

## Cetacean surveys in the Cape Verde Islands and the use of cookiecutter shark bite lesions as a population marker for fin whales

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### Abstract

We examined the distribution of cetaceans in the waters of the Cape Verde Islands in 2000 and 2001. Sperm whales (*Physeter macrocephalus*), a Yankee whaling target species in these waters, were commonly detected acoustically and visually along with smaller cetacean species, predominantly in the northeast, windward quarter of the archipelago. A group of 34 sub-adult long-fin pilot whale (*Globicephala melas*) skulls were found on a beach of the island of Boavista, suggesting an unusual mass stranding. Cookiecutter shark (*Isistius* sp.) bite lesions were detected in a possibly resident group of fin whales (*Balaenoptera physalus*), as well as in a humpback whale (*Megaptera novaeangliae*). No such lesions have been recently reported for other North Atlantic fin and humpback whales, although they were commonly described in fin and blue whales from the South Atlantic. The presence of bite lesions on these animals could represent a marker to differentiate groups of fin whales and their movement in the region. The relationship between fin whales detected in Cape Verde waters and those from other regions warrants further scrutiny using genetic and photo-identification techniques, in the context of the presence or absence of cookiecutter shark markers.

**Key words:** Cape Verde Islands, sperm whale, *Physeter*, odontocetes, fin whale, *Isistius*, cookiecutter shark, *Balaenoptera*.

### Introduction

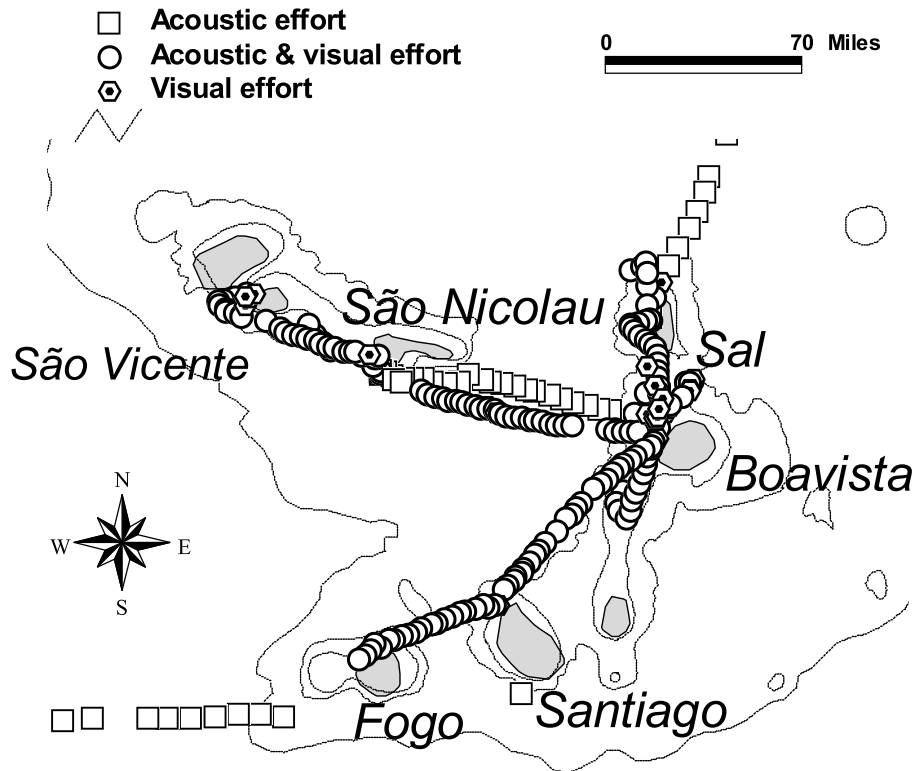
The Cape Verde Archipelago is situated 450 km west of the Senegal coast of northwestern Africa. The islands were of historic importance for Yankee whalers (Townsend, 1935; Hazoet & Wenzel, 2000; Reeves *et al.*, 2002) who exploited sperm (*Physeter macrocephalus*) and humpback whales (*Megaptera novaeangliae*) and who recruited crew

there. Recent sightings and strandings in the region have been summarized (Reiner *et al.*, 1996; Hazoet & Wenzel, 2000), in reports that provide a checklist for cetaceans to be found around the archipelago.

