism and diagnostic features. Boletin de la Sociedad Entomológica Aragonesa 52: 281-284.

Martens, A., 2010. Ecology of dragonflies (Odonata) at the westernmost spot of Africa, the island of Santo Antão, Cape Verde. International Journal of Odonatology 13: 241-254 + pl. IVa.

Martens A. & C.J. Hazevoet, 2010. Dragonflies (Insecta, Odonata) of São Vicente, Cape Verde Islands: 10 species on a desert island. Zoologia Caboverdiana 1: 112-115.

Martin, R.,1908. Voyage de feu Leonardo Fea dans l`Afrique Occidentale. Annali del Museo Civico di Storia Naturale di Genova (Ser. 3) 3 (for 1907): 649-667.

Martiré, D., 2010. Les Libellules et Ephémères de La Réunion. Biotope & Muséum national d'histoire naturelle, Mèze & Paris. 72 pp.

McLachlan, R., 1883. Two new species of *Anax*, with notes on other dragon-flies of the same genus. The Entomologist's Monthly Magazine 20: 127-131.

Prendergast, E.D.V., 1998. The Gambia: additions to the list of Odonata, and further distribution records. International Journal of Odonatology 1: 165-174.

Schneider, W., 1992. *Anax tristis* Hagen, 1867 (Aeshnidae) and *Tholymis tillarga* (Fabricius, 1798) (Libellulidae) recorded from off Angola (Odonata). Fragmenta Entomologica 23: 243-246.

Suhling, F., R. Jödicke & W. Schneider, 2003. Odonata of African arid regions – are there desert species? Cimbebasia 18: 207-224.

Vieira, V., 2008. First record of *Sympetrum fonscolombii* (Selys, 1840) for the Sal Island, Cape Verde. Boletín de la Sociedad Entomológica Aragonesa 42: 376.

WaIoff, Z., 1966. The upsurges and recessions of the desert locust plague: an historical survey. Anti-Locust Memoirs 8: 1-111.

Weidner, H., 1969. Beobachtungen wandernder Feldheuschrecken auf hoher See. Anzeiger für Schädlingskunde und Pflanzenschutz 42: 118-121.

Received 20 January 2013
Revised 30 June 2013
Accepted 15 November 2013

Zoologia Caboverdiana 4 (1): 8-16
Available at www.scvz.org

Is community-based conservation a feasible option for sea turtles in Sal, Cape Verde Islands?

Nicola Piludu[1] & Jacquie Cozens[2]

Keywords: sea turtles, loggerhead, *Caretta caretta*, conservation, Cape Verde Islands

ABSTRACT

Cape Verde is one of the most important nesting sites for loggerhead turtles *Caretta caretta*, with the island of Sal having the second biggest population in the country. Loggerheads in Sal face a number of threats, from poaching to coastal development. The non-profit organisation SOS Tartarugas was founded in 2008 to ensure the conservation of the species. Community-based conservation (CBC) is one of the most popular strategies for carrying out wildlife conservation in Africa and even though the organisation employs international staff and volunteers, involving Cape Verdeans in the project is one of its main objectives. The implementation of CBC in Sal has however been very difficult. This study employed two different methods, a Delphi survey and semi-structured interviews, to describe the desirability and feasibility of a CBC approach in Sal and assess what challenges its implementation faces. Results strongly confirm the desirability of CBC in Sal, but also point out a number of challenges, from lack of education to the need for stable jobs for the Cape Verdeans involved in conservation.

RESUMO

Cabo Verde é um dos mais importantes locais de nidificação para as tartarugas cabeçudas Caretta caretta, tendo a ilha do Sal a segunda maior população do país. As tartarugas cabeçudas enfrentam uma série de ameaças na ilha do Sal, desde a caça ao desenvolvimento costeiro, e a organização sem fins lucrativos SOS Tartarugas foi fundada em 2008 para garantir a conservação da espécie. A conservação baseada na comunidade (CBC) é uma das estratégias mais populares para a realização de conservação da vida selvagem em África e apesar da organização mobilizar funcionários e voluntários internacionais, um dos seus principais objetivos é envolver cabo-verdianos no projeto. A implementação da CBC na ilha do Sal tem, todavia, apresentado muitas dificuldades. O estudo aqui descrito utilizou dois métodos diferentes, uma pesquisa Delphi e entrevistas semi-estruturadas, para descrever a desejabilidade e viabilidade de uma abordagem CBC na ilha do Sal, bem como para avaliar os desafios associados à sua implementação. Os resultados confirmam fortemente a desejabilidade da CBC na ilha do Sal, mas também apontam uma série de desafios, desde falhas ao nível da educação à necessidade de empregos estáveis para os cabo-verdianos envolvidos na conservação.

[1] Via dell'Autonomia Regionale Sarda, Quartu S. Elena, 09045 Italy; nicola.pld@gmail.com
[2] ADTMA-SOS Tartarugas, Santa Maria, Sal, Republic of Cape Verde; jacquie@sostartarugas.org

INTRODUCTION

The loggerhead turtle *Caretta caretta* is listed by the International Union for Conservation of Nature (IUCN) as endangered (EN) and is protected worldwide by a number of national laws and international agreements (United States Congress 1973, CITES 1973, IUCN 1996, CMS 2001, Assembleia Nacional de Cabo Verde 2002, NOAA 2011). In coastal areas (which, by definition, make up their nesting areas), however, illegal harvest is a common threat to loggerheads, as sea turtles are often used by local communities as an additional food source (e.g. Mancini & Koch 2009, Senko *et al*. 2011). Cape Verde hosts five species of sea turtles. Loggerhead, green *Chelonia mydas*, leatherback *Dermochelys coriacea*, hawksbill *Eretmochelys imbricata* and olive ridley *Lepidochelys olivacea* turtles are all found in Cape Verdean waters and the islands are considered to be one of the most important nesting sites for loggerhead turtles (Assembleia Nacional 2002, Marco *et al*. 2011). All five species are protected under Cape Verdean law by Decreto Regulamentar N° 7/2002, but this is not properly enforced and the establishment of protected areas in the main nesting beaches of the archipelago has sometimes resulted in the creation of 'paper parks' (Cabrera *et al*. 2000, Assembleia Nacional de Cabo Verde 2002). Hunting sea turtles for protein can be considered a traditional activity in the islands, having been performed intensively by local communities for at least 500 years (Loureiro & Torrão 2008). Biological factors make sea turtles vulnerable to overexploitation (Scott *et al*. 2011, Senko *et al*. 2011) and by the 2000s poaching was threatening the survival of the loggerhead population of Cape Verde (Marco *et al*. 2010). The sale of turtle meat is not a relevant part of the country's economy, but it has subsistence value for some families (Espírito Santo *et al*. 2010).

