Cape Verde Expedition (2014) Report on the IWDG Humpback Whale Expedition

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Cape Verde Expedition 2014

Report on the IWDG
Humpback Whale Expedition

Adult humpback whale and calf in Cape Verde, September 2014 © Joanne O'Brien

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Cape Verde Expedition 2014

Report on the IWDG Humpback Whale Expedition

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Introduction

Humpback whales *Megaptera novaeangliae* undergo the longest annual migration of any mammal. They summer in high latitude feeding grounds and winter in low latitude breeding grounds and this pattern is thought to be driven by reproductive and energetic constraints. During winter, they are found in shallow tropical seas where calving and mating occurs simultaneously as the mothers are in oestrus while lactating and gestation is nearly one year.

Given that humpback whales in the Northern Hemisphere will be feeding at high latitudes during boreal summer when those from the Southern Hemisphere will be calving in low latitudes, they are separated by several thousand kilometers of ocean. Thus southern and northern whales can potentially share the same breeding ground, but experience a temporal separation and thus rarely, if ever, mix. This is known as an 'anti-tropical' distribution and has given rise to structured (reproductively isolated) populations of humpback whales within ocean bodies in the absence of any physical barriers to dispersal (Palsboll *et al.* 1997). Humpbacks from both northern and southern hemispheres breed around Mexico and Puerto Rico for example, but six months apart (Rasmussen *et al.* 2007). Historically, Mackintosh (1942) and Mathews (1937) reported that a similar situation might exist in West Africa – whereby whales summering near the Arctic and Antarctic both wintered in the same location. However, this has not yet been examined in recent times.

In the North Atlantic, there are believed to be less than 11,600 humpback whales (Smith *et al.* 1999). The primary breeding ground is in the West Indies, where the majority of humpback whales from the North Atlantic go to breed. A second North Atlantic breeding ground, Cape Verde Islands, is estimated to host between 99 (CV = 0.23) and 171 (CV = 0.02) (Punt *et al.* 2006; Ryan *et al.* 2011) individuals, a mere relict of the *several thousand* whales there before whaling commenced. The two breeding populations are reproductively isolated from one another (Bérubé *et al.* 2013). As such, the Cape Verdean humpback whales are believed to be one of the most endangered populations in the world given the small population size. Recent molecular genetic analysis of Cape Verdean humpback whales suggests they are genetically discrete and not part of a panmictic population in the North Atlantic (Bérubé *et al*. 2013). To date, we have identified around 200 individual humpback whales in Cape Verdean waters through photo identification. Some of the Cape Verdean humpback fluke photographs have been matched to the North Atlantic Humpback Whale Catalogue, to places including Iceland, Norway and the Azores.

There has been an increasing number of sightings from experienced observers, of humpback whales around Boa Vista and Maio between July and November. The timing of these sightings is consistent with an austral migratory cycle, and not a boreal one, indicating that these whales may be from the Southern Hemisphere feeding grounds. Hazevoet *et al.* (2011) were the first to document these sightings and suggested that these humpbacks are either i) stragglers from the boreal spring that have not migrated north after the breeding season, ii) southern hemisphere whales that feed at high latitudes in the Antarctic and breed off West Africa which have moved further north and crossed the equator to Cape Verde or iii) a combination of both.

Several key questions remain to be answered regarding the Cape Verdean humpback whales:

1. Is Cape Verde a breeding ground for humpback whales feeding in both hemispheres?
2. Where are their feeding grounds (*i.e.* migratory destination)?
3. Are humpbacks that breed in Cape Verdean reproductively isolated from adjacent populations?

This expedition carried out in August-September 2014 had the main objective of trying to locate humpbacks whales in the late boreal summer and if successful to photograph and biopsy sample individuals in an attempt to determine from which hemisphere they breed.

Recent developments in knowledge of humpback whales off Cape Verde

This expedition was a continuation of long collaborative effort between researchers from different countries who have pioneered research on humpback whales in Cape Verde since the early 1990s. The long term aim of this project is to increase knowledge on a poorly understood and threatened population of humpback whales in the Eastern North Atlantic. Through increasing our knowledge base, we aim to inform international bodies (e.g. International Whaling Commission and International Union for the Conservation of Nature) and national agencies (e.g. Instituto Nacional de Desenvolvimento da Pesca (INDP) and the Cape Verdean government) as well as other interested parties (e.g. developers, tourism operators) on the ecology and conservation status of these whales, using the best techniques currently available including molecular genetic analysis and photo identification.

The expedition was designed to contribute to ongoing projects including; the Irish Whale and Dolphin Group Cape Verde project started in 2003 which attempts to locate the breeding grounds of humpback whales visiting Ireland, the North Atlantic Humpback Whale Catalogue, USA and a long term study on baleen whale genetics at the Centre for Ecological and Evolutionary Studies at University of Groningen, The Netherlands. The primary goal of this year's expedition was to survey the Cape Verde archipelago during the autumn, a period where there have been no dedicated cetacean surveys. The aim was to try and locate humpback whales and collect photo-id data and tissue samples, in order to determine if Cape Verde constitutes a breeding ground for humpback whales that feed in both the Northern and Southern hemispheres.

