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# ZOOLOGIA CABOVERDIANA

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Front cover | Capa: Golden orb-web spider *Nephila senegalensis* (Walckenaer, 1842), Ribeira da Lagoa, Maio, 20 May 2009 (Tiago Peixoto).


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# An overview of the spider fauna of Maio (Cape Verde Islands), with some additional recent records (Arachnida, Araneae)

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Keywords: Araneae, Maio island, Cape Verde Islands, distribution, new data

ABSTRACT

Based on a collection of spiders obtained during ecological fieldwork in 2009 and an extensive literature review, we summarize the current state of knowledge of spider biodiversity on the island of Maio. The total number of species reported from Maio is now 46, representing 18 families and including 16 species (35%) endemic to the Cape Verde Islands. The family Dictynidae (meshweb spiders), represented by the saline-adapted *Devade* cf. *indistincta*, is reported for the first time from Cape Verde.

RESUMO

No seguimento de estudos ecológicos e trabalho de campo correspondente realizados em 2009, e após extensa revisão bibliográfica, sumarizamos o actual conhecimento acerca da biodiversidade das aranhas na ilha de Maio. O número total de espécies identificadas aumentou para 46, sendo estas representantes de 18 famílias, nas quais se incluem 16 espécies (35%) endémicas de Cabo Verde. É pela primeira vez descrita em Cabo Verde a família Dictynidae, representada pela *Devade* cf. *indistincta*, adaptada à salinidade.

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## INTRODUCTION

Spiders are common predators in almost all terrestrial ecosystems, and they are widely used as ecological indicators (Clausen 1986, Gibson *et al.* 1992, Wise 1993, Duffey & Feest 2009). Compared to that of other Macaronesian archipelagos, the spider fauna of the Cape Verde Islands is only poorly known. For example, in their recent study of spider diversity and evolution in Macaronesia, Cardoso *et al.* (2010) had to exclude Cape Verde from their analysis due to insufficient knowledge, despite a long history of arachnological reports from Cape Verde.

The history of Cape Verde spider studies started with John Blackwall's 1865 description of material collected by John Gray, containing 19 species mostly from the islands of Santo Antão, Santiago and São Nicolau (Blackwall 1865). This was followed by a series of publications summarizing the results of various expeditions (e.g. Simon 1883, 1897, Berland 1936, Berland & Denis 1946, Denis 1941, 1944). These works, together with findings on about 280 specimens collected in 1978–1980, were summarized in the first detailed preliminary checklist of spiders from Cape Verde by Assmuth & Groh (1982), who report a total of 67 species, including five species from Maio.

Since then, the interest in spiders from Cape Verde has been surprisingly limited. In addition to a number of papers treating individual families (e.g. jumping spiders, Salticidae; Wesołowska 1989, 1998) or single species (*Koinothrix pequenops*; Jocqué 1981), the only recent comprehensive treatments of Cape Verdean spiders are those by Günther Schmidt and his collaborators (Schmidt 1996, 1997a, b, c, d, 1999, 2001, Schmidt & Bauer 1994, Schmidt *et al.* 1994, Schmidt & Krause 1994, 1995, 1998). During a large number of field trips covering all inhabited islands of Cape Verde, Schmidt almost doubled the number of species known for the archipelago, including numerous newly described species. Despite the limitations of Schmidt's work (Wunderlich 1987), in particular the lack of informative illustrations, his publications still represent the most valuable summary of the status of Cape Verdean arachnology. In addition, the single Portuguese language publication on the spider fauna of Cape Verde is a brief report by Baessa-de-Aguiar (1998) on new records for 19 species from various islands.

The present study focuses on a small collection of spiders from the island of Maio, at 269 km$^2$ one of the smaller of the Cape Verde islands. Maio is largely a dry semi-desert island dissected by numerous ravines with seasonal water flow. Some of the characteristic habitats are rocky and sandy shores, salt pans (Salinas de Porto Inglês), sand dunes, salt marshes and arid mountainous grassland.

The Cape Verde government has recognized eight protected areas on Maio, including Terras Salgadas National Park, Natural Park of Ribeira de Lagoa and Salinas de Porto Inglês Landscape Reserve (Natura 2000). The objective of the current study was to collect data on the biodiversity of various plant and animal taxa. Here we present details of the arachnid specimens obtained during these surveys.

## MATERIAL AND METHODS

Fieldwork was carried out from 15 April 2009 to 30 May 2009 and from 10 September 2009 to 8 October 2009 at two sites: Salinas de Porto Inglês (15° 9' N, 23° 13' W) and Ribeira de Lagoa (15° 8' N, 23° 9' W). At both sites pitfall traps were dug along 50 m and 25 m transects in April and September, respectively. Small, plastic cups (70 mm diameter, 200 ml volume) were buried, with the top of the cup level with the soil. One cup was positioned every 5 m along the transect and then left for 24 hours. In April, twelve 50 m transects were put in place at Salinas de Porto Inglês and nine 50 m transects at Ribeira de Lagoa. In September, thirteen 25 m transects were put in place at Salinas de Porto Inglês and six 25 m transects at Ribeira de Lagoa. The total sampling effort was 132 trap-days at Salinas de Porto Inglês and 99 trap-days at Ribeira de Lagoa in April and 78 trap-days at Salinas de Porto Inglês and 36 trap-days at Ribeira de Lagoa in September. At

Salinas de Porto Inglês, transects were placed in sand dunes and arid land under *Acacia* trees (*Acacia americana*, *A. tortilis*), whereas at Ribeira de Lagoa the transects were placed in agricultural land, dry riverbed and arid land with *Acacia* trees. Different locations in the same habitat and vegetation types were sampled in April and September. A few spiders were also collected fortuitously by hand. All specimens were preserved in 92% alcohol in sealed plastic vials; in most cases the vials were labeled with the GPS coordinate of the specimen, the site name and the date. Specimens were deposited in the collection of the Zoology Museum of the University of Glasgow (GLAHM). Nomenclature follows Platnick (2011).

## RESULTS

Our invertebrate collection from Maio, Cape Verde Islands, contains a total of 16 spider species from 11 families (73 specimens, representing about 14% of the known Cape Verde spider fauna; cf. Schmidt *et al.* 1994). Spiders were the third most abundant invertebrate order in the pitfall trap samples, appearing in almost equal numbers to beetles (Coleoptera) and ants (Hymenoptera). The abundance of spiders was clearly not biased by the presence of one or two hyper-abundant species: the most abundant spider, the endemic ground-spider *Berlandina nigromaculata*, constitutes only 16% of the material.

Schmidt *et al.* (1994) reported 20 spider species from Maio, which was increased to 36 species by Schmidt & Krause (1998) and Schmidt (1999). Our collection contains six of these and adds 10 new species (marked * below) to the known spider fauna of Maio. Five of the species in our sample are endemic to the Cape Verde Islands (marked $^{E}$).

### Araneidae – Orb-web spiders

*Neoscona* cf. *subfusca** (C. L. Koch, 1837)
Maio: no location details, 1F, IX.2009, GLAHM 140439.
A single, badly damaged female specimen is tentatively assigned to *Neoscona subfusca*, the most widely distributed (and highly variable) species of the genus (Grasshoff 1986).

gen. sp. 1*
Maio: no location details, 1M, IX.2009, GLAHM 140438.
One male araneid specimens collected in September 2009 has not yet been identified to species, but is certainly new for Maio and probably new to the Cape Verde Islands, as it does not match any of the species reported from the archipelago so far.

Other araneid species reported by Schmidt (1999): *Argiope sector* (Forsskål, 1776).

### Dictynidae – Meshweb spiders

*Devade* cf. *indistincta** (O. P.-Cambridge, 1872)
Maio: Lagoa, 4M, IX.2009, GLAHM 140402, GLAHM 140404, GLAHM 140426; Maio: no location details, 1M, IX.2009, GLAHM 140440.
The five *Devade* cf. *indistincta* males are the first record of this species (and this family) from the Cape Verde Islands. The species is widespread in saline and sandy habitats around the Mediterranean (Simon 1911), often close to the coast, from Spain and Algeria in the west to Syria in the east (Esjunin 1994, Esjunin & Efimik 2000). On Maio, these small spiders were mostly collected together with *Hogna* cf. *ferox*, all of them in September at the Lagoa sampling site. The Cape Verde specimens are only tentatively identified as *D. indistincta*, but may belong to a new related species, as there are slight differences in the male palp compared to the illustrations in Esjunin & Efimik (2000), in particular a less prominent lateral hook of the conductor. Individual males from southern France, Tunisia and Egypt examined in the Muséum national d'Histoire naturelle, Paris (MNHN B.443, AR444, AR449, AR 5286; all identified as "*D. hirsutissima* (E. Simon)")

showed considerable variation in pedipalpal morphology. A revision of a larger amount of material covering the wide range of the species is desirable before a final decision on the taxonomic status of the Maio material is made.