Besides poaching, sea turtles face a number of threats in Cape Verde, including habitat loss due to intense coastal development and predation. This caused a drop in local population numbers that inspired the foundation of many conservation initiatives in the archipelago (e.g. López Jurado *et al*. 2000, Marco *et al*. 2010). In the island of Sal, the conservation organisation SOS Tartarugas was founded to stop poaching of nesting females, but up until 2012 very few Cape-Verdeans have been involved long-term with the project (SOS Tartarugas 2013). Conversely, similar projects in other Cape Verdean islands can count on a great deal of community participation (e.g. Hancock *et al*. 2012). Simply deterring hunting is generally not considered enough to ensure the conservation of species hunted for meat and understanding the social context in which poaching takes place is often necessary to find a long-term solution (Milner-Gulland & Bennett 2003). Community-based conservation (CBC) projects aim at addressing this issue and are known to have higher chances of success, as the participation of the local community often results in higher long-term sustainability of conservation (Waylen *et al*. 2010).

The aim of this study was to assess whether CBC is a feasible option for loggerhead turtles in Sal. We present a number of challenges that its implementation currently faces on the island and we discuss several strategies that can be used to overcome them.

METHODS

Two different methods were used in the study, an internet-based Delphi survey with international experts and semi-structured interviews with local respondents in the field. The Delphi survey was carried out between March and June 2012; the field-based interviews were completed between June and October 2012. Given the complexity of the social aspect of conservation in Sal, a qualitative approach was chosen (e.g. Mehta & Heinen 2001, Macys & Wallace 2003, Gadd 2005, Campbell *et al*. 2009, Fuentes & Cinner 2010).

The Delphi method is a forecasting tool that uses the information available to a heterogeneous group of experts in order to achieve a forecast on uncertain matters. Surveys are carried out in two or more rounds and the results of the earlier rounds are aggregated and then fed back into the following questionnaires. This allows the panel to anonymously assess the same matters multiple times until consensus is reached (Preble 1983, Rowe & Wright 1999). Under Delphi, having a small expert panel is not considered an issue, as having representative

views has priority over numbers (Gupta & Clarke 1996, Rowe & Wright 1999, Stewart 2001).

The island of Sal has a very diverse ethnic composition. Besides the local population, expatriates from mainland Africa, Europe, China and the Americas are a consistent part of the island demographics (World Bank 2012). To complicate things further, until 2012 conservation activities have been carried out virtually exclusively by international staff and volunteers. It was concluded that this diversity needed to be represented in our sample and that involving both local and international experts could better describe the distribution of knowledge of conservation issues in Sal. To compose the panels, a preliminary list of 192 potential respondents was compiled based on their knowledge and awareness of conservation issues in Sal. Respondents were then divided in groups according to nationality and occupation (research, business owners, the media, nature conservation, civil society groups). Fifty Cape Verdean and thirty-nine international respondents were then randomly selected. Questionnaires were sent out with an introductory letter to the respondents to be completed online. Besides respondent demographics, questions were open-ended and focused on sea turtle conservation, awareness, international and local participation and tourism.

The need to carry out face-to-face interviews became apparent when the Cape Verdean response rate stayed low compared to the international one. Key informants were identified using snowball sampling. While snowball sampling is sometimes regarded as producing a not representative sample (Bernard 1995), the use of key informants has been widely used in conservation research (Macys & Wallace 2003, Gadd 2005, Campbell *et al*. 2009, Fuentes & Cinner 2010) and was considered appropriate for this study. Eleven Cape Verdean respondents were contacted and agreed to participate in the survey. In order to promote truthfulness, respondents remained anonymous. Face-to-face interviews were carried out in the towns of Santa Maria (n=9) and Espargos (n=2) in Sal. Respondents were presented with the results of the Delphi survey and asked to comment on the main themes identified; each interview was carried out in Portuguese and recorded with the permission of the respondent.

RESULTS

a) Delphi survey (Table 1)

The first round of the Delphi survey received a response rate of 18%; a total of 16 respondents completed the questionnaire. 8% of the contacted Cape Verdean (n=4) and 30.7% of the contacted international experts (n=12) responded to the questionnaire. Cape Verdean was the most represented nationality (25%; n=4), followed by British and Italian (18.8%; n=3), Spanish (12.5%; n=2), American, French, Portuguese and Brazilian (6.2%; n=1). Concerning profession, the larger groups of respondents worked in research or were business owners (37.5%; n=6). Of the informants that took part in the first round of surveys, 31.2% (n=5) responded to the second round.

A large majority of the panel (81.2%; n=13) agreed that awareness of local conservation issues is low and more than half (68.7%; n=11) added that there still is the need for more awareness campaigns. The totality of the panel stated that increasing local participation is desirable and a large majority (68.7%; n=11) stated that at the moment the level is low. Regarding the challenges to local participation, the majority of the panel (81.2%; n=13) mentioned financial reasons, such as the need of stable jobs all year round. Large percentages of respondents mentioned lack of ownership of the conservation project and a high international presence (56.2%; n=9) and lack of awareness of conservation issues (37.5%; n=6). A large majority (87.5%; n=14) of respondents stated that the participation of international volunteers and staff is desirable, as they provide skills and knowledge. The majority of the panel (62.5%; n=10) agreed that conservation should be led by whoever is most qualified, with three respondents adding that Cape Verdeans should be in a leadership position, provided that they gain the necessary skills and knowledge.

	Delphi round 1 (%)	Delphi round 2 (%)	Interviews (%)
Awareness of conservation issues			
Awareness of conservation issues is low	81.2	100	45
Awareness of the legally protected status of sea turtles is high	25	/	/
Education and outreach are necessary	68.7	100	100
Participation in conservation activities			
Higher local participation is desirable	100	/	90.9
Local participation is currently low	68.7	/	54.5
International participation is desirable	87.5	100	100
Challenges to local participation			
Economic reasons (stable jobs etc.)	81.2	80	18.2
Lack of ownership and strong international presence	56.2	20	18.2
Lack of awareness of conservation issues	37.5	100	72.7
Hard working conditions	18.7	/	/
Lack of enforcement of conservation laws	12.5	/	27.3
Tourism			
Sea turtles can support ecotourism	100	/	36.4
Ecotourism is desirable	43.7	100	/
Ecotourism can fund conservation	37.5	100	/
Ecotourism can raise awareness	31.2	/	/
Ecotourism can disturb turtles	31.2	100	/

Table 1. Themes mentioned by respondents (%) during the Delphi survey and semi-structured interviews.

The totality of the respondents stated that conservation can bring benefits to the local population, with a large majority (75%; n=12) mentioning benefits of a financial nature. A smaller percentage stated that conservation can give tourists cultural benefits (18.7%; n=3), with one respondent adding that this is only true for tourists and not locals. The entire panel stated that sea turtles have the potential to generate tourism in Sal, with large groups of respondents stating that tourism can be used to fund conservation (37.5%; n=6) and to increase awareness of conservation issues (31.2%; n=5).