However, there is little information about the relative abundance of each species in different parts of the archipelago. Herein we describe the distribution of small cetacean and sperm and fin whales (*Balaenoptera physalus*) in the windward and leeward island groups. The presence of fin whales was until now regarded as unconfirmed (Hazoet & Wenzel, 2000), although Yankee whalers did describe, but not identify to species, finbacked whales (Reeves *et al.*, 2002). We also describe for the first time on North Atlantic fin whales, extensive cookiecutter shark bite lesions in what could be a novel biogeographic unit of this species.

### Materials and methods

The study area comprised the waters around the Cape Verde Archipelago (Fig. 1). Two vessels were used in this study. The primary vessel used was *Rosita*, a 17-m sloop, in the period from 7 November to 27 December 2000. The second vessel used in this study was the *Sodade*, a 37-m schooner during the period of 31 March to 4 April and 20 April to 4 May 2001. Aboard *Rosita* one to six observers had an eye height of 3 m. Data recorded at each hour, and at every cetacean observation, included GPS position, depth, estimated visibility in miles, cloud cover, and wind speed. When a visual sighting occurred, an approach sufficiently close to identify the species and estimate number of animals present was made. Species identifications were confirmed with a minimum of two observers, with appropriate reference to field guides and confirmation of still photographs and video with colleagues as necessary. A 5-min acoustic watch was kept every 20 to 60 min, using a towed hydrophone array with two Benthos AQ-4 hydrophone elements on



**Figure 1.** Acoustic and visual effort in Cape Verde waters by the sailing vessel *Rosita* between 7 November and 27 December 2000.

100 m of cable, connected to a Sony DAT TCD D8 recorder. The frequency range of the system was 20 Hz to 24 kHz. The combined sensitivity of the hydrophone elements and preamplifiers was  $-173$  dB re 1 V per micropascal. When animals were detected acoustically, a species identification was made only if there were sounds characteristic of that species; thus delphinid clicks and whistles were logged as unidentified dolphin, whereas humpback song and sperm whale clicks were logged as such. The acoustic and visual effort is shown in Figure 1. A visit by foot on 3 December 2000 was also made to a beach on the eastern coast of Boavista based on a local map showing stranding events.

### Results

Species detections are summarized in Table 1 and plotted in Figure 2. The prevailing high wind and sea state during the winter trade wind season made visual sighting of all species difficult. On passage to the Cape Verde Islands from La Gomera, Canary Islands, 180 miles north-east of the island of Sal on 17 November 2000, rough-toothed dolphins (*Steno bredanensis*) were observed once. Around the

islands, pantropical spotted (*Stenella attenuata*) and Atlantic spotted (*S. frontalis*) dolphins were also identified, although their distinction is difficult in the field. They were found primarily in waters  $<500$  m deep. Bottlenose dolphins (*Tursiops truncatus*) were observed once on the NW tip of the island of Santiago. Pilot whales (*Globicephala* sp.) were observed to the west and south of the island of Sal. On the basis of a previous report (Hazvoet & Wenzel, 2000), these were likely to be short-fin pilot whales (*G. macrorhynchus*), but since both this species and long-fin pilot whales (*G. melas*) have been reported from strandings in the region we cannot rule out *G. melas*.

The most common species detected around the Cape Verde Archipelago was the sperm whale. These were commonly found in waters deeper than 500 m, north and west of Sal, and Boavista, and between Boavista and São Nicolau. Their regular and unique underwater sounds make this species the easiest to detect in these waters.

Thirty-four skulls of beach-stranded long-fin pilot whale were found at Praia dos Balejos ( $16^{\circ}05.5'N$ ,  $22^{\circ}40.2'W$ ), on the eastern shore of the island of Boavista, on 3 December 2000. The

**Table 1.** Number of acoustic detections and sightings, and sighted group size ranges, for each cetacean species detected in the Cape Verde region between 7 November and 27 December 2000.