## Gnaphosidae – Ground spiders

*Berlandina nigromaculata*[E] (Blackwall, 1865)
Maio: Lagoa, 4M, 1F, 1 subadult M, IX.2009, GLAHM 140384, GLAHM 140386, GLAHM 140391; Maio: Salina, 1F, 19.IV.2009, GLAHM 140429; 1 juvenile, 25.IV.2009, GLAHM 140380; 1M, 22.V.2009, GLAHM 140382; 4M, 1F, 1 juvenile, IX.2009, GLAHM 140390, GLAHM 140394, GLAHM 140392.
This endemic species was collected as adults and juveniles in both April and September 2009, at all sampling sites. This relatively large, cream-colored spider is one of the most abundant species on the island of Maio.

*Zelotes laetus* (O. P.-Cambridge, 1872)
Maio: Salina, 3M, 2F, IX.2009, GLAHM 140406, GLAHM 140407, GLAHM 140419, GLAHM 140423; Maio: no location details, 1F, IX.2009, GLAHM 140444.
*Z. laetus* was found only in September 2009 at Salinas de Porto Inglês. For a long time, this species was considered endemic to the Cape Verde Islands (under the name *Zelotes salensis* Berland, 1936, after the type locality on the island of Sal). It was only recently synonymized with the cosmopolitan species *Z. laetus* (FitzPatrick 2007). However, the wide and disjunct distribution of this species (which includes Africa north of the equator, France, Portugal, Israel, Saudi Arabia, the southwestern United States, Mexico, Peru, Hawaii and the Galapagos Islands) is quite atypical for a gnaphosid spider. Comparable patterns are only found in the originally Mediterranean species *Zelotes nilicola* (O. P.-Cambridge, 1874), *Trachyzelotes jaxartensis* (Kroneberg, 1875), *T. kulczynskii* (Bösenberg, 1902) and *T. lyonneti* (Audouin, 1826), and in the synanthropic species *Scotophaeus blackwalli* (Thorell, 1871) and *Urozelotes rusticus* (L. Koch, 1872). Therefore, the taxonomic status of the Cape Verde specimens (and especially the synonymy with the American populations) deserves additional study.

Other gnaphosid species reported by Schmidt (1999): *Australoechemus celer*[E] Schmidt & Piepho, 1994, *Drassodes assimilatus* (Blackwall, 1865), *Setaphis atlantica*[E] (Berland, 1936).

## Linyphiidae – Dwarf spiders

gen. sp. 2*
Maio: Salina, 1F, IX.2009, GLAHM 140408.
The single linyphiid female from Salinas Porto Inglês clearly does not belong to the only linyphiid species described before from Cape Verde (*Koinothrix pequenops* Jocqué, 1981). It is a tiny, large-eyed, pale spider, which because of the epigynal structure could belong to the species reported as "*Meioneta* spec." from São Vicente by Assmuth & Groh (1982). A definitive taxonomic assignment will require additional material, in particular male specimens.

## Lycosidae – Wolf spiders

*Arctosa variana** C. L. Koch, 1847
Maio: Salina, 1M, 11.V.2009, GLAHM 140410; 1 subadult M, IX.2009, GLAHM 140393; Maio: Lagoa, 1 juvenile, 22.IV.2009, GLAHM 140411.
This species seems to be widespread on the island, but rather rare. Single juveniles were found at both sampling sites. The only adult specimen was collected in May 2009 at the Salina.

*Hogna* cf. *ferox* (Lucas, 1838)
Maio: Lagoa, 1F, 15.IV.2009, GLAHM 140428; 1M, 25.IV.2009, GLAHM 140395; 13M, 1F, IX.2009, GLAHM 140385, GLAHM 140387, GLAHM 140397, GLAHM 140399, GLAHM 140401, GLAHM 140403, GLAHM 140417; Maio: Salina, 1 subadult M, IX.2009, GLAHM 140405; Maio: no location details, 1M, IX.2009, GLAHM 140400.

This is the most abundant species in our sample, almost exclusively collected in September 2009 from the Lagoa site. The predominance of male specimens is noteworthy, indicating a pronounced difference in mobility of the sexes. Wunderlich (1991) considers *H. ferox* s. str. to be endemic to the Canary Islands, in which case the correct name for the Cape Verde species would probably be *H. helva* (Blackwall, 1865).

Other lycosid species reported by Schmidt (1999): *Allocosa caboverdensis*[E] Schmidt & Krause, 1995.

### Nephilidae – Giant orb-web spiders

*Nephila senegalensis* (Walckenaer, 1841)
Maio: Lagoa, 1F, 8.V.2009, GLAHM 140409.
One female of this striking black-and-yellow spider was collected by hand from its web high in a tree at Ribeira de Lagoa.

### Oxyopidae – Lynx spiders

*Oxyopes* cf. *caboverdensis**[E] Schmidt & Krause, 1994
Maio: Lagoa, 1M, IX.2009, GLAHM 140416.
A single specimen was collected in September 2009 at Ribeira de Lagoa.

Other oxyopid species reported by Schmidt (1999): *Peucetia viridis* (Blackwall, 1858).

### Philodromidae – Running crab spiders

*Thanatus atlanticus*[E] Berland, 1936
Maio: Salina, 1M, IX.2009, GLAHM 140421.
This is the only valid species that has Maio as its type locality, having been described by Berland based on a female specimen collected in July 1934 on Maio by Auguste Chevalier (MNHN B.1567). The male assigned here to *Thanatus atlanticus* was initially thought not to match the male tentatively identified as belonging to this species by Schmidt & Krause (1995). The tibial apophysis is long, thin and pointed, different from the figure in Schmidt & Krause (1995). Examination of Schmidt's specimen in the Senckenberg Museum in Frankfurt am Main (SMF38024-128; "Kapverden: Boavista: Lavageröll bei Sal Rei: G. Schmidt leg. u. det. 16.4.1994") shows, however, that the figure is misleading: the Boavista specimen clearly possesses the same strongly sclerotized pointed tibial apophysis as the Maio specimen.

*Thanatus vulgaris** Simon, 1870
Maio: Salina, 1M, IX.2009, GLAHM 140422.
Collected in September 2009 at Salinas de Porto Inglês. Several juvenile philodromid specimens collected at Riberia de Lagoa and Salinas de Porto Inglês in September 2009 may also belong to this widespread species.

### Salticidae – Jumping spiders

*Pellenes* cf. *vanharteni**[E] Wesołowska, 1998
Maio: Lagoa, 1M, 2.V.2009, GLAHM 140412; Maio: Salina, 1M, 10.V.2009, GLAHM 140424; 1M, 22.V.2009, GLAHM 140383; 1M, 1F, IX.2009, GLAHM 140420, GLAHM 140427.
Adult specimens tentatively assigned to this species were mainly collected in May and September 2009 at Salinas de Porto Inglês.

*Wesolowskana lymphatica*[E] (Wesołowska, 1989)
Maio: Vila [do Maio], 1M, 15.IV.2009, GLAHM 140418; 1F(?), 19.IV.2009, GLAHM 40414.
This species was collected in April 2009 at Vila do Maio. The female specimen is badly damaged and has not been identified with certainty. This species has probably had the most dynamic taxonomic history of all the endemic spiders of Cape Verde. Described only in 1989, as *Luxuria lymphatica* (Wesołowska 1989), it has also been reported as *Baryphas dubius* (originally used for the male of *L. lymphatica*, described in the same paper), *Hyllus dubius*, and *Blaisea dubia*, illustrating the still fluid state of salticid taxonomy.

Other salticid species reported by Schmidt (1999): *Menemerus bivittatus* (Dufour, 1831), *Phlegra insulana*[E] Schmidt & Krause, 1998, *Wesolowskana marginella*[E] (Simon, 1883).

**Sparassidae – Huntsman spiders**

*Heteropoda venatoria** (Linnaeus, 1767)
Maio: no location details, 1F, IX.2009, GLAHM 140415.

A single specimen of this large pantropical synanthropic species was collected by hand.

**Thomisidae – Crab spiders**

*Xysticus* sp.*
Maio: no location details, 1 subadult F, IX.2009, GLAHM 140443.
The single *Xysticus* specimen in our sample is a subadult female collected in September 2009. Based on its coloration, the specimen is likely to belong to the only *Xysticus* species reported from the archipelago so far, the endemic *Xysticus pigrides* Mello-Leitão, 1929.