Objectives

Project Goals

- To test the hypothesis that Cape Verde hosts humpback whales with fidelity to feeding grounds in both hemispheres.
- To test whether Cape Verdean humpback whales are part of a panmictic North Atlantic population using a suite of microsatellites and the mtDNA D-Loop (with reference to data from the YoNaH, MoNaH, and other projects).
- To catalogue and establish photo-identification additional matches in to the North Atlantic humpback whale photo ID catalogue (Allied Whale).
- Analysis of site fidelity and an abundance estimate using photo ID images from previous expeditions.
- To record the distribution and abundance of other cetacean species to contribute to the overall knowledge of cetaceans in Cape Verde
- To inform resource managers of areas of key habitat for breeding humpback whales (and other cetaceans) to contribute to long term conservation of marine biodiversity in Cape Verde

Methods

As in previous yacht-based expeditions the methodology followed similar surveys carried out in 2003 and 2006 (Wenzel *et al.* 2009). A 41ft Lipari catamaran was chartered as a bare-boat from Mindelo, São Vicente from 31 August until 13 September 2014. A skipper was flown out to run the vessel while the scientific team also acted as crew. A film-maker, who is an experienced sailor and involved in two previous yacht-based expeditions to Cape Verde, was also in the party. The cruise plan was decided ahead of the charter and designed to maximize survey effort in those locations with recent sightings of humpback whales (e.g. off the island of Maio), as well as visiting habitats that are known to hold humpback whales during the spring (e.g. Boavista). Track lines were determined each day depending on weather conditions (wind, swell) and the availability of suitable anchorages. Night passages were to be avoided as this causes fatigue in the crew and reduces sighting efficiency during daylight hours.

Sightings effort

Survey effort was recorded through the use of LOGGER software (© IFAW), which tracks the vessel through a GPS receiver every 15 seconds and prompts the surveyors to input environmental data every 30 minutes. A continuous watch for cetaceans was maintained from the yacht during daylight hours. Shifts of two people alternating each hour were positioned one on the port and one on the starboard side of the upper deck. All cetacean species were recorded with a best estimate of numbers, presence of calves and behaviour. The position of each sighting was recorded by entering a waypoint into LOGGER and the radial distance and angle to the sighting relative to the boat was recorded.

Photo-identification

Many species of cetacean have distinctive markings or colouration, which is specific to that individual, through which individuals can be recognised. Notches and nicks often occur on the dorsal fins of dolphins and toothed whales. Images suitable for species identification and photo-identification were recorded whenever possible using digital SLR camera and 300 to 500mm lenses. Photo-identification used standard methodology as outlined in Smith *et al.* (1999). Images of flukes were submitted to the North Atlantic Humpback Whale catalogue for matching and analysed for re-sightings within Cape Verdean waters.

Biopsy sampling

Skin and blubber biopsies were taken using a remote biopsy darting system: a *Barnett Panzer 5* crossbow with 150 lb draw and 40 mm biopsy tips (Ryan *et al.* 2011). Whales were approached from the side but only those that surfaced within 10m and started their terminal dive (when they normally fluke) were to be sampled. Their behaviour before, during and after a biopsy attempt was recorded as per standard protocols (Clapham and Matilla, 1993).

Sampling will be carried out under licence from the Cape Verdean government, and exported under CITES permit. Sterilization of biopsy tips and handling of samples were carried out as per Wenzel *et al.* (2010). Tissue samples will be duplicated and stored according to strict protocol (Ryan *et al.* 2012). Briefly, stable isotope samples (skin and blubber) will be stored frozen in aluminium foil. Contaminant samples (skin and blubber) will also be stored frozen in solvent-washed foil in glass vials. DNA samples (skin only) will be stored frozen in tubes of salt-saturated 20% DMSO preservative.

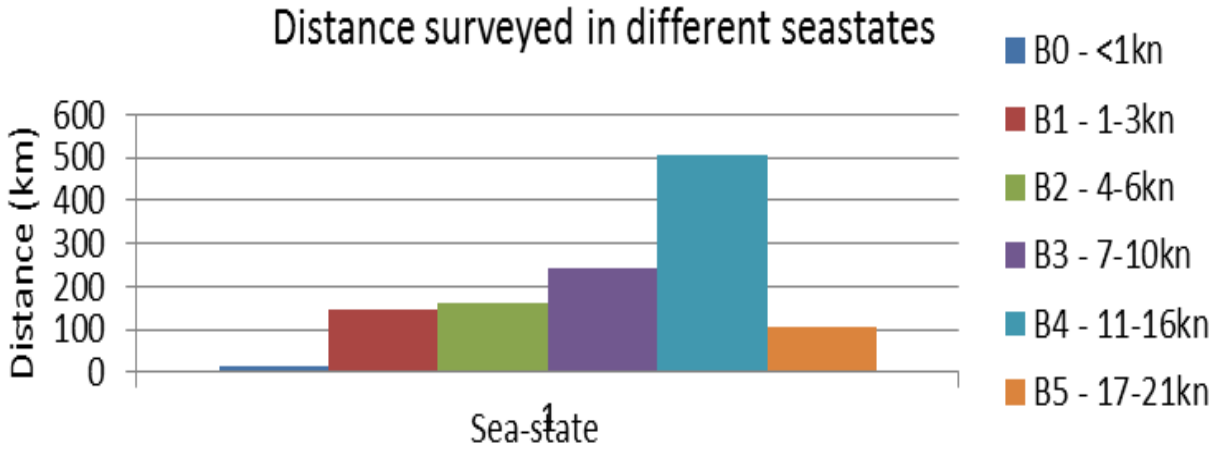
Acoustic monitoring

Two dipping hydrophones were used to listen for singing humpback whales, both in their presence and randomly in what was considered suitable habitat. They were both broad spectrum hydrophones acquiring signals from around 1 kHz up to 80 kHz. It was not possible to tow these from the vessel during passage as they were very sensitive to the sound generated by the waves and wake resulting in considerable ambient noise.