Name	Common name	Species code for Figure 2	No. acoustic detections	No. sightings	Group size range for sightings
<i>Stenella frontalis</i>	Atlantic spotted dolphin	Sf	0	5	3–50
<i>Tursiops truncatus</i>	Bottlenose dolphin	Tt	0	2	10–300
<i>Balaenoptera physalus</i>	Fin whale	Bp	0	7	1–12
<i>Megaptera novaeangliae</i>	Humpback whale	Mn	0	1	1
<i>Globicephala</i> sp.	Pilot whale	Gsp	0	4	1–40
<i>Stenella attenuata</i>	Pantropical spotted dolphin	Sa	0	2	30–100
<i>Steno bredanensis</i>	Rough-tooth dolphin	Sb	0	1	15
<i>Physeter macrocephalus</i>	Sperm whale	Pm	16	25	1–3
	Unidentified dolphin	Ud	11	30	1–3
	Unidentified small whale	Usw	0	2	1

stranding date is unknown. The straight distance from the tip of the rostrum to the foramen magnum ranged from 42.5 to 47.0 cm. The skulls were beach-worn and toothless. Their identification is clear especially if compared to the Cape Verde short-fin pilot whale illustrated by Hazevoet and Wenzel (2000). A single sperm whale skull was found in multiple fragments at the same site as for the long-fin pilot whale skulls. The rostrum to foramen magnum measurement was estimated to be 310 cm.

Fin whales were sighted in coastal waters just NW of the island of Boavista. Seven sightings of groups ranging in size from one to twelve individuals, were made from *Rosita* on 14 December 2000 and 15 December 2000 in a water temperature of 23 to 25°C and a depth of 50 to 60 m. The fin whale sightings all occurred between 16.19° and 16.30°N, and 22.92° and 22.97°W. Short 5-min dives were followed by 3 to 5 blows at the surface, with apparent lunge feeding. Fish, approximately 50 cm long were seen jumping in the paths of surfacing whales; it appeared that the fish were being pursued or chasing a smaller prey also being pursued by the whales.

Analysis of scar and chevron patterns of the fin whales indicated that we photographed at least eight different individuals, of which six or seven had ovoid lesions (Fig. 3A and B). In two cases, it was unclear if photographs were of the same or different animals. A further sighting was made from *Sodade* on 29 April of a single fin whale at 16.21°N and 22.90°W (in the same general location as the December 2000 sightings).

A humpback whale (*Megaptera novaeangliae*) bearing two ovoid scars was observed from the *Sodade* at 16.13°N and 22.97°W on 31 March 2001. The two ovoid scars are illustrated in Figure 3C.