Other thomisid species reported by Schmidt (1999): *Misumenops spinulosissimus*[E] (Berland, 1936).

**Taxa not found in the present survey**

The following additional taxa reported from Maio by Schmidt (1999) were not found in our sample: **Filistatidae:** *Filistata canariensis* Schmidt, 1976*;* **Hersiliidae:** *Hersiliola simoni* (O. P.-Cambridge, 1872)*;* **Miturgidae:** *Cheiracanthium furculatum* Karsch, 1879*, Cheiracanthium halophilum*[E] Schmidt & Piepho, 1994*;* **Oecobiidae:** *Oecobius navus* Blackwall, 1859 (as *O. annulipes*)*;* **Pholcidae:** *Artema atlanta* Walckenaer, 1837*, Micropholcus fauroti* (Simon, 1887)*, Smeringopus pallidus* (Blackwall, 1858)*;* **Selenopidae:** *Selenops radiatus* Latreille, 1819; **Theridiidae:** *Argyrodes argyrodes* (Walckenaer, 1841)*, Coleosoma africanum*[E] Schmidt & Krause, 1995*, Kochiura aulica* (C. L. Koch, 1838)*, Latrodectus cinctus* Blackwall, 1865*, Latrodectus geometricus* C. L. Koch, 1841*, Lactrodectus* nr. *geometricus* "black" (unclear status)*, Latrodectus pallidus* O. P.-Cambridge, 1872*, Nesticodes rufipes* (Lucas, 1846)*, Theridion cuspulatum*[E] Schmidt & Krause, 1998*, Theridion musivivoides*[E] Schmidt & Krause, 1995*, Tidarren cuneolatum* (Tullgren, 1910) (as *T. chevalieri*).

## DISCUSSION

In agreement with earlier studies of Cape Verde spiders, the most common species in our collection are *Berlandina nigromaculata* (Gnaphosidae) and *Hogna* cf. *ferox* (Lycosidae). Other relatively common species are *Pellenes* cf. *vanharteni* (Salticidae), *Zelotes laetus* (Gnaphosidae), and *Devade* cf. *indistincta* (Dictynidae). With the exception of *B. nigromaculata*, these species are all restricted to only one of the sampling sites, indicating rather strict habitat requirements. The remaining identified species are present mostly as singletons.

The discovery of many species that are new for Maio (10 species) or even for Cape Verde (*Devade* cf. *indistincta*), extending the number of known species from 36 to 46 (22% increase), is surprising in such a small collection. To some extent, this is probably due to the collection date. The most interesting species were found in September 2009, while previous visits by Schmidt and co-workers had been exclusively in spring. Also, the use of pitfall traps rather than hand collecting may have contributed to the different coverage. The latter factor is probably also responsible for the strong bias towards male specimens (42 vs. 15 specimens; 73%; the remaining 16 specimens are juveniles or subadult).

The total number of species present on Maio is probably larger. A conservative estimate (Chao1 = $N_{obs}$ + $(N_{singletons}{}^2/(2{*}N_{doubletons}))$ = $16+10^2/2$) predicts

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66 species (Chao 1984, Colwell & Coddington 1994). Treating the checklist of Schmidt *et al.*(1994) and the present collection as replicates (a not quite legitimate procedure), one can calculate the analogous Chao2 estimate (Chao2 = $N_{total}$ + $(N_{unique}{}^2/(2*N_{shared}))$ = $31+(11+15)^2/(2*5))$, i.e. 99 species. Although the uncertainty of these estimates is quite large, the numbers do not seem unreasonably high, even considering that Maio is one of the dry and ecologically less diverse islands within Cape Verde, given that the total known number of species in the Cape Verde Islands is at least 120 (Schmidt *et al.* 1994, Schmidt & Krause 1998, Schmidt 1999). Considering the severe undersampling in this study (singleton frequency = 10/16 = 63%; sampling intensity = (42+15)/16 = 3.6), these numbers are possibly still underestimates of the real diversity of spiders on Maio (Coddington *et al.* 2009).

These estimates of total expected spider diversity agree well with the numbers reported from islands of comparable size among the northern Macaronesian archipelagos (e.g., São Jorge, Azores, 246 km$^2$, 54 species; El Hierro, Canary Islands, 278 km$^2$, 99 species; Cardoso *et al.* 2010). Compared to these islands, perhaps the most surprising feature of the spider fauna of Cape Verde is the absence of any spectacular evolutionary radiation, which occurred in such striking forms on the more northerly Macaronesian islands of Madeira and the Canaries (Wunderlich 1991, Arnedo *et al.* 2001, Dimitrov *et al.* 2008). The genera that are forming the most species-rich endemic complexes on Madeira and the Canary Islands are either absent (*Pholcus, Spermophorides, Lepthyphantes*) or represented by individual cosmopolitan species (*Dysdera, Oecobius*) in Cape Verde. The reason for the lack of extensive radiation of spider genera is probably the comparative homogeneity of habitats on some of the islands (Maio, Boavista, Sal), which are almost uniformly arid (Wunderlich 1991).

The largest gap in our sample concerns the family Theridiidae (comb-footed spiders): not a single one of the 10 reported species was found in our pitfall traps. This family includes some of the most interesting Cape Verdean spiders, including the dangerously venomous black-widow spiders (*Latrodectus*) and the genus *Tidarren*, famous for the genital self-mutilation of the males (Knoflach & van Harten 2006). Similarly, Pholcidae (daddy long-leg spiders) were not recorded. The reason is probably the difference in sampling techniques, as all of Schmidt's work relied on hand collecting, while the majority of our specimens came from pitfall traps. This emphasizes the need for a diverse array of sampling methods (and times) for obtaining a comprehensive biodiversity profile of spiders (Green 1999, Sørensen *et al.* 2002, Borges & Brown 2003, Cardoso 2009).

With 57 adult specimens, our spider sample is small, but considering that it was obtained on a single island during a period of two months, it nonetheless compares well with the 280 specimens collected during three field seasons from eight islands by Assmuth & Groh (1982) and their co-workers. These numbers reflect the considerably lower spider densities on the arid Cape Verdean islands, compared to forest and grassland ecosystems that have previously been the focus of spider biodiversity studies (e.g. Coddington *et al.* 1996, Toti *et al.* 2000, Bell *et al.* 2001, Scharff *et al.* 2003, Cardoso *et al.* 2008). In a temperate European forest, the number of spider species on a single tree trunk can exceed that of many Cape Verdean islands (Blick 2011), and the number of specimens collected by an experienced collector in a single day is easily larger than our entire sample (e.g. Scharff *et al.* 2003). Any attempts to use spiders as indicator species for monitoring habitat quality and development in Cape Verde will need to take the much lower productivity of the semi-desert ecosystem into account. Sampling intensity has to be sufficiently low to be compatible with conservation concerns, while still being high enough to allow meaningful conclusions (Dobyns 1997).

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# New records of the olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz, 1829) from the Cape Verde Islands

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Keywords: marine turtle, olive ridley, *Lepidochelys olivacea*, stranded, distribution, Atlantic, Africa, Cape Verde Islands

ABSTRACT

The olive ridley sea turtle *Lepidochelys olivacea* has been recorded in the Cape Verde Islands, but the most recent published data (1998-2000) are of stranded individuals and remains only. This article presents new data on olive ridleys recorded during the years 2001-2011 on Boavista and Sal islands. The presence of this species does not appear to be related to nesting activity. The possible geographical origin of these turtles is discussed. In addition, we propose some studies that could help to reinforce the conservation of sea turtles in West Africa.

RESUMO

A tartaruga olivácea *Lepidochelys olivacea* tem sido descrita nas ilhas de Cabo Verde. Os dados publicados mais recentes (1998-2000) dão conta de indivíduos encalhados e a restos encontrados nas praias. Este artigo reúne novos dados desta espécie registados nos últimos anos (2001-2011) nas ilhas de Boavista e Sal. A presença desta tartaruga nas águas do arquipélago não parece ter relação com a actividade de desova. Para esclarecer a possível origem destas tartarugas em Cabo Verde são discutidas algumas hipóteses. São igualmente propostas algumas pesquisas que poderiam contribuir para fortalecer a conservação das tartarugas marinhas na África Ocidental.