Results

Cruise Plan

During the 12 days at sea a total of 1182 km of track line was surveyed. Sea conditions were generally favourable with 48% of effort conducted in ≤sea-state 3. The survey went largely as planned. Only one night was spent at sea (2-3 September) when the anchorage at Carracal, São Nicolau proved to be unsuitable but only a short part of the passage between São Nicolau and Boavista was sailed during the night. The survey plan did not include the island of Sal as no sightings of humpback whales had been reported for a long time despite relatively good coverage from this island. Less time than hoped was available around the island of Maio. Although sea conditions were excellent on the approach to Maio from Boavista on 6 September, the wind picked up throughout 7 September reaching Force 8 by afternoon and shelter was sought in Praia on Santiago as the anchorage at Porto de Maio was very exposed.



Cetacean species recorded

At least seven cetaceans were identified to species level and possibly up to ten species in total. The humpback was the only baleen whale species recorded but we also recorded eight odontocete species. These included melon-headed, short-finned pilot and killer whales and rough-toothed, pan-tropical and Atlantic spotted dolphin. Two beaked whale species were observed which have been tentatively identified as Gervais and Blainvilles beaked whales. One sighting was of a breaching *Kogia* species, most likely Dwarf sperm whale *Kogia simus*.

Table 1. Summary of daily log during Cape Verde 2014.

Date	Anchorage (start)	Anchorage (finish)	Encounters	Species
31 Aug	Mindelo, São Vicente	Tarrafal, São Nicolau	1	MHW
1 Sep	Tarrafal, São Nicolau	Tarrafal, São Nicolau	1	Kogia ?
2 Sep	Tarrafal, São Nicolau	Carriçal, São Nicolau	1	ASD
3 Sep	Carriçal, São Nicolau	Sal Rei, Boavista	0	
4 Sep	Sal Rei, Boavista	Sal Rei, Boavista	3	MHW, RTD, HW
5 Sep	Sal Rei, Boavista	Sal Rei, Boavista	1	RTD
6 Sep	Sal Rei, Boavista	Pt do Maio, Maio	2	HW incl. adult and calf
7 Sep	Pt do Maio, Maio	Praia, Santiago	6	PTSD, HW, BW
8 Sep	Praia, Santiago	Praia, Santiago	1	BW
9 Sep	Praia, Santiago	Tarrafal, Santiago	3	PTSD, SFPW, RTD
10 Sep	Tarrafal, Santiago	Tarrafal, São Nicolau	2	PTSD, KW
11 Sep	Tarrafal, São Nicolau	Mindelo, São Vicente	4	ASD, HW
Total			**25**	**7 (possibly 10 species)**

MHW = Melon-headed whale *Peponocephala electra*, ASD = Atlantic Spotted dolphin, *Stenella frontalis*, RTD = Rough-toothed dolphin *Steno bredanensis*, HW = Humpback whale *Megaptera novaeangliae*, PTSD = Pan-tropical Spotted dolphin *Stenella attenuata*, BW = Beaked whale, KW = Killer whale *Orcinus orca*, SFPW = Short-finned pilot whale *Globicephala macrorhynchus*

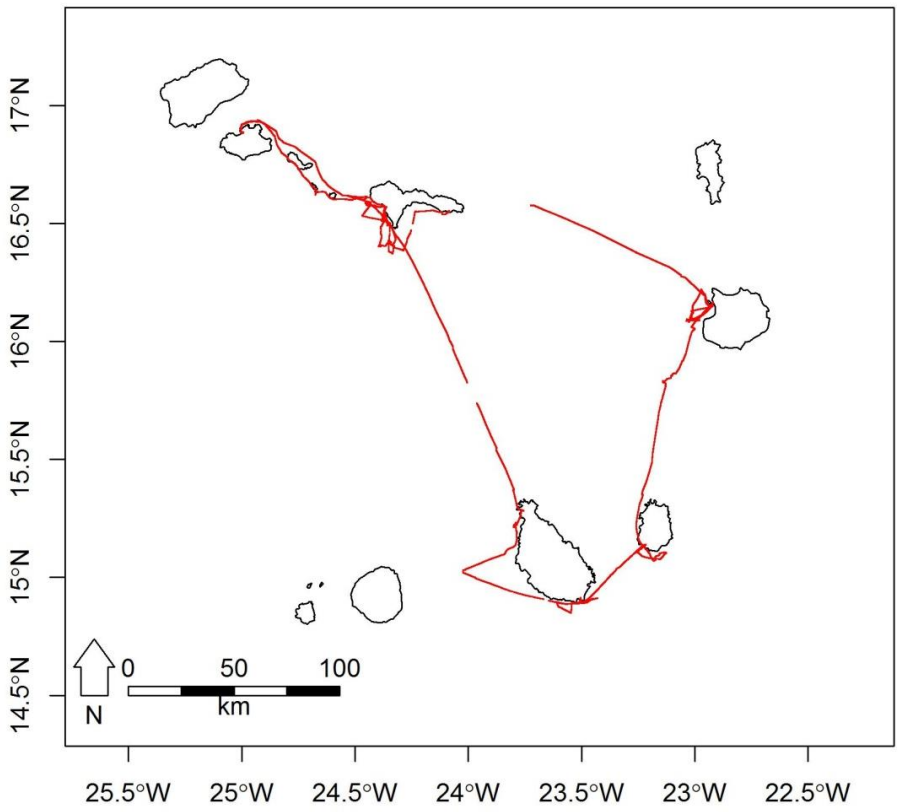


Figure 1. Map showing route surveyed for cetaceans (breaks signify loss of GPS)

Humpback whale *Megaptera novaeangliae*

There were nine sightings in total of humpback whales. The first sighting was in Baia de Sal Rei off Boavista which is the best site in Cape Verde for humpback whales during the breeding season in the spring (Ryan *et al.* 2013b). The sighting was of a single individual, estimated as immature as it did not appear fully grown. A biopsy sample was obtained from this whale. A blow, assumed to be from a humpback was seen the following morning in the same area in Baia de Sal Rei, but was not observed again despite an hour searching. On transit between Boavista and Maio an adult and young calf were observed around João Valente Seamount between the two islands. The calf was very small and kept close to the mother and we could not approach close enough to attempt a biopsy sample of the adult.