The second round largely confirmed the results of the first one. The entire panel agreed that awareness of conservation issues in Sal is low, but increasing. The panel agreed that in order to increase community participation awareness programmes are desirable and that the target of these programmes should be fishermen (60%; n=3), children and young people, civil society groups and politicians (40%; n=2). Four respondents (80%) stated that in order to increase participation, providing stable jobs will be necessary.

The entire panel stated that international participation in conservation is desirable and four respondents (80%) added that even a strong international presence will not result in locals not feeling ownership of conservation, thus disproving the results of the first round. The whole panel also agreed that having Cape Verdean staff in position of responsibility might help in encouraging participation, but that at the moment locals do not possess the necessary scientific knowledge and skills to lead conservation projects and that training programmes are therefore desirable.

b) Semi-structured interviews (Table 1)

Eleven Cape Verdean respondents were interviewed in the field. Respondents worked in civil society groups, conservation and the environment and tourism (27.3%; n=3). Other respondents worked in education (9.1%; n=1) or represented the local authorities (9.1%; n=1).

When asked about awareness of sea turtle conservation issues in Sal among the local population, half the panel stated it was increasing and mentioned the awareness campaigns carried out on Sal. Respondents mentioned the general public (63.6%; n=7), fishermen (36.4%; n=4), children (18.2%; n=2) and lower-class people

(9.1%; n=1) as the priority targets of education activities.

Concerning the level of local participation in conservation activities, the majority of the panel (54.5%; n=6) stated it was low and an increase in local participation is desirable (90.9%; n=10). The majority of the panel (72.7%; n=8) mentioned lack of awareness as the main challenge to local participation. When asked about international participation in conservation activities, the entire panel stated it is desirable. Regarding leadership of conservation activities, the panel stayed divided. Some respondents mentioned a partnership between stakeholders (45.4%; n=5), while others suggested that Cape Verdean leadership is desirable (36.4%; n=4). A smaller group of respondents (27.3%; n=3) stated that local authorities should be in charge.

DISCUSSION

Some observations on the level of community participation in conservation can already be made from the response rate, as the local response rate was significantly lower than the international one. Respondents confirmed these observations and stated that local participation is, indeed, low. The totality of the panel expressed complete support of increasing local participation and stated that conservation should focus on the local community. Responses generally supported the theories of CBC, and suggested that a participatory approach is not only desirable and appropriate, but also the best strategy to achieve sustainable conservation (Hulme & Murphree 1999, Adams & Hulme 2001a, Barrow *et al*. 2001, Hulme & Infield 2001).

The majority of the respondents stated that conservation should be led by whoever is more qualified; a joint effort between local and international actors has been suggested as a suitable option, which again supports the theory that participatory approaches are suitable in natural resource management (Hulme & Murphree 1999, Adams & Hulme 2001b, Berkes 2004). While various respondents stated that Cape Verdeans should ideally be in a leadership position, it was suggested that Cape Verdeans in Sal do not have, at the moment, the skills and knowledge to do so and that education is therefore a priority. Lack of awareness of conservation issues was also mentioned; respondents however stated that awareness is currently increasing, which can be related to the educational programmes currently in place in Sal. Education and awareness campaigns have been identified as one of the key features of CBC (Hulme & Murphree 1999, Adams & Hulme 2001a, Hulme & Infield 2001).

Both international and local respondents strongly suggest that international participation is desirable for several reasons as well; the benefits of international participation in conservation volunteering have indeed been noted in previous studies on conservation tourism (Campbell 2002, Campbell & Smith 2005). Respondents also suggested that the fact that conservation is currently mainly in the hands of foreigners could result in lack of ownership by Cape Verdeans. This would mirror what has been said by previous studies that suggested that strong international presence can result in the alienation of locals and resentment towards conservation (Hulme & Murphree 1999, Barrow *et al*. 2001, Adams & Hulme 2001b, Berkes 2004, Bajracharya *et al*. 2006). However, this was not entirely confirmed during the second round of questionnaires or the interviews. The panel stayed divided on whether international presence can inhibit local participation and further research is recommended.

A large majority of the panel mentioned the need of providing stable jobs in conservation as the biggest challenge to CBC in Sal. Sea turtle conservation work is largely seasonal. Loggerhead turtles nest in Sal from June to October, and there are fewer opportunities in the remaining months of the year. The fact that respondents identified the need of providing jobs to establish conservation perfectly fit with the CBC framework, as it is generally believed that in order to avoid resentment and alienation in the local community it is necessary to compensate locals for the losses caused by conservation (Adams & Hulme 2001a, Hulme & Infield 2001, Mehta & Heinen 2001, Bajracharya *et al*. 2006). Especially in sea turtle conservation, it would appear that providing jobs to locals significantly improved the chances of success (Kutty 2004, Muir & Abdallah 2006). Even before they were directly asked about the desirability and feasibility of developing ecotourism in Sal, multiple respondents mentioned it as the best option to generate job opportunities. The totality

of the panel agreed that sea turtles have the potential to generate tourism in Sal, which is what is generally believed for charismatic vertebrates, and that tourism might be the only option to fund conservation (Scheyvens 1999, Tisdell & Wilson 2002, Brightsmith *et al*. 2008).

During the first round of questionnaires, some respondents suggested that sea turtles can provide cultural benefits to the tourists that have the chance to observe the nesting process. This is reported by various studies on wildlife tourism, that confirm that observing wild animals in their natural environment is usually much appreciated by Western tourists (Wilson & Tisdell 2001, Ballantyne et al. 2009, Meletis & Harrison 2010). Respondents seemed to hint at the fact that this is not true for the local population, which would also conform to the general belief that this is a prerogative of people who do not directly depend on their environment for their survival (Gibson & Marks 1995, Akama 1996, Tambiah 2000, Kutty 2004, Muir & Abdallah 2006). This was however not confirmed in the second round of questionnaires. The issue was discussed during the field interviews, but again it was not possible to get to a conclusive result.

CONCLUSIONS

This study aimed at investigating the desirability and feasibility of a community-based approach for sea turtle conservation in the island of Sal, Cape Verde Islands. The desirability of CBC has been confirmed by the data collected. Virtually every respondent strongly supported increasing community participation in conservation activities. The panel however also confirmed that this faces several challenges in Sal, from lack of education to the need for stable jobs for Cape Verdeans involved in conservation. Respondents strongly suggested that ecotourism is the best option to provide new job opportunities and therefore support the implementation of CBC.

This being said, the majority of the panel also stated that international participation is positive for many reasons, including bringing knowledge and skills. Lack of technical knowledge in the Cape Verdean community has in fact been mentioned as a challenge to Cape Verdean leadership of conservation, and the need for education, awareness campaigns and training has been indicated as one of the main priorities for conservation in Sal.

It was not possible to reach conclusive results on whether intense foreign presence can inhibit ownership of conservation by locals and whether sea turtles can provide cultural benefits to Cape Verdeans. Further research on these issues is therefore recommended.