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## INTRODUCTION

On a global scale, the olive ridley sea turtle *Lepidochelys olivacea* is considered the most abundant species of marine turtle (Marcovaldi 2001), although its conservation status varies among different populations (Spotila 2004). At present the species is categorized as vulnerable on the IUCN Red List (IUCN 2011). The species is distributed in tropical and subtropical waters worldwide. In the Pacific Ocean, the nesting distribution ranges from the beaches of southern Mexico to Ecuador (Spotila 2004, Alava *et al.* 2007). In the central Indian Ocean, the beach holding the largest number of nests is located on the eastern coast of India, while nesting also occurs in Sri Lanka, Pakistan and Bangladesh (Spotila 2004). In the western Indian Ocean basin there are nesting beaches in Oman, Kenya, Tanzania and Mozambique (Spotila 2004). In the western Atlantic Ocean, nesting areas are scarce, with some nesting areas in the Guyanas and Brazil (Reichart & Fretey 1993, Marcovaldi 2001, da Silva *et al.* 2007, Kelle *et al.* 2009). Olive ridleys nest *en masse* on some beaches, especially in Ostional and Nancite (Costa Rica), La Escobilla (Mexico) and Gahirmatha (India) (Spotila 2004). This kind of event is known as *arribada* and consists of thousands of females emerging to nest on the same beach, with each laying event lasting several days (Marcovaldi 2001). Nevertheless, solitary nesting is the more common laying strategy on most nesting grounds (IUCN 2011).

The olive ridley sea turtle is an omnivorous species, with a rather unspecialized diet. Like the loggerhead sea turtle *Caretta caretta*, it appears to show a more plastic foraging behavior than other sea turtle species (McMahon *et al.* 2007). While Australian females feed in neritic waters (McMahon *et al.* 2007, Whiting *et al.* 2007), males and females from the eastern tropical Pacific spend most of their time outside the breeding season in an oceanic environment and have been characterized as nomadic, highly migratory oceanic wanderers (Plotkin 2010). On the other hand, some adult females from Oman appear to be sedentary (Papathanasopoulou 2009). Thus far, little is known about the early life ecology and movements of olive ridleys (Spotila 2004). In the Central Pacific, juveniles from both eastern and western Pacific populations are found in an oceanic habitat (Polovina *et al.* 2004).

Compared to other areas, knowledge about the life cycle and distribution of marine turtles in the eastern Atlantic is poor (Formia *et al.* 2003, Fretey 2001). According to current knowledge, the olive ridleys' northern limit of distribution could be in Mauritania (Carr 1957), as its presence there was recently confirmed by at sea captures of adult individuals (Mint-Hama *et al.* in press). The occurrence of olive ridleys north of the Canary Islands and Madeira seems to be accidental (Fretey 2001).

Along the western African coast, the olive ridley sea turtle nests from Guinea Bissau (Bijagós archipelago) to Angola, regularly at some localities and incidental at others (Carr & Campbell 1995, Fretey 1999, Fretey *et al.* 2005, Pauwels & Fretey 2008, Godgender *et al.* 2009, Catry *et al.* 2010, Ségniagbeto *et al.* in press, J. Gómez pers. comm.). The possibility of the olive ridley nesting in southern Senegal (Casamance region) cannot be dismissed, but there are as yet no confirmed records (Diagne 1999).

Immature olive ridleys have been captured incidentally (Angoni *et al.* 2010) along the coast of Cameroon, suggesting that these waters (which are rich in sediment and shrimp) may be developmental areas. Adults are widespread year-round in oceanic waters off Angola (Weir *et al.* 2007) and in waters off Congo (Godgender et al. 2009) and this area probably constitutes a feeding ground for turtles nesting along these coasts.

In the Cape Verde Islands, most recent (1998-2000) records of olive ridleys are of stranded individuals (both dead and alive) and remains (carapaces) (Fretey 2001). L.F. López-Jurado (in Fretey 2001) reported carapaces displayed in gift shops on Sal island and mentioned stranded olive ridley turtles on Sal and São Nicolau. Fretey (2001) reported six records of carapaces or remains of dead turtles on Maio (1), Santa Luzia (1), Santiago (1) and Boavista (3), as well as an entangled live individual on Boavista. Here we present new data on olive ridleys recorded during the past decade (2001-2011) on two islands in the Cape Verde archipelago (Boavista and Sal) and discuss their possible geographical origin.

Fig. 1. Olive ridley *Lepidochelys olivacea*, found at Atalanta beach, Boavista, 4 November 2004 (Nuria Varo-Cruz). Fig. 2. Olive ridley, Baía Grande, Boavista, 26 January 2010 (Jon Crighton).

## RECENT OCCURRENCES IN THE CAPE VERDE ISLANDS

The records here reported were brought to our attention by fishermen and local inhabitants as well as tourists, who informed Cabo Verde Natura 2000 or SOS Tartarugas, both NGOs working in the archipelago.

On 4 November 2004, an olive ridley was delivered alive to the staff of Cabo Verde Natura 2000. This turtle was found stranded along the shore of Atalanta beach, northern Boavista, showing obvious dehydration symptoms, malnutrition and buoyancy difficulties. Despite treatment, it died after a few days (Fig. 1).

On 26 January 2010, an olive ridley was found at Baía Grande beach, northern Boavista. The turtle was floating near the shore and appeared to be in poor shape. After pictures being taken, the turtle was released (Fig. 2).

On 27 November 2010, local fishermen caught an olive ridley, with a deformed carapace and both left flippers missing, off southern Sal. This turtle was delivered to the staff of SOS Tartarugas and after a veterinarian checkup an euthanasia was done. The deformity of the carapace entailed a strong shift in the configuration of scutes and scales (Fig. 3).

On 28 March 2011, tourists found an entangled olive ridley at Atalanta beach, northern Boavista. After being disentangled it was released into the sea (Fig. 4).

Fig. 3. Olive ridley *Lepidochelys olivacea* with deformed carapace, captured off Santa Maria, Sal, 27 November 2010 (Jacquie Cozens/SOS Tartarugas Cabo Verde). Fig. 4. Olive ridley, Atalanta beach, Boavista, 28 March 2011 (Ian Ford).

Table 1 summarizes information of records of olive ridley sea turtles in the Cape Verde Islands. Information obtained from photos and measurements taken of some individuals show that records no. 1 and 7 were the smallest turtles recorded, their size being indicative of juveniles (cf. Fretey 2001). These two records are of carapaces found in a house at Praia Gonçal (Maio island) and in the capital Praia (Santiago island) and, therefore, we cannot be entirely sure that they were captured or found in Cape Verde. The remaining records may concern either adults or large juveniles.

| Record | Date | Location | Island | CCL/CCW | A/D/C | Condition |
|---|---|---|---|---|---|---|
| 1 | 22 August 1999 | Praia Gonçal | Maio | 47/48 | C | unknown |
| 2 | 20 October 1999 | Praia do Castelo | S. Luzia | – | C | unknown |
| 3 | 01 December 1999 | Ponta do Sol | Boavista | 66/68 | D | S, E |
| 4 | 02 December 1999 | Praia Atalanta | Boavista | – | A | S, E |
| 5 | 08 April 2000 | Praia de Galeo | Boavista | 60/64 | C | unknown |
| 6 | 09 April 2000 | Baía Pedra Alvim | Boavista | 71/71.5 | C | unknown |
| 7 | 16 April 2000 | Praia | Santiago | 20/– | C | unknown |
| 8 | 04 November 2004 | Praia Atalanta | Boavista | – | A | S |
| 9 | 26 January 2010 | Baía Grande | Boavista | – | A | S |
| 10 | 27 November 2010 | Off Santa Maria | Sal | – | A | F |
| 11 | 28 March 2011 | Praia Atalanta | Boavista | – | A | S, E |

Table 1. Records of olive ridley sea turtle *Lepidochelys olivacea* in the Cape Verde Islands during the years 1999-2011. Record 1 from Varo-Cruz *et al.* (1999) and Fretey (2001), records 2-7 from Fretey (2001), records 8-11 this paper. CCL: curve carapace length (cm), CCW: curve carapace width (cm). A: alive, D: dead, C: carapace or remains, S: stranded, E: entangled; F: floating.

## DISCUSSION

Two factors need to be considered in relation to Fretey's (2001) Cape Verde records and those presented in this paper: 1) the condition of the individual turtles and 2) the location of the records (Fig. 5). Nine individuals found along the shore were either entangled, in bad health or dead. Since 1998, intensive surveys of sea turtle nesting have been conducted on large stretches of Boavista's beaches, during which no nesting olive ridleys have been recorded. Thus, the presence of olive ridley in the Cape Verde Islands does not appear to be related to nesting activity. Therefore, we must seek another explanation for the presence of this species in the archipelago.