The following day two whales were observed off the southeast Maio over a shallow shelf projecting from the island. This area was searched on the recommendation of Edita Magileviciute of the Maio Biodiversity Foundation who joined us for the day. Although we did not approach close enough to obtain a biopsy sample as the sea conditions were quite poor, a good fluke shot was obtained of one of the whales. On the same day during passage to Praia for shelter two humpbacks were observed breaching in the distance and another humpback fluked close to the vessel in high sea-state. Both whales were in deep water >1000m to the east of the approaches to Praia.

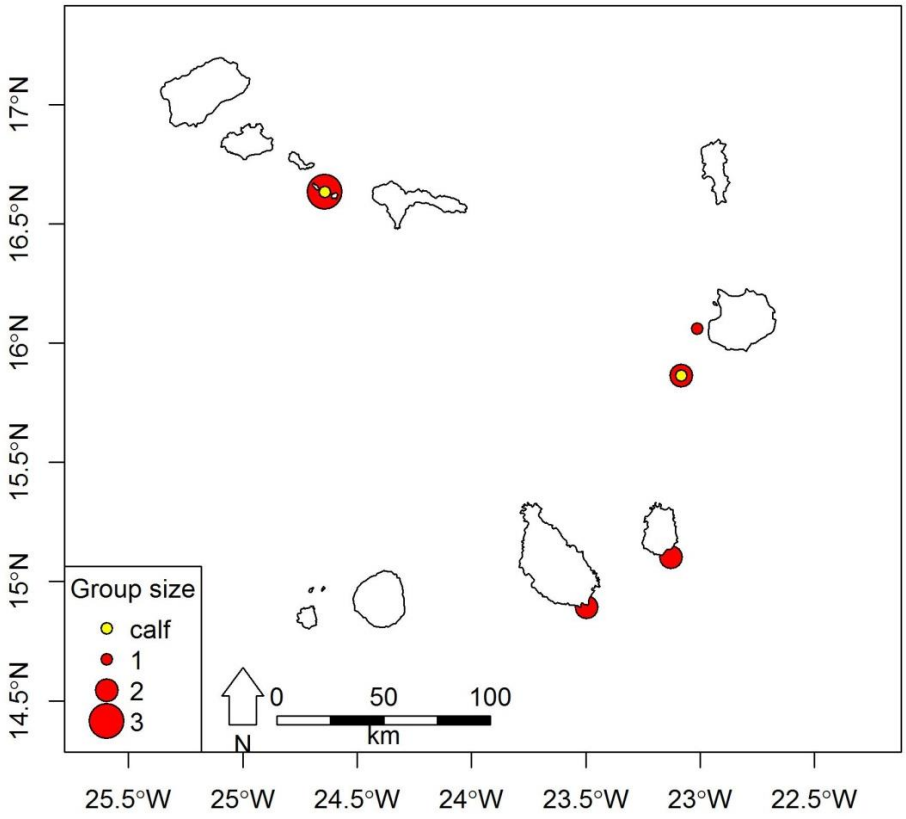


Fig. 2. Location of humpback whale sightings around Cape Verde

The last sighting was of three whales' together close into the island of Branco, observed while sailing between São Nicolau and Saint Luzia. The initial cue was breaching. The adult and calf were close to a third whale, which could have been acting as an "escort". A biopsy sample was obtained from the adult (female/mother?) and a very small skin sample from the calf. A poor fluke shot was obtained from one of the adult whales.

Table 2. Summary of humpback whale sightings and encounters in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
4 Sep	Sal Rei, Boavista	16.06019N, 23.01318W	1		Biopsy sample
6 Sep	Sal Rei, Boavista	16.04304N, 23.00931W	1		
6 Sep	João Valente Seamount	15.86356N, 23.08271W	2	Adult and calf	
7 Sep	Pt do Maio	15.10373N, 23.12754W	1		Fluke shot
7 Sep	Pt do Maio	14.89512N, 23.49361W	1		Fluke shot
7 Sep	Praia, Santiago	14.8938N, 23.49747W	2	Breaching in distance	
7 Sep	Praia, Santiago	14.8938N, 23.49747W	1	Fluked near vessel	
11 Sep	Branco	16.63471N, 24.64199W	2	Adult and calf	Biopsy sample
11 Sep	Branco	16.63471N, 24.64199W	1	Adult possible escort	

Four fluke shots were obtained during the expedition. One good image was taken off Maio on 7 September and fluke 2 towards the evening on the same day off Praia, Santiago. The other two flukes were captured off Branco on 11 September. Fluke 3 is of the adult and Fluke 4 of the calf associating with Fluke 3.

Fluke 1 off Maio © Pedro López Suárez

Fluke 2 off Praia © Pedro López Suárez

Fluke 3 off Branco © Pedro López Suárez

Fluke 3 off Branco © Pedro López Suárez

Fluke 4 off Branco © Pedro López Suárez

Close encounters with individual whales were had during three occasions, one of a single animal, one with adult and calf and one with adult, calf and potential "escort". Good images of individual whales were taken during all three encounters. During the encounters and from analysis of images what was immediately apparent was the lack of white on the dorsal side of the large pectoral fins. This is consistent with humpback whales feeding at high latitudes in the southern hemisphere during the boreal spring and breeding off West Africa.