ACKNOWLEDGEMENTS

NP would like to thank Ms. Sian Pierce for her guidance and SOS Tartarugas for their support. Comments by two anonymous reviewers improved the manuscript.

REFERENCES

Adams, W. & D. Hulme, 2001a. Conservation & community. Changing narratives, policies & practices in African conservation. Pp. 9-23 in: Adams, W. & D. Hulme (eds.), African Wildlife & Livelihoods. James Currey, London, UK.

Adams, W. & D. Hulme, 2001b. If community conservation is the answer in Africa, what is the question? Oryx 35: 193-200.

Akama, J., 1996. Western environmental values and nature-based tourism in Kenya. Tourism Management 17: 567-574.

Assembleia Nacional, 2002. Decreto-Regulamentar N°7/2002 de 30 de Dezembro. Boletim Oficial da República de Cabo Verde, I Série, No. 37: 874-898.

Bajracharya, S., P. Furley & A. Newton, 2006. Impacts of community-based conservation on local communities in the Annapurna Conservation Area, Nepal. Biodiversity and Conservation 15: 2765-2786.

Ballantyne, R., J. Packer & K. Hughes, 2009. Tourists support for conservation messages and sustainable management practices in

wildlife tourism experiences. Tourism Management 30: 658-664.

Barrow, R., H. Gichochi & M. Infield, 2001. The evolution of community conservation policy and practice in East Africa. Pp. 59-73 in: Adams, W. & D. Hulme (eds.), African Wildlife & Livelihoods. James Currey, London, UK.

Berkes, F., 2004. Rethinking community-based conservation. Conservation Biology 18: 621-630.

Bernard, H., 1995. Research methods in anthropology: qualitative and quantitative approaches. Rowman & Littlefield Publisher Inc., Walnut Creek, USA. 148 pp.

Brightsmith, D.J., A. Stronza & K. Holle, 2008. Ecotourism, conservation biology, and volunteer tourism: a mutually beneficial triumvirate. Biological Conservation 141: 2832-2842.

Cabrera, I., D. Cejudo & L.F. López-Jurado, 2000. Human predation on marine turtles in the archipelago of Cape Verde, western Africa. Pp. 217 in: Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation, 2-6 March 1999, South Padre Island, Texas, USA. NOAA Technical Memorandum NMFS-SEFSC-443.

Campbell, L., 2002. Conservation narratives in Costa Rica: conflict and co-existence. Development and Change 33: 39-56.

Campbell, L., J.J. Silver, N.J. Gray, S. Ranger, A. Broderick, T. Fisher, M.H. Godfrey, S. Gore, J. Jeffers, C. Martin, A. McGowan, P. Richardson, C. Sasso, L. Slade & B. Godley, 2009. Co-management of sea turtles fisheries: biogeography versus geopolitics. Marine Policy 33: 137-145.

Campbell, L. & C. Smith, 2005. Volunteering for sea turtles? Characteristics and motives of volunteers working with the Caribbean Conservation Corporation in Tortuguero, Costa Rica. MAST 3/4: 169-193.

CITES, 1973. Convention on International Trade in Endangered Species of Wild Fauna and Flora. Washington D.C.

CMS, 2001. Memorandum of understanding on the conservation and management of marine turtles and their habitats in the Indian Ocean and South-East Asia. Manila, Philippines.

Espírito Santo, I., S. Martins, D. Simba, A. Marco, E. Abella, P. Sanz, J. Graça & L.F. López-Jurado, 2010. Efforts to increase the participation of local communities in the conservation of the endangered loggerhead population of Cape Verde. Pp. 225 in: Proceedings of the Twenty-Eight Annual Symposium on Sea Turtle Biology and Conservation, Loreto, Baja California Sur, Mexico, January 2008. NOAA Technical Memorandum NMFS-SEFSC-602.

Fuentes, M.M.P.B. & J.E. Cinner, 2010. Using expert opinion to prioritize impacts of climate change on sea turtles' nesting grounds. Journal of Environmental Management 91: 2511-2518.

Gadd, M., 2005. Conservation outside of parks: attitudes of local people in Laikipia, Kenya. Environmental Conservation 32: 50-63.

Gibson, C.C. & S.A. Marks, 1995. Transforming rural hunters into conservationists: an assessment of community-based wildlife management programs in Africa. World Development 23: 941-957.

Gupta, U.G. & R.E. Clarke, 1996. Theory and applications of the Delphi technique: a bibliography (1975–1994). Technological Forecasting and Social Change 53: 185-211.

Hancock, J., E. Santos, A. Monteiro & J. Rocha, 2012. Saving turtles one kid at a time in Cape Verde: the school in nature project. Pp. 92 in: Proceedings of the Thirty-First Sea Turtle Symposium, International Sea Turtle Society. San Diego, USA, April 2011. NOAA Technical Memorandum NMFS-SEFSC-631.

Hulme, D. & M. Infield, 2001. Community conservation, reciprocity & park-people relationships, Lake Mburo National Park, Uganda. Pp. 106-130 in: W. Adams & D. Hulme (eds.), African Wildlife & Livelihoods. James Currey, London.

Hulme, D. & M. Murphree, 1999. Communities, wildlife and the 'new conservation' in Africa. Journal of International Development 11: 277-285.

IUCN, 1996. *Caretta caretta*. [Online]. Available at http://www.iucnredlist.org/apps/redlist/details/3897/0 [Accessed 23 December 2011].

Kutty, R., 2004. Community based conservation of olive ridley turtles in India. Pp. 19-21 in: Proceedings of the Twenty-First Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-528.

López-Jurado, L.F., C. Évora, D. Cejudo & P. Alfama, 2000. Proposals for the conservation of marine turtles on the island of Boa Vista (Republic of Cabo Verde, Western Africa). Pp. 204-205 in: Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation, 2-6 March 1999, South Padre Island, Texas, USA. NOAA Technical Memorandum NMFS-SEFSC-443.

Loureiro, N.S. & M.M.F. Torrão, 2008. Homens e tartarugas marinhas. Seis séculos de história e histórias nas ilhas de Cabo Verde. Anais de História de Além-Mar 9: 37-78.

Macys, S. & G. Wallace, 2003. Marine turtle conservation efforts on Holbox Island, Quintana Roo, Mexico: the fishermen's perceptions. Chelonian Conservation and Biology 4: 620-625.

Mancini, A. & V. Koch, 2009. Sea turtle consumption and black market trade in Baja California Sur, Mexico. Endangered Species Research 7: 1-10.

Marco, A., E. Abella, O. López, N. Varo, S. Martins, P. Sanz & L.F. López-Jurado, 2010. Massive capture of nesting females is severely threatening the Caboverdian loggerhead population. Pp. 93-94 in: Proceedings of the Twenty-Eighth Annual Symposium on Sea Turtle Biology and Conservation, 22-26 January 2008, Loreto, Baja California Sur, Mexico. NOAA Technical Memorandum NMFS-SEFSC-62.