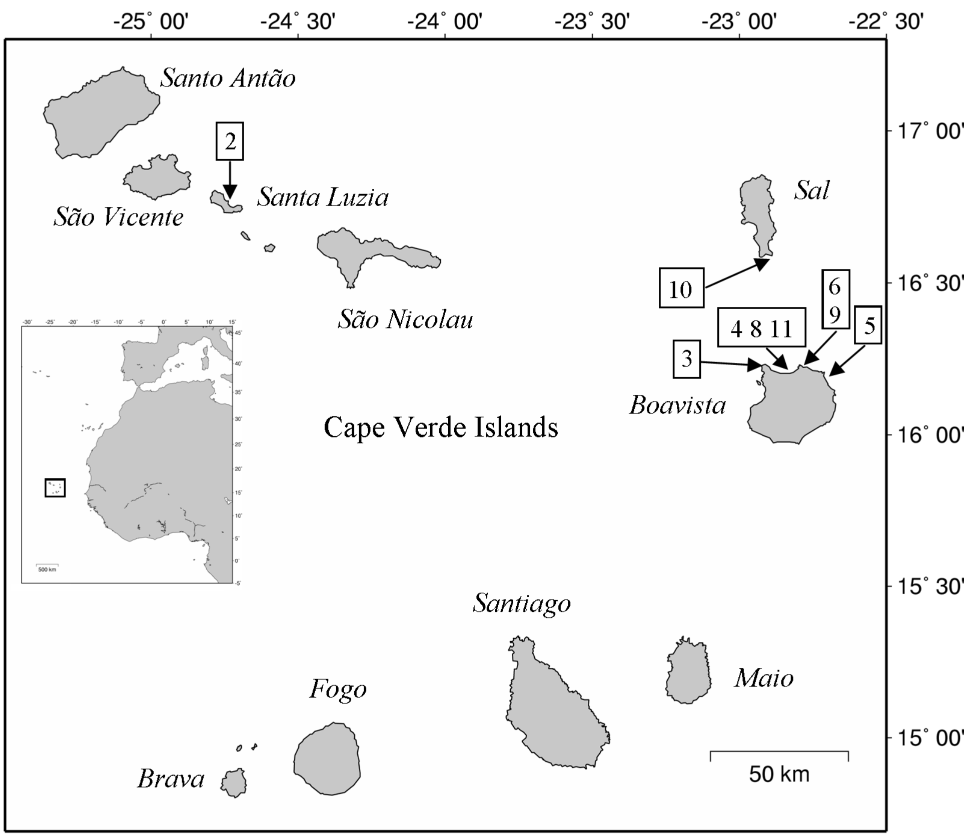


Fig. 5. Map of the Cape Verde Islands showing locations of records in Fretey (2001) and those reported in the present paper (except two carapaces found in private houses; Table 1: records 1 and 7). Adapted from seaturtle.org Maptool http://www.seaturtle.org/maptool/ (accessed 6 September 2011).

The nesting beaches of olive ridleys in Guinea-Bissau (Catry *et al*. 2010), Sierra Leone (Fretey & Malaussena 1991) and Liberia (Stuart & Adams 1990) are not very far away from the Cape Verde Islands. There could exist neritic or oceanic feeding grounds in the waters of this region and sick individuals could drift to the inshore waters of Cape Verde.

As there are important nesting populations in Brazil and the Guyanas, an American origin for olive ridleys in Cape Verde must also be considered. Leatherback *Dermochelys coriacea* (Pritchard 1973, Ferraroli *et al.* 2004) and hawksbill turtles *Eretmochelys imbricata* (Marcovaldi & Filippini 1991, Bellini *et al*. 2000, Grossman *et al*. 2007) equipped with satellite transmitters or monel tags in South America are known to have crossed the Atlantic from west to east. Olive ridleys belonging to western Atlantic breeding populations may have crossed the ocean and reached Cape Verde coasts.

Regardless of their origin and since olive ridley records in Cape Verde often concern sick or dead animals, they may have been displaced by the currents. Individuals feeding or moving in this part of the Atlantic, i.e. to the north of Cape Verde, may be displaced southwards by the Canary Current and appear on Cape Verde shores, which could perhaps account for the northern position in the archipelago of the stranded animals.

Many different threats to sea turtles in West Africa, including degradation and destruction of habitat, a high rate of by-catch in fisheries and the capture of females and nest poaching on nesting beaches, have been reported (e.g. Fretey 2001, Formia *et al.* 2003, Weir *et al.* 2007, Godgender *et al.* 2009). Our data show an indirect consequence of fisheries, with several entangled individuals (cf. Table 1, records 3, 4, 11).

Nowadays satellite tracking provides accurate information about the routes followed and the areas used by animals equipped with a transmitter. Equipping olive ridleys from both sides of the Atlantic with such devices would disclose usage and distribution of olive ridley habitat and reveal the relative importance of Cape Verde waters for the species. Genetic characterization of African stocks, together with representative samples from the nesting area as a whole (published studies include only a small sample and from one location only; cf. Bowen *et al.* 1998) would allow to establish the genetic structure of the region's populations, the relationships amongst Atlantic and more widely studied (e.g. Bowen *et al.* 1998, López-Castro & Rocha-Olivares 2005) populations and to identify conservation units in the eastern Atlantic. All such information is essential for the much needed implementation of conservation measures for sea turtles, including the olive ridley, in West Africa.

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# Nesting activity of the loggerhead sea turtle *Caretta caretta* (Linnaeus, 1758) on Maio, Cape Verde Islands

**Jacquie Cozens [1], Harriette Taylor [1] & João Gouveia [1]**

Key words: Loggerhead turtle, *Caretta caretta*, Maio, Cape Verde

ABSTRACT

Loggerhead sea turtles *Caretta caretta* may now be the only species of marine turtle nesting on the island of Maio, Cape Verde Islands. Threats to loggerhead turtles include hunting of females on land and males and females in the water, poaching of nests and, increasingly, light pollution and other disturbances related to tourism development. Length and remoteness of the beaches on Maio lead to limited monitoring and data collection. Although it is believed that Maio has one of the largest nesting populations of loggerheads in the Cape Verde Islands, very little information exists regarding the nesting beaches and the population of nesting females. During July 2009, a four day survey of the island was carried out in order to obtain insight as to the status of nesting loggerheads on Maio. The census showed that compared to the island of Sal the number of turtles nesting on Maio was higher at 19.64% more nests and 39.9% more tracks during the same period. It is recommended that in order to determine the true size of the Maio nesting population a full census should be undertaken over several seasons.

RESUMO

É provável que as tartarugas-comuns *Caretta caretta* sejam actualmente a única espécie de tartarugas marinhas a nidificar na ilha do Maio, Cabo Verde. Algumas das principais ameaças à tartaruga comum incluem a caça de fêmeas em terra e de fêmeas e machos no mar, o roubo dos ovos, bem como, de forma crescente, a poluição luminosa e outras perturbações relacionadas com o desenvolvimento turistico. A extensão e localização remota das praias da ilha do Maio têm contribuído para uma monitorização e recolha de dados limitada. Apesar de se suspeitar que o Maio possui uma das maiores populações nidificantes de tartarugas-comuns em Cabo Verde, a informação sobre as praias onde a nidificação ocorre e sobre a população de fêmeas é escassa. Em Julho de 2000, foi efectuado um estudo de quatro dias sobre o estado dos ninhos na ilha. O recenseamento demonstrou que, em comparação com a ilha do Sal durante o mesmo período, o número de ninhos era superior em 19.64% e o número de rastos em 39.9%. Recomenda-se que sejam conduzidos recenseamentos sistemáticos ao longo de várias estações para determinar o tamanho real da população nidificante no Maio.

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## INTRODUCTION

The Capeverdean island of Maio is located south of Boavista and east of Santiago (Fig. 1), and although there is no published data to support the theory, it is believed to have one of the most significant sized nesting populations of loggerhead turtles in the archipelago. There is also only a limited amount of information about the total number of nesting turtles in all the Cape Verde islands. In the past, like elsewhere in Cape Verde, other species such as hawksbill *Eretmochelys imbricata* and green *Chelonia mydas* turtles may have nested on Maio, but possibly due to excessive hunting and poaching of nests, today only loggerheads remain (cf. López-Jurado *et al*. 2000, Loureiro & Torrão 2008).

Aside from the killing of nesting females, a problem seen across the whole of Cape Verde (Araújo 2009), Maio also has a high incidence of egg poaching and hunting of male turtles for the penis (which is often mixed with the local spirit, grogue, and sold as an aphrodisiac). Another concern is the amount of development for tourism, which is responsible for the increase of degradation in nesting beaches and habitat loss (Taylor & Cozens 2010).