Young humpback whale off João Valente Seamount between Boavists and Maio © Joanne O'Brien

Adult humpback whale off João Valente Seamount and immature in Baia de Sal Rei, Boavista © Pedro López Suárez
(note: bite marks from cookie-cutter sharks)

In addition to the dark pectoral fins, it was noted that there was an apparently high occurrence of lesions consistent with bites from cookie-cutter sharks. The incidence may be higher than on those humpback whales observed breeding in Cape Verde during the boreal spring. It has been suggested by Wenzel and López Suárez (2012) that Cape Verde might be a "hotspot" for cookie cutter shark interactions with cetaceans. The high incidence of lesions from cookie-cutter sharks on humpback whales was also noted by Elwen *et al.* (2014) from an analysis of images taken off Namibia. Further investigation of the relative incidences of cookie cutter lesions on humpback whales may be useful and related to population structure with whales travelling through equatorial waters to Cape Verde more exposed to an increased interaction with these opportunistic feeders.

Rough-toothed dolphin *Steno bredanensis*

There were three sightings of rough-toothed dolphins during the survey. Two were off Boavista in Baia de Sal Rei and one in association with short-finned pilot whales off Tarrafal, Santiago. Rough-toothed dolphins are considered widespread in Cape Verde and amongst the more common dolphin species recorded (Hazevoet *et al.* 2010).

Table 3. Summary of rough-toothed dolphin sightings in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
4 Sep	Sal Rei, Boavista	16.10397N, 23.01214W	3	Bowriding briefly	
5 Sep	Sal Rei, Boavista	16.08843N, 23.03057W	1	Bowriding briefly	
9 Sep	Tarrafal, Santiago	15.21788N, 23.79105W	5	with short-finned pilot whales	filmed

Pan-tropical Spotted dolphin *Stenella attenuata*

Three sightings of pan-tropical spotted dolphins were recorded. They were identified as *Stenella attenuata* from the white tip on the beak of adults, dark cape and abundance of spots. Species identification is consistent with Hazevoet and Wenzel (2000). Pan-tropical spotted dolphins are one of the more common dolphin species in Cape Verde (Hazevoet *et al.* 2010) with numerous sightings over the past 10 years.

Table 4. Summary of pan-tropical spotted dolphin sightings in Cape Verde 2014

Date	Location	Position	Number	Behaviour
7 Sep	Pt of Maio	15.12204N, 23.23499W	60	Travelling
9 Sep	Tarrafal, Santiago	14.93421N, 23.78721W	30	Travelling
10 Sep	Tarrafal, Santiago	15.53909N, 23.87591W	100	Travelling

Pan-tropical spotted dolphins north of Tarrafal, Santiago © Joanne O'Brien

Atlantic Spotted dolphin *Stenella frontalis*

There were three sightings of Atlantic spotted dolphin. A sighting of around 100 individuals was made near the tip of Ponta de Couço, east of Tarrafal on São Nicolau on 2 September. They were slow swimming and readily came to the vessel. Nine days later a group totalling around 40 individuals were observed foraging to the west of Tarrafal. Surface rushes were observed as the dolphins formed three smaller groups with shearwaters in close attendance. Atlantic spotted dolphins are among the most often encountered dolphin species in Cape Verdean waters (Hazevoet *et al.* 2010) with numerous sightings over the past 10 years.

Table 5. Summary of Atlantic spotted dolphin sightings in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
2 Sep	Tarrafal, São Nicolau	16.49824N, 24.3528W	100	Slow travel	Filmed
11 Sep	Tarrafal, São Nicolau	16.59899N, 24.52324W	40	Foraging and bow-rode	
11 Sep	Tarrafal, São Nicolau	16.72119N, 24.74143W	4	Bow rode briefly	