Marco, A., E. Abella, C. Monzón-Argüello, S. Martins, S. Araujo & L.F. López-Jurado, 2011. The international importance of the archipelago of Cape Verde for marine turtles, in particular the loggerhead turtle *Caretta caretta*. Zoologia Caboverdiana 2: 1-11.

Mehta, J.N. & J.T. Heinen, 2001. Does community-based conservation shape favorable attitudes among locals? An empirical study from Nepal. Environmental Management 28: 165-177.

Meletis, Z. & E. Harrison, 2010. Tourists and turtles: searching for a balance in Tortuguero, Costa Rica. Conservation and Society 8: 26-43.

Milner-Gulland, E.J. & E.L. Bennett, 2003. Wild meat: the bigger picture. Trends in Ecology & Evolution 18: 351-357.

Muir, C. & O. Abdallah, 2006. Community-based conservation of sea turtles at Mafia Island, Tanzania. Pp. 79-81 in: Proceedings of the Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-536.

NOAA, 2011. Sea Turtles [Online]. Available at: http://www.nmfs.noaa.gov/pr/species/turtles/ [Accessed 23 December 2011].

Preble, J., 1983. Public sector use of the Delphi technique. Technological Forecasting and Social Change 23: 75-88.

Rowe, G. & G. Wright, 1999. The Delphi technique as a forecasting tool: issues and analysis. International Journal of Forecasting 15: 353-375.

Scheyvens, R., 1999. Ecotourism and the empowerment of local communities. Tourism Management 20: 245-249.

Scott, R., R. Marsh & G.C. Hays, 2011. Life in the really slow lane: loggerhead sea turtles mature late relative to other reptiles. Functional Ecology 26: 227-235.

Senko, J., A.J. Schneller, J. Solis, F. Ollervides & W.J. Nichols, 2011. People helping turtles, turtles helping people: understanding resident attitudes towards sea turtle conservation and opportunities for enhanced community participation in Bahia Magdalena, Mexico. Ocean & Coastal Management 54: 148-157.

SOS Tartarugas, 2013. SOS Tartarugas [online]. Available at: http://www.sostartarugas.org/SOSTartarugas/Welcome.html [Accessed 1 October 2013].

Stewart, J., 2001. Is the Delphi technique a qualitative method? Medical Education 35: 922-923.

Tambiah, C., 2000. "Community Participation" in sea turtle conservation: moving beyond buzzwords to implementation. Pp. 59-61 in: Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-443.

Tisdell, C. & C. Wilson, 2002. Ecotourism for the survival of sea turtles and other wildlife. Biodiversity and Conservation 11: 1521-1538.

United States Congress, 1973. U.S. Endangered Species Act of 1973. Washington D.C.

Waylen, K.A., A. Fischer, P.J.K. McGowan, S.J. Thirgood & E.J. Milner-Gulland, 2010. Effect of local cultural context on the

success of community-based conservation interventions. Conservation Biology 24: 1119-1129.

Wilson, C. & C. Tisdell, 2001. Sea turtles as a non-consumptive tourism resource especially in Australia. Tourism Management 22: 279-288.

World Bank, 2012. Cape Verde: country brief [Online]. Available at: http://go.worldbank.org/96LOVZBGZ0 [Accessed 5 April 2012].

Received 28 October 2013
Revised 1 December 2013
Accepted 15 December 2013

Zoologia Caboverdiana 4 (1): 17-20
Available at www.scvz.org

Short note | Nota breve

Possible breeding of Cape Verde storm-petrel *Oceanodroma jabejabe* (Bocage, 1875) on Santa Luzia, Cape Verde Islands

Nuno Oliveira, Jailson Oliveira, Tommy Melo, José Melo & Pedro Luís Geraldes

Santa Luzia (18º52´, 18º60´N; 24º41´, 24º48´W) is the smallest island (35 km^2) in the Cape Verde archipelago[1]. Although uninhabited today, two families of goatherds lived on Santa Luzia until the mid-1960s. In 1990, together with the nearby islets of Branco and Raso, Santa Luzia was designated a Nature Reserve by law. The island is extremely arid and barren, with hills, stony plains and sand-dunes being the main features. The highest elevation reaches 395 m a.s.l. The vegetation is characterized by a single floristic zone (Duarte *et al*. 2008), dominated by drought resistant species such as *Cistance phelipaea*, *Polycarpaea nivea*, *Zygophyllum simplex*, *Heliotropium ramisissimum*, *Frankenia ericifolia* and *Euphorbia tuckeyana* (Schleich & Wuttke 1983, Dinis & Matos 1994, Sánchez Pinto *et al*. 2005). The northern shoreline of the island is characterized by steep cliffs, 10-30 m in height. The remaining shore consists of sandy beaches in the southern part and rocky beaches along the western, north-eastern and eastern coast of the island (Dinis & Matos 1994).

At present, no seabirds are known to breed on Santa Luzia nor are there confirmed records from historical times. However, as is still the case at the nearby islets of Raso and Branco, considerable numbers must have bred in Santa Luzia in the past, witness the extended bonebeds (of as yet unidentified taxa) that exist on the island (cf. Mateo 2012: 75). Whether these seabird colonies disappeared due to human depredation or already withered in prehistorical times, as has been the case on other islands in the Cape Verde archipelago (cf. Boessneck & Kinzelbach 1993), is still to be determined.

Cape Verde storm-petrel *Oceanodroma jabejabe* (Bocage, 1875) is a small seabird endemic to the Cape Verde archipelago. Based on diagnostic differences in vocalizations (Bolton 2007) and molecular data (Friesen *et al*. 2007) compared to other Atlantic *Oceanodroma* storm-petrels, it was recently recognized as a diagnosably distinct lineage within the *Oceanodroma castro*-complex (Sangster *et al*. 2012). Cape Verde storm-petrel is known to breed on the islets of Cima (one of the Rombo islets), Branco, Raso and perhaps still on the islets of Pássaros and Curral Velho, both off Boa Vista (Hazevoet 1995). Possibly, it also breeds in small nmbers along the coasts of some of the main islands (Hazevoet 1994, 1995). Remains of several Cape Verde storm-petrels were recently found on the cliffs at Baía do Inferno (aka Baía de Santa Clara) on the south-western coast of Santiago (S. Martins *in litt.*). The total population of Cape Verde storm-petrel was tentatively estimated at *ca.* 1,000 pairs (Hazevoet 1994, 1995). Cliff holes and burrows under rocks close to the shoreline are the preferred breeding habitat, often in the company of other breeding procellarids. Breeding sites are visited only at night during the breeding season, with birds calling in flight as well as in their burrows, as is typical of the breeding behaviour of many petrel species (Warham 1990).