Illegal removal of sand for construction is also a problem on Maio as it is on many other islands in Cape Verde. Removing sand from prime nesting beaches causes females to find other, possibly less suitable, locations to nest (Witherington & Martin 1986). Laws exist, such as Article 206 of the Cape Verde Constitution, which are designed to prevent sand removal as well as promote the protection of the environment. Unfortunately these laws are not usually implemented.


Fig. 1. Map of the Cape Verde Islands

One of the biggest concerns for Maio's nesting population is the limited knowledge of the life cycle and endangered status of turtles amongst the people of Maio. In Cape Verde, there seems to be a general lack of awareness of both the importance of turtles and the need to protect them (Marco *et al*. 2010). In 2008, only 44 nests were identified in São Vicente island and 11 in Santo Antão, compared to 382 in Maio, indicating the significance of the island within Cape Verde (Araújo 2009).

The Câmara Municipal (City Hall) of Maio, together with the Direcção Geral do Ambiente (Department for the Environment) mounts a turtle protection campaign each year, which encompasses outreach activity and beach patrols on foot during the night by local guards. Patrols consist of the collection of data such as number of nests, tracks and dead turtles, but are primarily performed to deter hunting of the females for meat. These local guards live in coastal communities and have received training to undertake the patrols, although standards of data collection are not uniform and the suitability of beaches has not been assessed, for example quality of sand or likelihood of inundation.

The aim of this study was to gain a better understanding of the quality and accessibility of Maio's nesting beaches, as well as allowing further understanding of nesting abundance by assessing a few days activity over the peak season. Prior to the survey, the key beaches were reported to be in the southeastern part of the island as well as in Morro (southwest), Praia Rotcha (Vila de Maio) and Santana (northwest) (data Câmara Municipal do Maio).

## METHODS

The non-governmental organization SOS Tartarugas visited Maio from 15 July to 5 August 2009 with the objective of undertaking a full survey of sea turtle nesting beaches and to assist with outreach activities. The island survey was conducted between 17 and 21 July in conjunction with the Câmara Municipal do Maio, other local organizations and individual citizens (see Acknowledgements).

Every stretch of sandy beach was walked during daylight (see Appendix 1) and the following data were recorded:

- Name of beach,
- Beach length and GPS coordinates,
- Observations on beach conditions,
- Presence of turtle nests,
- Presence of false crawls,
- Signs of human nest robbery,
- Presence of dead turtles.

Beaches were assessed for nesting suitability taking into account factors such as quality of sand, width, slope, likelihood of flooding, presence of vegetation and amount of pollution or degradation caused by litter (visually assessed). Data were analyzed to determine the most prolific nesting beaches. Data were simultaneously collected on both Sal and Maio during the morning of the same days by various members of SOS Tartarugas personnel using the same methodology to record nests and tracks. All visible activities were recorded.

## RESULTS

A total of 353 activities were recorded on Maio island during the census: 286 tracks and 67 nests (23%). Fig. 2 compares data for nests on Maio for the same period (17–21 July 2009) on Sal island. Maio recorded a higher number of loggerheads nesting, with 19.64% more nests and 39.9% more tracks than Sal during this period. The highest number of nests was seen at Santana Beach (n = 34), while the highest number of tracks was found at Djampaja Beach (n = 62) (Fig. 3). The highest nesting density was seen on Praia de Farol (a rate of one nest per 37 m).

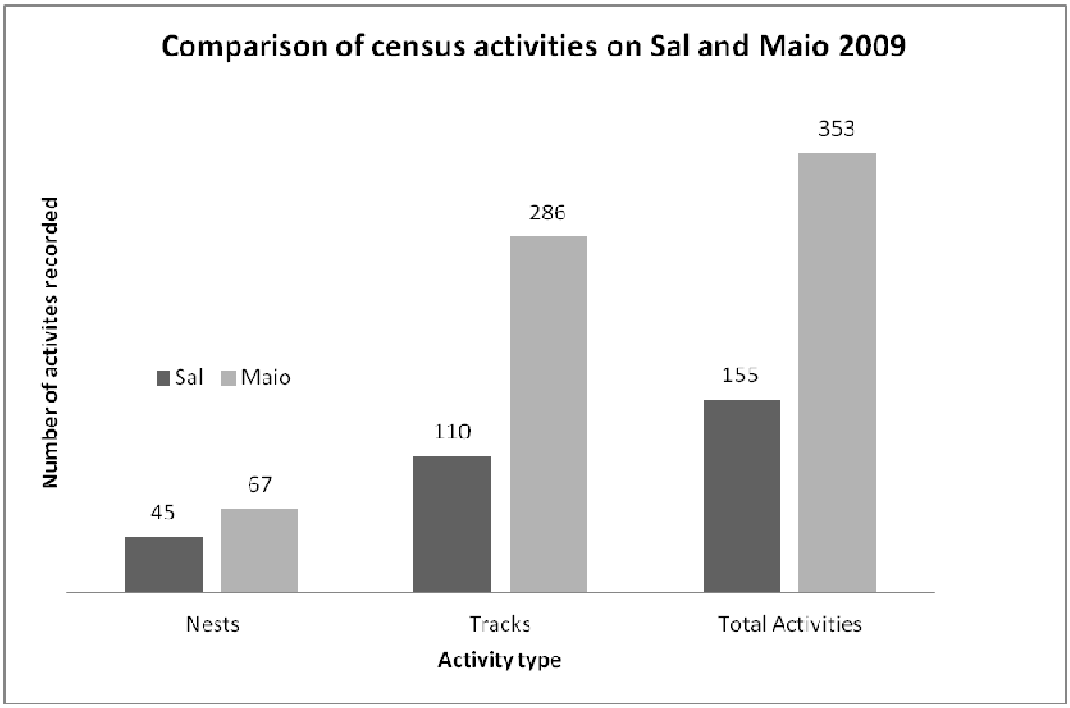


Fig. 2. Comparison of activities on Sal and Maio between 17 and 21 July 2009.

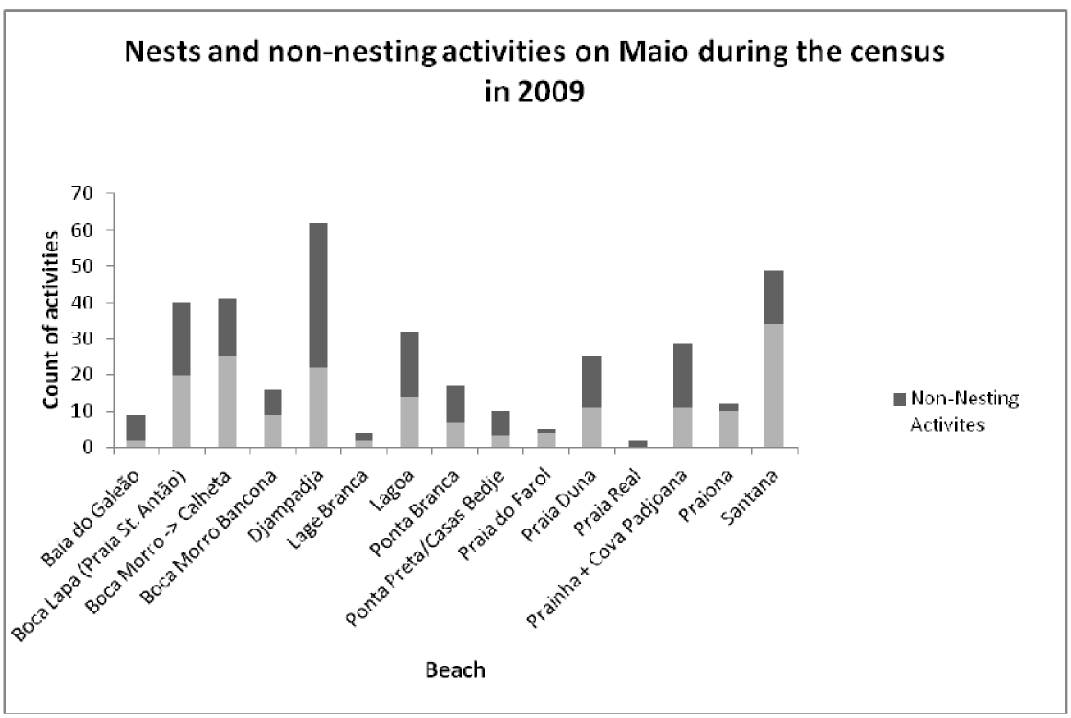


Fig. 3. Nests and non-nesting activities on Maio during the census in 2009.