Atlantic spotted dolphins © Pedro López Suárez

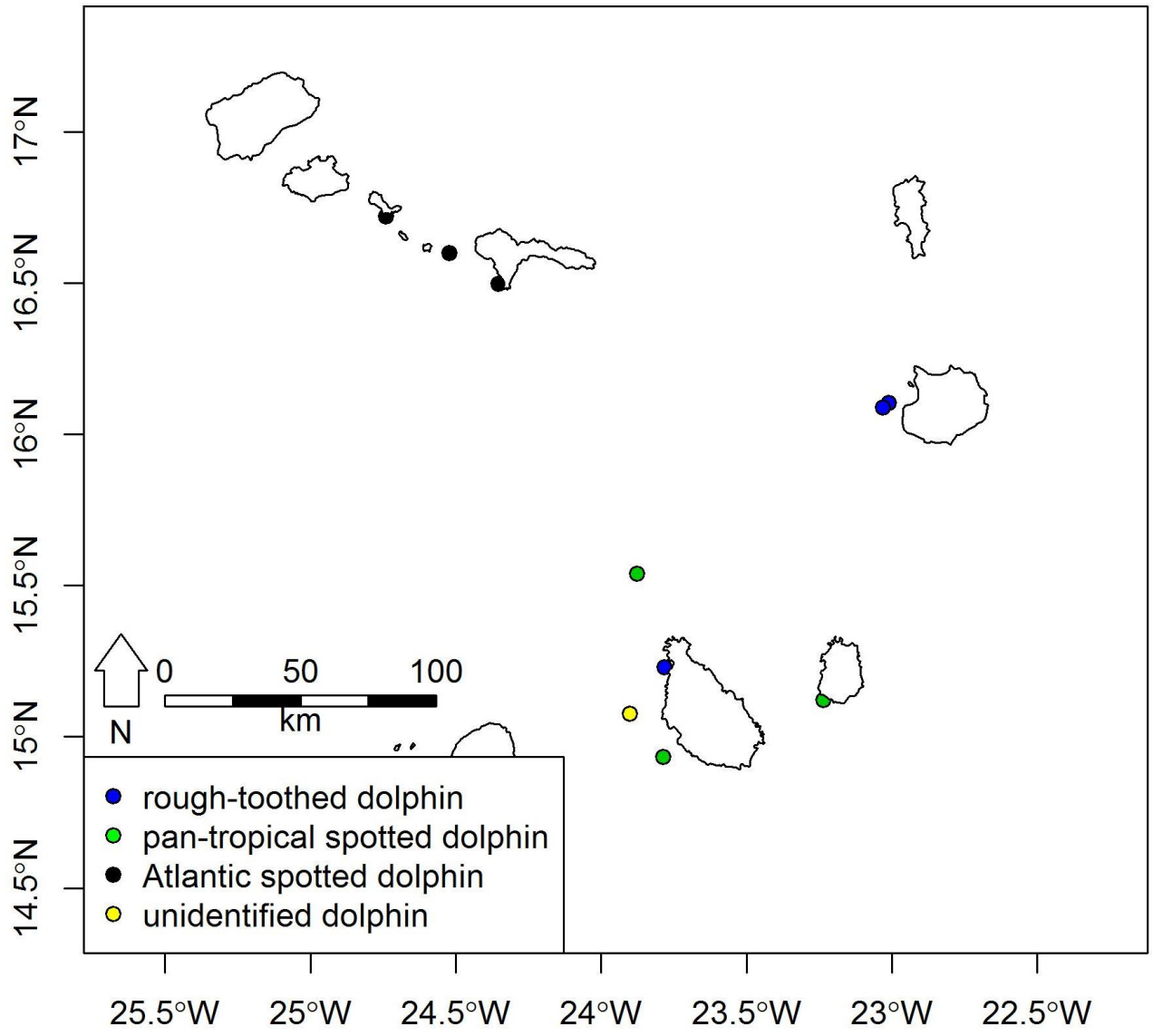


Fig. 3. Location of dolphin sightings around Cape Verde

Melon-headed whale *Peponocephala electra*

There were two sightings of melon-headed whales. A group of around 30-40 whales were observed off the lighthouse as you approach Tarrafal, São Nicolau. They were quite dispersed and apparently feeding in small groups. A second larger group of 200-300 individuals were observed in Bhai de Sal Rei off Boavista travelling at high speed in a long line but close together. A sighting of a single rough-toothed dolphin preceded the sighting by <1 minute.

Melon-headed whales were thought to be rare of infrequent in Cape Verde but more recent sightings and strandings have confirmed them as commonly occurring around Cape Verde (Hazevoet *et al.* 2010). Although previously sighted off Boavista and also stranded the sighting of around 200-300 individuals on 4 September was noteworthy.

Table 6. Summary of melon-headed whales sightings in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
31 Aug	Tarrafal, Santiago	16.58969N, 24.43394 W	30-40	Foraging	
4 Sept	Sal Rei, Boavista	16.12916N, 23.01401W	200-300	Travelling	Filmed

Melon-headed whales off Baia de Sal Rei, Boavista © Pedro López Suárez

Short-finned pilot whale *Globicephala macrorhynchus*

There was one sighting of short-finned pilot whales, a large group off Tarrafal, Santiago, observed with around 5 rough-toothed dolphins. Photographs were taken of the group but no individuals had distinctive markings suitable for photo-identification. Short finned pilot whales are frequently reported around Cape Verde including Santiago (Hazevoet *et al.* 2010).

Table 7. Summary of short-finned pilot sighting in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
9 September	Tarrafal, Santiago	15.21788N, 23.79105W	50-60	Logging with RTD	Filmed

Killer whale *Orca orcinus*

There was one sighting of killer whales, a small large group of 5 individuals off Tarrafal, São Nicolau. The group consisted of one adult male, and one juvenile and three others and was travelling east. Images were taken for photo-identification. There are only three documented sighting records of killer whales in Cape Verde (Hazevoet *et al.* 2010), one from western Boavista in September 2001, one south of Sal in February 1996 and a more recent sighting of six individuals on from 23 November 2013, off southern Sal (Notícias Zoológicas, 2014). There were good images were taken of the present sighting and submitted to the North Atlantic Killer Whale catalogue. It is not possible to attempt to match these individuals yet but they did not fit into the Type 1 killer whale typically reported in the northeast Atlantic (Andrew Foote, *pers. comm*.)

Table 8. Summary of killer whale sightings in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
10 Sep	Tarrafal, São Nicolau	16.52157N, 24.37805W	5	Slow travelling	Images for photo-id