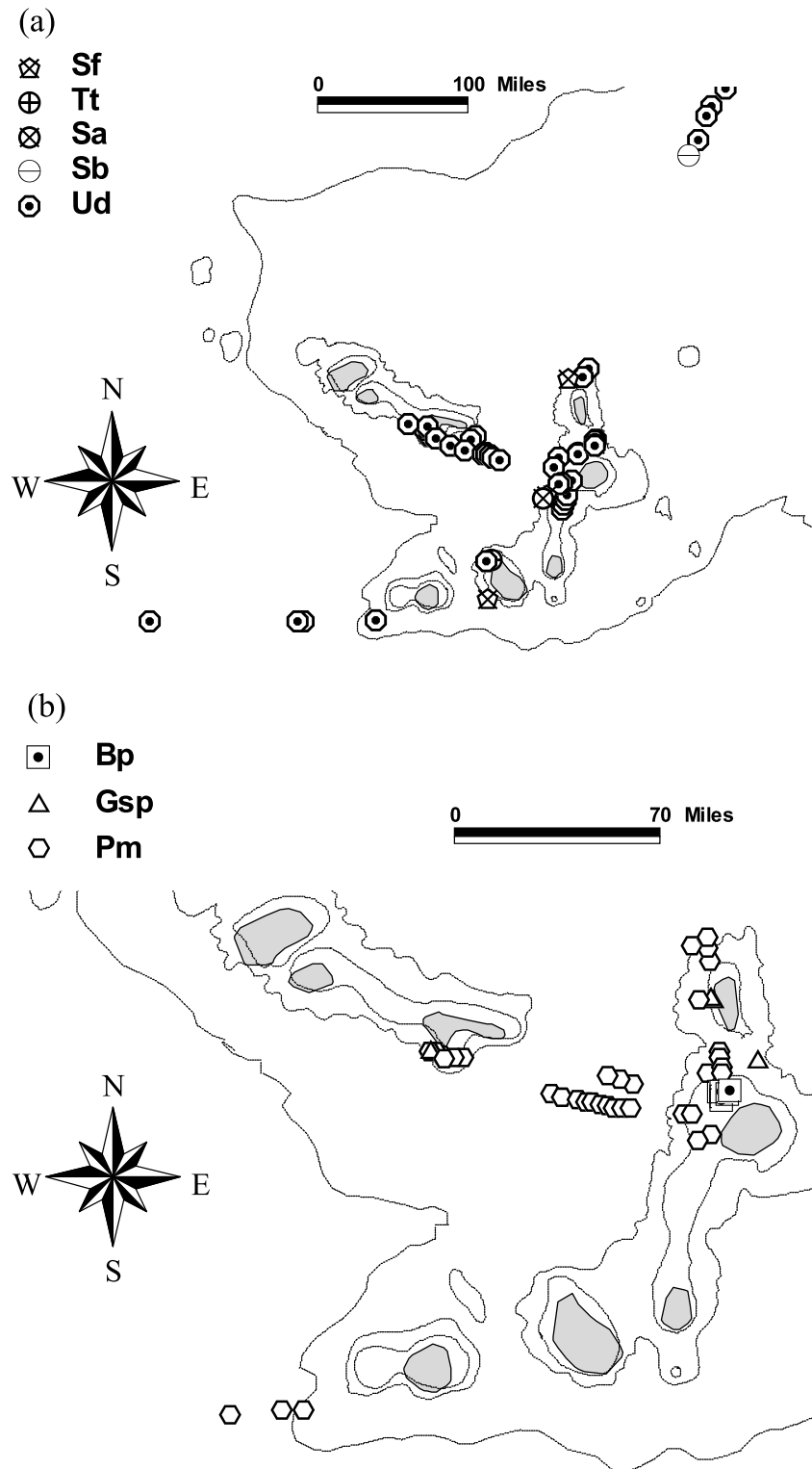
## Discussion

This paper has three features: further information on cetacean distribution in the Cape Verde region, data on strandings, and a description of lesions on fin and humpback whales.