During the nights of 12 and 13 August 2012, we inspected the only area deemed to have nesting habitat suitable for Cape Verde storm-petrel on Santa Luza. Eight listening points were selected along the north-western coast of the island in order to try and detect calling Cape

[1] In Cape Verde, a distinction is made between islands (*ilhas*) and islets (*ilhéus*).

Fig. 1. Map of Santa Luzia, with listening points selected to detect calling activity of Cape Verde storm-petrel *Oceanodroma jabejabe*, 12-13 August 2012. Inset: Cape Verde Islands, indicating the position of Santa Luzia within the archipelago.

Point	Date	Start time	Call rate
P1	7/12/2012	20:25	0
P2	7/12/2012	20:40	0
P3	7/12/2012	21:20	0
P4	7/12/2012	21:50	4
P5	7/13/2012	20:30	0
P6	7/13/2012	20:50	0
P7	7/13/2012	21:20	0
P8	7/13/2012	21:50	0

Table 1. Dates and time spent at listening points in Santa Luzia, Cape Verde Islands, in order to record Cape Verde storm-petrel *Oceanodroma jabejabe* calling activity. Each listening point was sampled during 15 minutes. Call rate was estimated as number of calls per hour.

Verde storm-petrels (Fig. 1). On each night, four different listening points were surveyed for 15 minutes each. Call rate was assessed as the number of detected calls per hour (Bolton 2007). Surveys were undertaken during the first three hours after sunset (Table 1), as storm-petrels call more actively during this period (Bolton 2007). Complementary ground searches were performed along the cliffs in the same area during daytime. Cape Verde storm-petrel calling activity was only detected at listening point P4, with a call rate of 4 calls/hour. During the ground search, six rocky fissures with signs of nesting were detected along the cliffs. In one, a few feathers were found and in another two feathers with the characteristic storm-petrel smell. Near listening point P1, the wings of at least six adult Cape Verde storm-petrels were found. In a crevice *ca*. 20 m from P6, a full-grown bird was found. Its posture suggested that it was incubating an egg

or brooding a small chick, but the crevice was too deep to examine the bird or the contents of the cavity directly and we could not rule out the possibility that it was a fully-grown nestling which had shed all down feathers. During the last daily ground search, 123 wings of Cape Verde storm-petrels were found within an area of 20 m^2 at the top of the cliff close to the P2 listening point. Some feathers were quite fresh and clean, while others were dirty and seemed to be more than a month old. Nearby this area, at a distance of less than 50 m, a feral cat *Felis catus* was observed for about 5 minutes, before it hide under a pile of rocks.

The feathers found in crevices and the presence of a possible nesting bird strongly point to the possibility of Cape Verde storm-petrels attempting to breed at the cliffs of Santa Luzia. Moreover, the discovery of wings of a large number of adults, presumably predated by cats, suggests that birds are coming to land, where they are vulnerable to predation. It seems quite possible that these birds were attracted by calling birds occupying nest crevices that were not accessible during our survey.

The nearest known Cape Verde storm-petrel breeding site is at Branco islet, *ca*. 10 km to the east of Santa Luzia. Although the islets of Raso and – to a lesser degree – Branco have been researched quite regularly during the past decade, Santa Luzia was seldom visited by seabird experts, probably partly because of its larger size and the effort needed to prospect all potential breeding areas. Storm-petrel nests are difficult to locate and the limited time researchers have spent in the island could explain the absence of breeding records so far.

Cats were probably brought to Santa Luzia during the 18th century, when the first goatherds settled there. The cat population is nowadays estimated to be 20-40 individuals (N. Oliveira unpublished data). Domestic cats have been introduced to many islands around the world and have often had a dramatic impact on the original wildlife (Medina *et al*. 2011, Nogales *et al.* 2013). Although no evidence of Cape Verde storm-petrel as a prey item was found in recent studies of feral cat diet on Santa Luzia (Donald *et al*. 2005, Medina *et al.* 2012), feral cats are known to prey on seabirds elsewhere, having caused the extinction of several populations (e.g. Wolf *et al*. 2006). They have been identified as the major predator even when multiple invasive mammal species are present (Hervías *et al*. 2013). When colonies of storm-petrels are extirpated, birds often do not return to their former breeding sites as a result of a combination of social constraints (Podolsky & Kress 1989) and demographic factors (Warham 1990). Urgent action is needed in order to evaluate cat predation on Cape Verde storm-petrel in Santa Luzia and effective measures are needed to mitigate the impact of feral cats. Further research should aim at improving our knowledge of this potential population in terms of number of breeding pairs, spatial distribution of nests, population trends and main threats. As the breeding season of Cape Verde storm-petrel is protracted, with nesting activity recorded from October to June (Hazevoet 1995), possibly extending into August (this study), multiple surveys should be carried out at different times of the year.

We wish to thank Mark Bolton for helpfully commenting on an earlier draft of this note. Samir Martins kindly informed us about the recent find of *Oceanodroma* remains on Santiago. We also thank Cornelis Hazevoet for providing editorial help.

REFERENCES

Boessneck, J. & R. Kinzelbach, 1993. Ein prähistorischer Brutplatz von Seevogeln auf der Insel Sal (Kapverden). Journal für Ornithologie 134: 245-271.

Bolton, M., 2007. Playback experiments indicate absence of vocal recognition among temporally and geographically separated populations of Madeiran storm-petrels *Oceanodroma castro*. Ibis 149: 255-263.

Diniz, A.C. & G.C. de Matos, 1994. Carta de zonagem agro-ecológica e da vegetação de Cabo Verde. VII – Ilha de Santa Luzia. Garcia de Orta, Sér. Bot., 12: 101-120.

Donald, P.F., M. de L. Brooke, M.R. Bolton, R. Taylor, C.E. Wells, T. Marlow & S.M. Hille, 2005. Status of Raso lark *Alauda razae* in 2003, with further notes on sex ratio, behaviour and conservation. Bird Conservation International 15: 165-172.