Killer whales off São Nicolau © Joanne O'Brien and © Pedro López Suárez

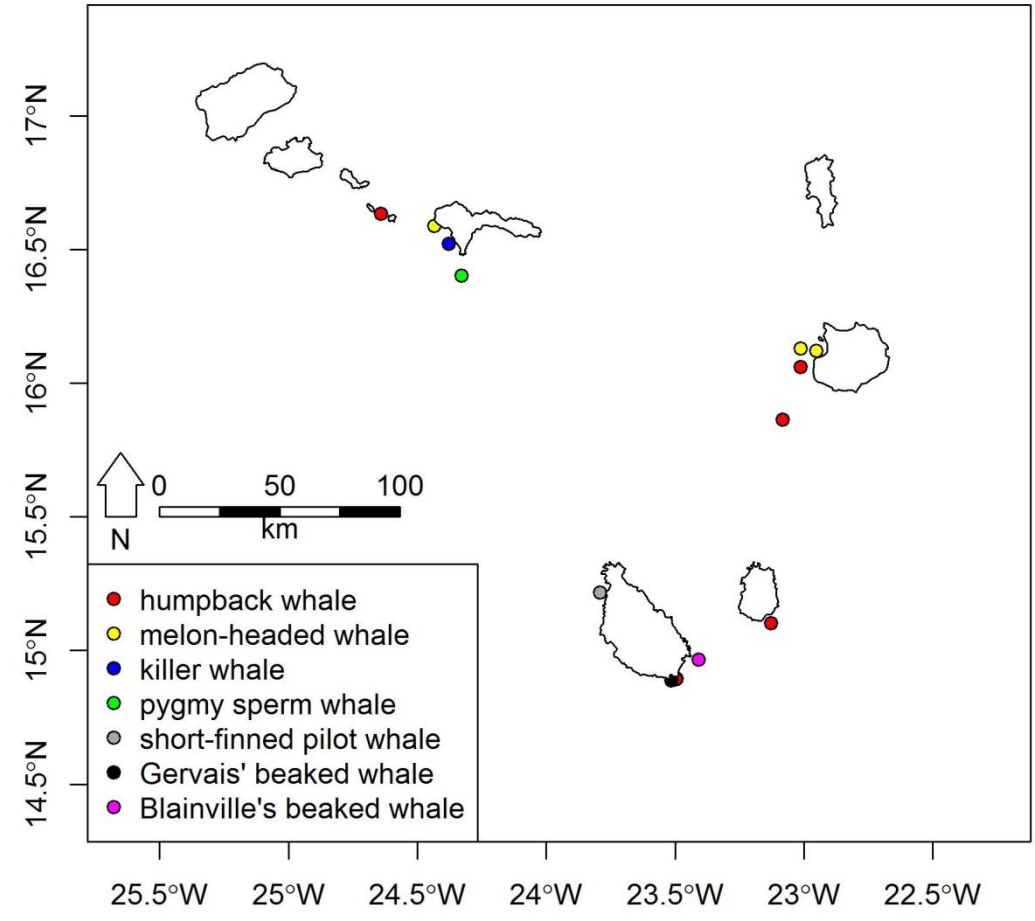


Fig. 5. Location of odontocete whale sightings around Cape Verde

Beaked whales

There were two sightings of beaked whales. One group of 4 individuals, including a calf or small juvenile, were observed mid-channel between Maio and Santiago in very rough seas (Force 8). They were observed for around 20-30 seconds during which time they surfaced on three occasions with poor images taken on the third surfacing. They were medium sized (c. 5-7m), light brown in colouration with a broad triangular shaped dorsal fin. The beak appeared above the water on surfacing with head also apparent. They were considered most likely to be Blainville's beaked whale (*Mesoplodon densirostris*) but the images were too poor to confirm.

The second sighting of beaked whales was on the 8 September near the port of Praia on Santiago. A number of small (maximum c.5m in length) grey coloured whales surfaced near the vessel but travelling away making it difficult to see their head or beak. There were 4 in total including one calf. On surfacing their beak was raised clear of the water before being slapped down onto the surface of the water. Based on the size and colour they were thought to be Gervais beaked whale (*Mesoplodon europaeus*). Good HD film on the whales was obtained and has been sent to a number of beaked whale specialists for species identification and although they thought they could be Gervais the footage was not quite good enough to confirm species identification.

This was only the third sighting record of a beaked whale from the Cape Verde. There were only two previous sightings of *Mesoplodon* species in Cape Verde. A group of four beaked whales were reported south of Sal in February 2010 (Hazevoet *et al.* 2010) which were thought to be of Gervais beaked whales but species identification could not be fully validated. Gervais beaked whale are known to occur in Cape Verde based on a recent stranding record from Maio in May 2013 (Koenen *et al.* 2013). Wenzel and López Suárez (2012) reported on a sighting of Blainvilles beaked whale in April 2011 off Boavista. The only other sighting records of Ziiphids in Cape Verde are of four records of Cuviers beaked whales *Ziphius cavirostris* (Hazevoet *et al.* 2010).

Image of possible Blainville's beaked whale between Maio and Santiago © Simon Berrow

Image of possible Gervais beaked whale and calf off Praia, Santiago © Simon Berrow

Table 9. Summary of beaked whale sightings in Cape Verde 2014

Date	Location	Position	Number/ Species	Behaviour	Comments
7 Sep	Maio - Santiago	14.96722N, 23.40863W	4 BBW ?	Slow travelling	Poor images
8 Sep	Praia, Santiago	14.88846N, 23.51483W	4 GBW ?	Slow travelling	filmed

BBW = Blainville's beaked whale *Mesoplodon densirostris*; GBW = Gervais beaked whale *Mesoplodon europaeus*

Dwarf Sperm whale *Kogia sima*

Two unidentified small whales were observed off Tarrafal, São Nicolau on 1 September. One whale was observed breaching twice. The initial identification was of a *Kogia* sp either Dwarf or Pygmy Sperm Whale. As the latter has not been recorded from Cape Verde and the former is only known from one stranding record (Hazevoet *et al*. 2010) it is thought most likely to be a Dwarf Sperm whale *Kogia sima*. There were no sightings of *Kogia* in Cape Verde prior to the present sighting. Opinions were sought from a number of specialists and all thought that it was *Kogia* and most likely *Kogia sima.*

Image of breaching *Kogia* sp off São Nicolau © Tony Whelan

Table 10. Summary of Kogia sightings in Cape Verde 2014

Date	Location	Position	Number	Behaviour	Comments
1 Sep	Tarrafal, São Nicolau	16.40329N, 24.3298W	2	breached	Images and film

Other species: Turtles, Manta Rays and sharks

A number of other sightings of note were recorded. There were three sightings of single loggerhead turtles and one green turtle and seven sightings of manta rays. Five of the manta ray sightings were of breaching individuals which often breached more than once. Two sightings of sharks on the surface were made, one of which was likely to be a hammerhead shark.