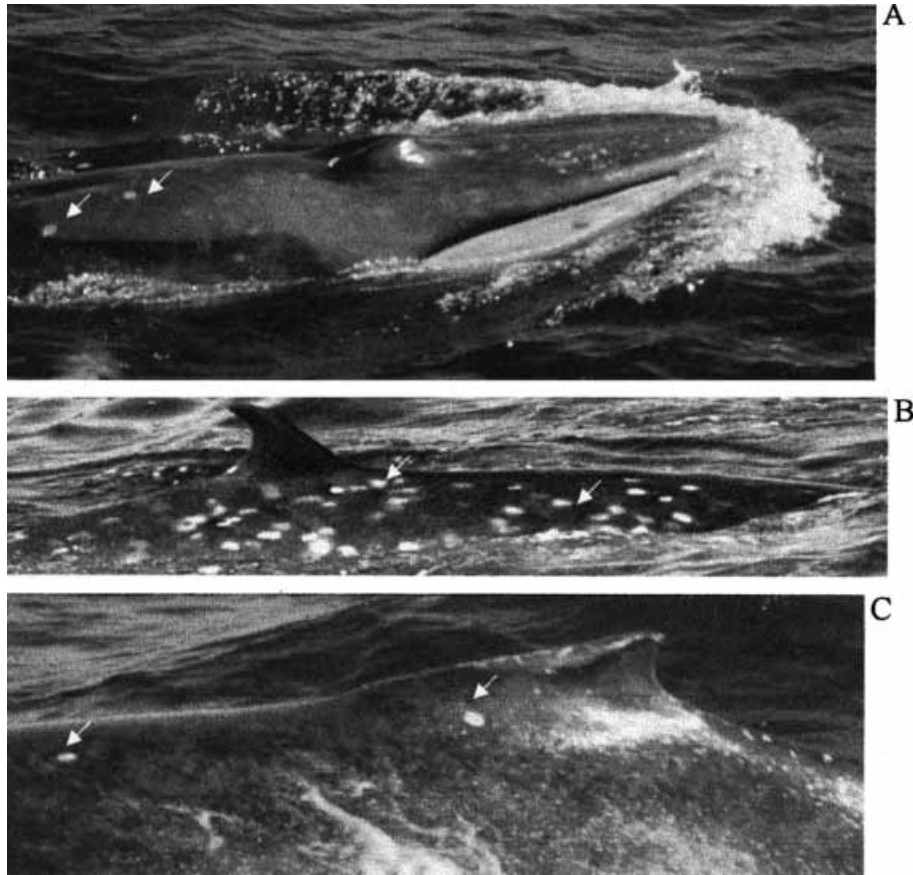
The records of cetacean species reported here do not extend the checklists published previously for the Cape Verde Archipelago (Reiner *et al.*, 1996; Hazvoet & Wenzel, 2000), but the observations do expand the spatial and temporal coverage available for the region. Most notable are the widespread sperm whales in the Northeast sector of the archipelago.

The 34 beached pilot whale skulls are of note because pilot whales usually mass strand in entire pods, showing a wide diversity of body sizes (Sergeant, 1982). The skull lengths reported here suggest the animals ranged in approximate total length from 290 to 320 cm, on the basis of a mounted skeleton of *G. melas* at Woods Hole Oceanographic Institution having a total length of 414 cm and a skull length of 60 cm, giving the skull length to be 14% of the total length. Such animals would be sexually immature and 2 to 4 years old based on previously published age/growth curves for this species (Sergeant, 1962). Adult females range up to 450 cm and males up to 600 cm. We could find no published or unpublished precedent for such a limited age and size class in a mass stranding event.

The fin whale scars are also of note because there has been no description of such uniform and ovoid lesions in this species from elsewhere in the North Atlantic. They have not been reported in fin whales from Southern Spain (Ana Cañadas, pers. comm.), in photographs of fin or sei whales from the Azores examined by one of us in photos from the North Atlantic fin whale catalogue maintained by the



**Figure 2.** Cetacean observations in Cape Verde waters by the sailing vessel *Rosita* between 7 November and 27 December 2000: (a) dolphins, (b) whales. See Table 1 for species key.



**Figure 3.** Cookiecutter shark bite wounds from the Cape Verde islands including right head of a fin whale showing characteristic lower right jaw, two recent bite wounds and numerous older scars (A); right side of fin whale showing multiple ovoid scars (B); left side of humpback whale showing two ovoid scars (C). Arrows show typical scars. Photographers: A and B: Oliver Moore; C: Aad Mueller.

College of the Atlantic, Bar Harbor, Maine (Dan DenDanto, pers. comm.), in fin whales in the Strait of Gibraltar (Renaud de Stephanis, pers. comm.) nor in the Mediterranean population of fin whales (Margherita Zanardelli, pers. comm.). The appearance of these lesions is so striking that it is reasonable to assume that their presence would not go unnoticed. Thus, the lesions described here appear to be novel for North Atlantic fin whales.

These lesions also have not been reported in North Atlantic humpback whales (Jooke Robbins, pers. comm.), or in Arabian Sea humpbacks (Mikhalev, 1997). But they have been detected in humpbacks on the Abrolhos Bank, northeast of Brazil, during July to November (Liliane Lodi, pers. comm.), and from the entire West African coast of Gabon (Howard Rosenbaum, pers. comm.).