Duarte, M.C., F. Rego, M.M. Romeiras & I. Moreira, 2008. Plant species richness in the Cape Verde Islands – eco-geographical

determinants. Biodiversity and Conservation 17: 453-466.
Friesen, V.L., A.L. Smith, E. Gómez-Diaz, M. Bolton, R.W. Furness, J. González-Solis & L.R. Monteiro, 2007. Sympatric speciation by allochrony in a seabird. Proceedings of the National Academy of Science of the USA 104: 18589-18594.
Hazevoet, C.J., 1994. Status and conservation of seabirds in the Cape Verde Islands. Pp. 279-293 in: D.N. Nettleship, J. Burger & M. Gochfeld (eds.), Seabirds on islands: threats, case studies, and action plans. BirdLife Conservation Series No. 1. BirdLife International, Cambridge, U.K.
Hazevoet, C.J., 1995. The birds of the Cape Verde Islands. BOU Check-list 13. British Ornithologists' Union, Tring. 192 pp.
Hervías, S., A. Henriques, N. Oliveira, T. Pipa, H. Cowen, J.A. Ramos, M. Nogales, P. Geraldes, C. Silva, R. Ruiz de Ybáñez & S. Oppel, 2013. Studying the effects of multiple invasive mammals on Cory's shearwater nest survival. Biological Invasions 15: 143-155.
Mateo, J.A., 2012. Las trágicas crónicas de la lisa gigante de Cabo Verde. Makaronesia 14: 64-88.
Medina, F.M., E. Bonnaud, E. Vidal, B.R. Tershy, E.S. Zavaleta, C.J. Donlan, B.S. Keitt, M. Le Corre, S.V. Horwath & M. Nogales, 2011. A global review of the impacts of invasive cats on island endangered vertebrates. Global Change Biology 17: 3503-3510.
Medina, F.M., P. Oliveira, P. Geraldes, J. Melo & N. Barros, 2012. Diet of feral cats *Felis catus* L., 1758 on Santa Luzia, Cape Verde Islands. Zoologia Caboverdiana 3: 67-73.
Nogales, M., E. Vidal, F.M. Medina, E. Bonnaud, B.R. Tershy, K.J. Campbell & E.S. Zavaleta, 2013. Feral cats and biodiversity conservation: the urgent prioritization of island management. BioScience 63: 804-810.
Podolsky, R.H. & S.W. Kress, 1989. Factors affecting colony formation in Leach's storm-petrel. Auk 106: 332-336.
Sánchez Pinto, L., M.L. Rodríguez, S. Rodríguez, K. Martín, A. Cabrera & M.C. Marrero, 2005. Pteridophyta, Spermatophyta. Pp. 38-57 in: M. Arechavaleta, N. Zurita, M.C. Marrero & J.L. Martín (eds.), Lista preliminar de especies silvestres de Cabo Verde (hongos, plantas y animales terrestres). Consejería de Medio Ambiente y Ordenación Territorial, Gobierno de Canarias, Santa Cruz de Tenerife.
Sangster, G., J.M. Collinson, P.A. Crochet, A.G. Knox, D.T. Parkin & S.C. Votier, 2012. Taxonomic recommendations for British birds: eighth report. Ibis 154: 874-883.
Schleich, H.H. & M. Wuttke, 1983. Die Kapverdischen Eilande Santa Luzia, Branco und Razo – ein Reisebericht. Natur und Museum 113: 33-44.
Warham, J., 1990. The petrels: their ecology and breeding systems. Academic Press, San Diego & London. 440 pp.
Wolf, S., B.S. Keitt, A. Aguirre-Munõz, B.R. Tershy, E. Palacios & D.A. Croll, 2006. Transboundary seabird conservation in an important North American marine eco-region. Environmental Conservation 33: 294-305.

Nuno Oliveira & Pedro Luís Geraldes, Sociedade Portuguesa para o Estudo das Aves, Avenida João Crisóstomo 18-4º dto, 1000-179 Lisboa, Portugal; nuno.oliveira@spea.pt
Jailson Oliveira, Tommy Melo & José Melo, Biosfera I, Caixa Postal 233, Mindelo, São Vicente, Republic of Cape Verde

Received 28 October 2013
Revised 14 December 2013
Accepted 19 December 2013

Zoologia Caboverdiana 4 (1): 21-24
Available at www.scvz.org

Short note | Nota breve

Nesting of green turtle *Chelonia mydas* on Sal, Cape Verde Islands, in August 2013

Jacquie Cozens, Berta Renom, Albert Taxonera, Cheryl Sanchez, Antonio Cruz & Ravi Lopes

The Cape Verde Islands rank among the world's most important breeding localities for the loggerhead sea turtle *Caretta caretta*, while hawksbill *Eretmochelys imbricata*, green *Chelonia mydas*, olive ridley *Lepidochelys olivacea* and leatherback *Dermochelys coriacea* turtles are also known to occur in Cape Verde seas (Marco *et al.* 2011). Olive ridley and leatherback turtles are solely known as migrants, but hawksbill and green turtles regularly use these waters as feeding grounds (Marco *et al.* 2011, Varo Cruz *et al.* 2011). Here, we document a rare nesting event of green turtle on the island of Sal, one of the windward (*barlavento*) islands, situated in the north-east of the archipelago.

On 24 August 2013, at 06:00 AM local time, Antonio Cruz and Ravi Lopes of the *Associação das Amigos das Tartarugas do Ambiente (ADTMA)-SOS Tartarugas*, a local NGO which has been protecting turtles and collecting data since 2008, discovered a green turtle nest at Costa da Fragata, along the south-eastern coast of Sal. So far, the only nesting turtle species recorded on Sal by *ADTMA–SOS Tartarugas* had been loggerhead turtle. The rangers were conducting a standard morning patrol in order to count the number of loggerhead nests and tracks from the previous night and to relocate any nests that were in danger of inundation from high tides or to protect them from other dangers.

Fig. 1. Nest and track of green turtle *Chelonia mydas* at Costa da Fragata, Sal, 24 August 2013.
Fig. 2. Nest and track of loggerhead turtle *Caretta caretta* at Ponta Preta, Sal, 15 June 2008. (ADTMA-SOS Tartarugas).

The turtle track and nest covered a considerably larger area than the usual loggerhead track and nest. Following the arrival of the project coordinators (AT and BR) and a ranger with considerable experience with green turtles elsewhere (CS), it was concluded that it had all the signs of a green turtle nest. The main indications were that the flipper marks in the track were symmetrical as opposed to loggerhead tracks, which alternate, and that the body pit and camouflage areas were much larger (Fig. 1-2). Except for egg chamber depth (see below), no measurements of track or nest were taken. The egg chamber was located at 16°37,257'N and 22°53,997'W. The nest had been laid in a narrow part of the beach within 2 m of the high water mark and was threatened by inundation. It was therefore decided that the nest should be relocated to the *SOS Tartarugas* hatchery at Ponta do Sinó in the south-west of Sal in order to ensure the safe incubation of the eggs. In other circumstances it would also have been possible to relocate the nest to another position on Costa da Fragata, but the same level of protection would not have been possible. Once the relocation began it became clear that the eggs were much larger than loggerhead turtle eggs. The eggs were subsequently measured by using calipers and the width was found to be an average of 47 mm compared to loggerhead eggs which average 41 mm (Fig. 3-4).

Fig. 3. Measuring a green turtle egg. Fig. 4. Size comparison of green (left) and loggerhead (right) turtle eggs (ADTMA-SOS Tartarugas).

The number of eggs in the nest was 148, compared to the average loggerhead nest on Sal of 84 eggs. The egg chamber depth was 81 cm, compared to the loggerhead average of 45 cm. Due to the lack of depth available in the hatchery, it was decided to split the nest into two, both with a depth of 45 cm.