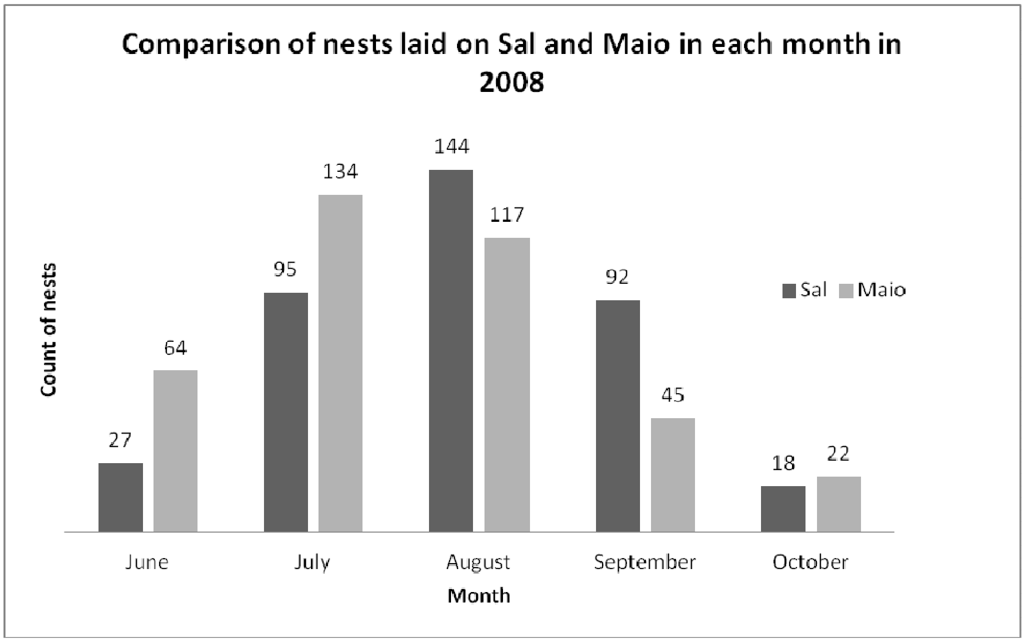


Fig. 4. Comparison of nests laid on Sal and Maio during June-October 2008.

Data collected on Maio by the Câmara Municipal in 2008 show a similar trend as in 2009, with Maio having higher numbers of tracks and nests (Fig. 4). August and September were an exception, with a higher number of activities on Sal compared to Maio, but this could be due to a decrease in monitoring activity on Maio at this time. Due to differences in data collection methods between islands and between individuals on Maio, comparison of data collected on Maio in 2008 with those of Sal can only be used as an indicator to activity level difference.

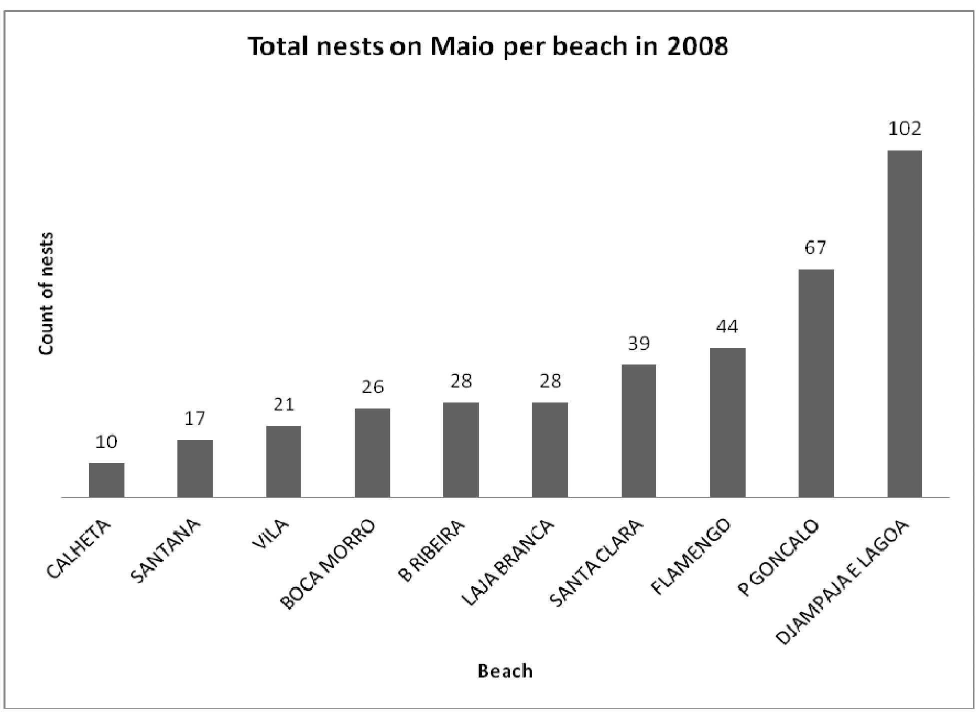


Fig. 5. Nests on Maio per beach in 2008.

Fig. 5 shows nest counts in 2008 at the different beaches (data Betty Silva, Câmara Municipal do Maio). During the 2009 census, three dead turtles, 32 stolen nests, three depredated nests and three inundated nests were recorded. Similar information from previous years is not available for comparison.

## DISCUSSION

The 2009 census gives a small insight as to how important Maio may be to turtle conservation in Cape Verde. The survey highlighted the difficulty in performing the census with a single team and limited transportation because many beaches were remote and difficult to access. Some beaches do not have official names or have several names, which sometimes makes it hard to clearly identify individual beaches. In addition to this, long stretches of coastline had in the past been identified as one beach, thereby increasing the difficulty of distinguishing at which specific areas nests had previously been recorded. However, Maio showed a significantly higher number of nests compared to Sal and over double the number of activities during the same period.

Tracks seen during the census were more concentrated in the southeastern area, which consists of many small beaches with difficult access, although generally nesting was seen to be dispersed across the island. On the southwestern coast there were also many tracks, but the beaches were easier to access. The survey demonstrated that nesting habitat is suitable on the southeastern beaches, possibly due to them being wide enough to limit flooding and therefore limiting the risk of nest inundation. Hunting of nesting females however, seems to be greater here than on the west coast despite the problems with access. This is believed to be due to the remoteness of the beaches. More nests were observed to be stolen from the west coast, which may be related to these beaches being closer to villages. Southern and southwestern beaches experience relatively high levels of inundation.

Guards monitoring beaches in Maio are community based, which is a positive factor in engaging the local population in conservation activities. However, guards have different levels of general knowledge, basic training and experience. Therefore, due to these differences, it is possible that data collected prior to the 2009 census may not be very accurate. It was also observed that some guards have long stretches of beach to patrol and this may hinder their ability to patrol effectively. Lack of equipment or suitable footwear to carry out patrols is another issue faced by the guards – it can be difficult to reach some beaches after heavy rains.

There are some inconsistencies with the data collection. For example, in 2008 Djampadja and Lagoa were counted as one beach as it was controlled by only one guard, but in 2009 these beaches were surveyed separately. In addition, in 2008 a lower number of nests were recorded on Maio in August than in July, which may point to errors in data collection since the peak nesting period in Cabo Verde is usually in August (Araújo 2009), although daily, monthly and yearly changes in the number of nests laid do occur. Even though patrols in 2009 were being carried out and data were collected according to standardized methods, the overall quality of these data varied. To increase the quality of data collecting, guards need more training, help and monitoring to ensure data are collected to a better standard. We suggest an island wide protocol to be created, ensuring the same methodology for basic data collection. This would also allow for fair and better comparisons between islands.

Although we know Maio to be an important nesting ground for loggerhead turtles (Araújo 2009), only limited studies have been undertaken to analyse the population size and insufficient protection has been given to nesting turtles. To understand the true significance of Maio for nesting loggerheads in Cape Verde, extensive monitoring should be conducted over several seasons to determine nesting activities and nests per season. Unlike the islands of Sal and Boavista, Maio is as yet not much affected by mass-tourism. Whilst this remains the case, a complete seasonal survey should be undertaken to further assess the current nesting habitat and implement a protection plan for the nesting beaches.

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Appendix 1. Position and length of beaches prospected during the sea turtle survey on the island of Maio, Cape Verde Islands, 17-21 July 2009. Positions were determined with a Garmin Etrek handheld device.