Jones (1971) convincingly linked these lesions to bites by the cookie-cutter shark, *Isistius* sp. They have been reported in dolphins (Gasparini & Sazima, 1996), pinnipeds (Le Boeuf *et al.*, 1987), swordfish (Munoz-Chapuli *et al.*, 1988) and other large marine animals that spend at least some of their time in the tropics. Mackintosh and Wheeler (1929) discussed, at length, the distribution of fin and blue whales (*B. musculus*) with the same lesions. Although these authors did not conclude that the causative agent was biting fish, from their careful drawings and photographs, the lesions can reasonably be attributed to *Isistius* sp. bites. Fresh lesions were found in animals taken off South Africa and healed scars in animals from sub-Antarctic South Georgia, suggesting a tropical perpetrator. Mackintosh & Wheeler (1929) suggested that fresh lesions could be more frequent to the north of



Saldanha Bay, South Africa, and remarked on the absence of descriptions of open lesions of this nature in whales from the North Atlantic (Sars, 1878, 1880; True, 1904).

The Atlantic distribution of *Isistius brasiliensis* has been summarized by Compagno (1984). The species has been found in a small area of the Bahamas, from Southern Brazil to the Cape Verde Islands, from Guinea to Sierra Leone, around Southern Angola, off South Africa, and around Ascension Island. *Isistius* sp. Bites also have been described in deep water marine mammal species stranded on the Atlantic coast of Florida (D. Odell, pers. comm.). *I. brasiliensis* also was described from the Northwest Gulf of Mexico (Retzer, 1990). It was found there with its congener *I. plutodus*. A more detailed Northeastern Atlantic biogeography for *I. brasiliensis* has been inferred on the basis of the prevalence of such bites in swordfish (Munoz-Chapuli *et al.*, 1988). Bites were found from 5° to 33°N off the African coast, with most between 5° and 20°N. In contrast, the distribution of *I. plutodus* is not well known. It has been suggested that large oval bites in prey around Puerto Rico are from *I. plutodus*, whereas the smaller bites are from *I. brasiliensis* (Pérez-Zayas *et al.*, 2002). Thus, the bite appearance would suggest that they were caused by *I. plutodus*, but given that *I. brasiliensis* is the only species known to be present in the region, we conclude that the bites are by *Isistius* sp. Future information about the zoogeography of *I. plutodus* could allow this conclusion to be refined.

The use of *Isistius* scarring to delineate populations has been suggested for Antarctic sei whales (Sherchenko, 1970) and for South Atlantic Bryde's whales (*B. edeni*) (Best, 1977). The apparent absence of such lesions from fin whales elsewhere in the North Atlantic, suggests that these animals in Cape Verde waters do not commonly migrate further north or west. Otherwise, the lesions would have been observed in fin whales taken in Spanish or Icelandic whaling, or by recent studies of fin whale photo-identification.

The suggestion that animals in Cape Verde waters are relatively isolated from stocks further north is supported by previous studies of North Atlantic fin whale stocks. Kellogg (1929), Sergeant (1977), and (Bérubé *et al.*, 1998) all suggested a number of separate stocks of fin whales in the North Atlantic with overlapping ranges, but limited gene flow between adjacent populations. Sergeant (1977) suggested a patchy continuum, with a range of tagged individuals that was between 500 and 1000 km.

Fin whales occur in the Azores from April through June and are absent from June to October (Gordon *et al.*, 1995). Winter data are unavailable for that archipelago. The mainland Spanish whal-

ing season ran from April to December with a peak in July and August (Aguilar & Sanpera, 1982). Fin whales in Brazilian waters may not regularly move north to equatorial waters, but remain in latitudes around 20°S (Zerbini *et al.*, 1997). However, the precedent for a year-round population of fin whales in the tropics exists in the Sea of Cortez population (Leatherwood *et al.*, 1982). Thus, we suggest that the fin whales in Cape Verde are either resident in this region or travel between this area and the South Atlantic Ocean. This should be further investigated by biopsy studies for genetic and photo-identification comparisons between animals in Cape Verde waters and other animals from the North and South Atlantic.

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