The first of the two nests to hatch did so on 13 October, i.e. after 51 days, with a hatching success of 60%. The second nest hatched on 16 October (54 days), with a hatching success of 51%, giving an overall success of 55.5%. Since the nest was split it is possible that the incubation period was thereby affected. The green turtle hatchlings were noticeably larger than loggerheads, with different markings, namely white margins on the flippers and a white plastron (Fig. 5). Seven green turtle hatchlings and seven loggerhead hatchlings, born on the same night, were measured to obtain a comparison of size and weight (Table 1). The average length of the green hatchlings was 4.98 cm compared to loggerheads which averaged 4.13 cm and the average weight of greens was 27.5 g, compared to 16.2 g for loggerheads. The hatchlings were released on Costa da Fragata close to where the nest was originally laid. A study of genetic material taken from unhatched embryos is being undertaken to try and establish the geographic location of their maternal nesting grounds.

Green turtle weight	Green turtle size	Loggerhead weight	Loggerhead size
26 g	5.1 cm	18 g	4.2 cm
29 g	5 cm	15 g	4 cm
29 g	5 cm	16 g	4.1 cm
26.5 g	4.9 cm	16 g	4 cm
28 g	5.1 cm	17 g	4.3 cm
27 g	5 cm	17 g	4.2cm
27 g	4.8 cm	15 g	4.1 cm

Table 1. Comparison of size and weight of seven green and loggerhead turtle hatchlings, Sal, October 2013.

Fig. 5. Hatchlings of green (left) and loggerhead (right) turtles, Sal, October 2013 (ADTMA-SOS Tartarugas).

During the 2013 season, nesting by green turtle was also reported from nearby Boa Vista Island (A. Marco, S. Martins, C. Roder *in litt.*), but further details have as yet not been published. In 2013, a rise in the numbers of green turtle was reported in many locations around the world (e.g. FWC 2013). Whether green turtles are expanding their nesting range to include the Cape Verde Islands remains to be seen. Nesting green turtles are globally distributed and widely found in tropical and subtropical waters along continental coasts and islands between *ca.* 30° N and 30° S, although there are some exceptions such as rookeries in Turkey and Cyprus (Márquez 1990). Green turtle occurs on the nesting beaches or in offshore waters of at least 139 countries and territories (Hirth 1997). Juvenile and subadult green turtles are often observed in Cape Verde waters (Ernst & Barbour 1989), but nesting is exceptional. The assertion by Márquez (1990) that Cape Verde beaches rank among 'the most important for the Atlantic population' of green turtle is evidently in error. Subadult green turtles observed in Cape Verde seas will migrate to their natal beaches in the Caribbean, Guinea-Bissau, Ascension Island and the Gulf of Guinea to breed after they have reached sexual maturity (Monzón Argüello *et al.* 2010). There exists unpublished evidence (including photographs, currently unavailable) that green turtle has nested on Sal in 2002 (Anonymous 2010; E.C. d'Oliveira unpublished data), but the occurrence reported here is the first to be properly documented.

We wish to thank two anonymous reviewers for their comments, which helped improve the manuscript. Pedro López Suárez helped in unearthing an unpublished report.

REFERENCES

Anonymous, 2010. Plano nacional para a conservação das tartarugas marinhas em Cabo Verde. Boletim Oficial da República de Cabo Verde, I Série, No. 48: 2032-2058.

Ernst, C.H. & R.W. Barbour, 1989. Turtles of the world. Smithsonian Institution Press, Washington D.C. 313 pp.

FWC, 2013. Green turtles nest at unprecedented pace in Florida this year. Florida Fish and Wildlife Conservation Commision; http://myfwc.com/news/news-releases/2013/october/30/sea-turtles/ [accessed 15 November 2013].

Hirth, H.F., 1997. Synopsis of the biological data on the green turtle *Chelonia mydas*. Biological Report 97 (1). Fish and Wildlife Service, U.S. Department of the Interior, Washington D.C. 120 pp.

Marco, A., E. Abella Pérez, C. Monzón Argüello, S. Martins, S. Araújo & L.F. López Jurado, 2011. The international importance of the archipelago of Cape Verde for marine turtles, in particular the loggerhead turtle *Caretta caretta*. Zoologia Caboverdiana 2: 1-11.

Márquez, R., 1990. FAO species catalogue. Vol. 11: Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis No. 125, Vol. 11. FAO, Rome. 81 pp.

Monzón Argüello, C., L.F. López Jurado, C. Rico, A. Marco, P. López, G.C. Hays & P.L.M. Lee, 2010. Evidence from genetic and Langrangian drifting data for transatlantic transport of small juvenile green turtles. Journal of Biogeography 37: 1752-1766.

Varo Cruz, N., P. López Suárez, J. Cozens, A, Liria Loza, J. Fretey & L.F. López Jurado, 2011. New records of the olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz, 1829) from the Cape Verde Islands. Zoologia Caboverdiana 2: 53-61.

Jacquie Cozens, Berta Renom, Albert Taxonera, Cheryl Sanchez, Antonio Cruz & Ravi Lopes, ADTMA-SOS Tartarugas, Santa Maria, Sal, Republic of Cape Verde; jacquie@sostartarugas.org

Received 20 November 2013
Revised 9 December 2013
Accepted 15 December 2013

SOCIEDADE CABOVERDIANA DE ZOOLOGIA

C.P. 177A, São Vicente, Republic of Cape Verde

E-mail: evandrobiologia007@gmail.com

Website: www.scvz.org

Officers | Direcção

President | Presidente	Rui Freitas
Vice-President | Vice-Presidente	Cornelis Hazevoet
Secretary | Secretário	Evandro Lopes
Treasurer | Tesoureiro	Ricardo Monteiro
Member | Vogal	Corrine Almeida

The **Sociedade Caboverdiana de Zoologia** sets itself as a goal to promote zoological research in the broadest sense in the Cape Verde Islands. It aims to achieve this:

- by publishing a scientific journal
- by organizing scientific meetings
- with any other legal means that the board deems beneficial for achieving its goal.

Membership has to be applied for with the Secretary in writing or electronically.

A **Sociedade Caboverdiana de Zoologia** tem como missão promover a investigação sobre a zoologia das ilhas de Cabo Verde, no seu sentido mais vasto. Esta missão é realizada através:

- da publicação de uma revista científica
- da organização de encontros científicos
- de quaisquer outros meios legais que a direcção julgue adequados.

As subscrições de membros podem ser efectuadas junto do Secretário por escrito ou por via electrónica.

ZOOLOGIA CABOVERDIANA

Volume 4 | Número 1 | Abril de 2013

[published January 2014]

All contents of *Zoologia Caboverdiana* can be downloaded at www.scvz.org

Todos os conteúdos da *Zoologia Caboverdiana* podem ser obtidos em www.scvz.org

Contents | Índice

Sociedade Caboverdiana de Zoologia

ISSN 2074-5737