Ponta Preta & Casas Velhas
Start - 15º 07.410/23º 12.363
End - 15º 06.991/23º 10.465
Length ca. 3.5 km

Djampadja (DJ1 - DJ2 - DJ3)
DJ1 Start – 15º 06.991/23º 10.465
DJ2 Start – 15º 06.840/23º 09.672
DJ3 Start – 15º 06.857/23º 09.214
Length ca. 2.3 km

Lagoa
Start – 15º 07.192/23º 08.823
End – 15º 07.499/23º 08.110

Praia Marco da Areia Branca
Start – 15º 07.676/23º 08.085
End – 15º 07.781/23º 08.002
Length ca. 3.4km

Ribeira Dom João
RJ1 Start – 15º 08.145/23º 07.416
End – 15º 08.159/23º 07.226
RJ2 Start – 15º 08.148/23º 07.201
End – 15º 08.143/23º 07.170

Ribeira Funda Baixo
Start – 15º 08.404/23º 06.817
End – 15º 08.316/23º 06.900

Ribeira Funda Riba
Start – 15º 08.632/23º 06.525
End – 15º 08.715/23º 06.477

Praia Flamengos
Start – 15º 09.566/23º 05.825
End – 15º 09.836/23º 05.518
Length ca. 4.4 km

Ponta Flamengo -> Ribeira Baía
Length ca. 2.5 km

Ribeira Baía
Start – 15º 11.183/23º 05.641
End – 15º 11.083/23º 05.586
Length ca. 1.4km

Praia Sta Clara
Start – 15º 11.936/23º 05.558
End – 15º 12.716/23º 05.684
Length ca. 1.5 km

Praia Guarda
Start – 15º 13.526/23º 05.695
End – 15º 13.635/23º 05.731
Sta Clara -> Praia Guarda
Length ca. 1.7 km

Boca Ribeira
Start – 15º 14.679/23º 05.916
End – 15º 14.521/23º 05.892

Praia Guarda -> Boca Ribeira
Length ca. 1.7 km

Prainha/Praiona/Boca Lapa
Boca Ribeira -> Prainha
Length ca. 1.3 km

Prainha
Start – 15º 15.366/23º 06.108
End – 15º 15.223/23º 06.037

Praiona
Start – 15º 15.962/23º 06.332
End – 15º 15.161/23º 06.349

Boca Lapa
Start – 15º 16.780/23º 06.098
End – 15º 16.546/23º 06.367

Praiona -> Boca Lapa
Length ca. 1.1 km

Laje Branca
Start – 15º 18.563/23º 08.492
End – 15º 18.595/23º 08.623

Boca Lapa -> Lage Branca
Length ca. 5.5 km

Baia do Galeão
Start – 15º 18.843/23º 09.143
Ends – 15º 18.241/23º 09.595

Laje Branca -> Baía do Galeão
Length ca. 1.9 km

Praia Real
Start – 15º 19.261/23º 09.853
End – 15º 19.315/23º 23º 10.482

Praia Farol
Start – 15º 19.877/23º 10.794
End – 15º 19.823/23º 10.317

Ponta Branca Bay 1 (Porto Cais)
Start – 15º 18.721/23º 11.679
End – 15º 18.729/23º 10.584

Ponta Branca Bay 2 (Porto Cais)
Start – 15º 18.629/23º 11.360
End – 15º 18.904/23º 11.957

Praia Real -> Ponta Branca
Length ca. 5.5 km

Baía de Santana
Start – 15º 17.479/23º 12.009
End –15º 16.471/23º 13.522

Praia Duna
Start – 15º 16.302/23º 13.527
End – 15º 15.820/23º 13.793

Praia Duna -> Santana
Length ca. 4.4 km

Calheta
Start – 15º 13.398/23º 13.040
End – 15º 15.820/23º 13.793

Praia Duna -> Calheta
Length ca. 4.7 km

Boca Morro/Bancona
Start – 15º 10.450/23º 13.923
End – 15º 11.208/23º 13.700

Calheta -> Boca Morro
Length ca. 5.7 km

Boca Morro -> Bancona
Length ca. 3.3 km

Bancona/Vila
Bancona -> Vila
Length ca. 1.9 km

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**Short note | Nota breve**

# *Leiosolenus aristatus* (Dillwyn, 1817), new to the Cape Verde Islands (Mollusca, Bivalvia, Mytilidae)

**Evandro P. Lopes**

Key words: Bivalves, Mytilidae, *Leiosolenus aristatus,* Cape Verde Islands, new record

*Leiosolenus aristatus* (Dillwyn, 1817) is a small bivalve that pierces into calcareous substrata, particularly shells of other mollusks. Previously, the taxon has often been placed in *Lithophaga* Röding, 1798. It was then transferred to *Myoforceps* Fischer, 1886, which is now included in the synonymy of *Leiosolenus* Carpenter, 1856 (cf. Huber 2012).

The species is distributed almost worldwide, including the Pacific and Atlantic Oceans (Huber 2012). In the western Atlantic, it is known from North Carolina to Florida, the Gulf of Mexico and the northern Caribbean Sea (Simone & Gonçalves 2006). In recent years, it has invaded the states of São Paulo, Rio de Janeiro and Santa Catarina along the Atlantic coast of Brazil (Simone & Gonçalves 2006, Vianna da Silva 2007, Breves-Ramos *et al.* 2010). In the eastern Atlantic, it occurs along western European coasts (Gofas *et al.* 2001), while in West Africa it is known from Mauritania, Senegal and Angola (Ardovini & Cossignani 2004, Gofas *et al. sine anno*).

The habitat of *Leiosolenus aristatus* consists of hard surfaces, such as shells, corals and barnacles. It often punctures shells of other mollusks, causing damage and deformities (Simone & Gonçalves 2006). The species is easily identified by the pointed tips at the posterior extensions of the shells, which cross like fingers (cf. Turner & Boss 1962, Abbott 1974, Morton 1993), hence the common name of scissor datemussel. Because of its habit of penetrating corals and because its presence often goes unnoticed initially, it may significantly change the structure of local coral communities and is considered an invasive species (Simone & Gonçalves 2006, Vianna da Silva 2007).

This note reports the first confirmed occurrence of *Leiosolenus aristatus* in the Cape Verde Islands (cf. Lopes 2010). Specimens were collected at Ponta do Sol (17°12'11"N, 25°05'38"W), in the north of Santo Antão island, 25 March 2009 (Fig. 1). The animals were collected from corals (Fig. 2), photographed in the field and preserved in alcohol 96º. After their taxonomic identity had been confirmed, the specimens were deposited in the collections of the Department of Engineering and Marine Sciences of the University of Cape Verde in Mindelo, São Vicente.

Should the record reported herein signify the settlement of a new invasive species in Cape Verde, it will be of interest to follow possibly harmful effects of its boring activities on the native marine biota.

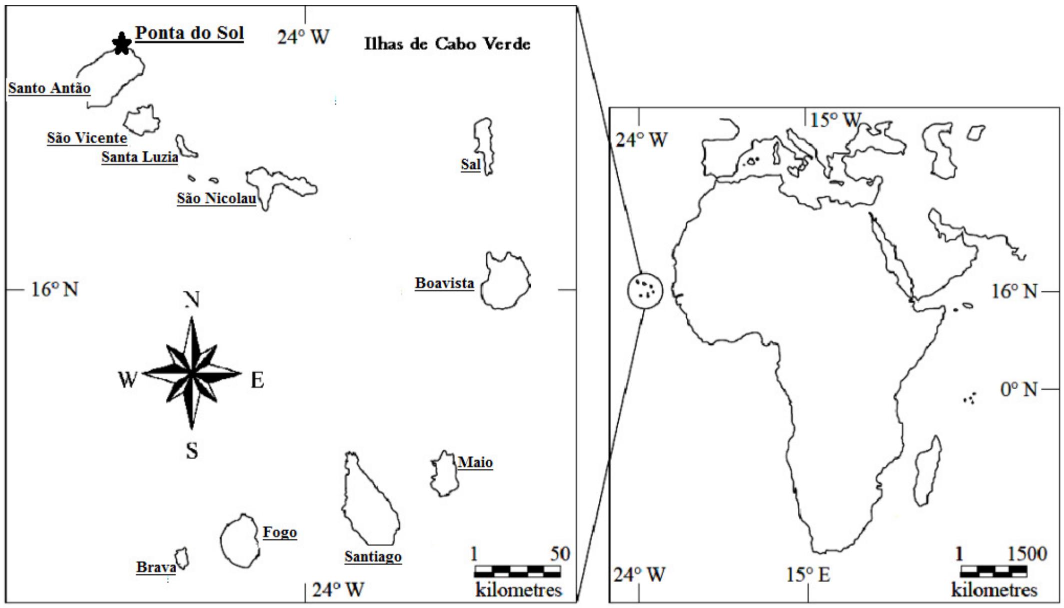


Fig. 1. Map of the Cape Verde Islands. * = collecting locality of *Leiosolenus aristatus*.

Fig. 2. *Leiosolenus aristatus*, embedded in coral, Ponta do Sol, Santo Antão, 25 March 2009 (Evandro Lopes).

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