Green turtle © Simon Berrow

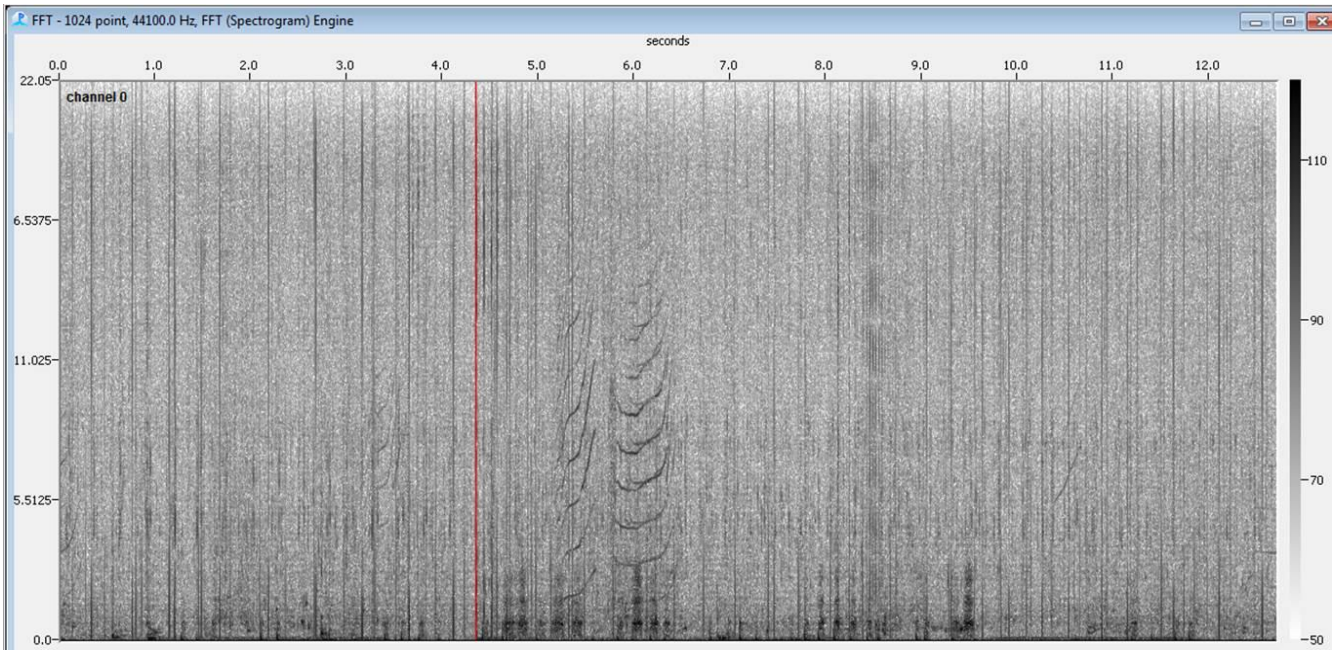
Manta ray © Pedro López Suárez

Table 11. Summary of turtle sightings in Cape Verde 23 February – 26 March 2006

Date	Species	Position	Number	Behaviour
31 Aug	Loggerhead	16.88636N, 24.99084W	1	Swimming slowly
3 Sep	Loggerhead	16.28921N, 23.07315W	1	Swimming slowly
5 Sep	Green turtle	16.08949N, 22.98542W	1	Swimming slowly
9 Sep	Loggerhead	14.94403N, 23.82084W	1	Swimming slowly
1 Sep	Manta Ray	16.43301N, 24.3838W	1	Filmed underwater
5 Sep	Manta Ray	16.09267N, 23.03088W	1	Swimming slowly
5 Sep	Manta Ray	16.13997N, 23.00821W	1	breaching
5 Sep	Manta Ray	16.19554N, 22.97967W	1	Breaching/juvenile
5 Sep	Manta Ray	16.20114N, 22.95786W	1	Breaching/juvenile
6 Sep	Manta Ray	15.91631N, 23.0543W	1	breaching
8 Sep	Manta Ray	14.89397N, 23.47452W	1	breaching
3 Sep	Hammerhead shark	16.37558N, 23.25575W	1	Swimming slowly
9 Sep	Unident. shark	15.07633N, 23.90248W	1	Swimming slowly

Acoustic recordings

No humpback whales were detected during any of the acoustic samples taken around Maio or Boavista when whales were visually recorded. Further acoustic samples were also taken in deep water between the islands of Santiago and Fogo and mid-way between Tarrafal on Santiago and Tarrafal on São Nicolau, largely to try and detect deep-diving species such as sperm whales. The only acoustic detections recorded were of a group of short-finned pilot whales off Tarrafal, Santiago. During this encounter, a group of rough-toothed dolphins were also present.



Spectrogram of short-finned pilot whales during the recording taken off Tarrafal, Santiago.

Genetic samples

Two good biopsy samples humpback whales were obtained during the survey. One sample was from a loan immature humpback whale in Baia de Sal Rei, Boavista on 4 September and one from an adult (presumed female) with calf off the island of Branco on 11 September. The calf was also struck with a biopsy dart but only a small piece of skin was obtained.

These samples have been sent to Per Palsboll at the University of Groningen, Netherlands. Samples of blubber and skin from both samples are also available to Pierre Gallego of d'Odyssea for contaminant analysis as part of a comparative study with samples obtained from Dominique in the Caribbean.

Media and Outreach

During the expedition a dedicated Facebook page (https://www.facebook.com/pages/CVI-Expedition-2014) which had 293 likes by the end of the two week trip. Contact was made with Sea Shepherd in Mindelo, who were providing boat support to a seabird project on Raso and Santa Luzia. The organisation have a long-term commitment to the Cape Verde and may be able to offer their vessel to future research trips. Interviews were given in Portuguese (BJ) to local media on the expedition objectives and success. A meeting was had in Mindelo

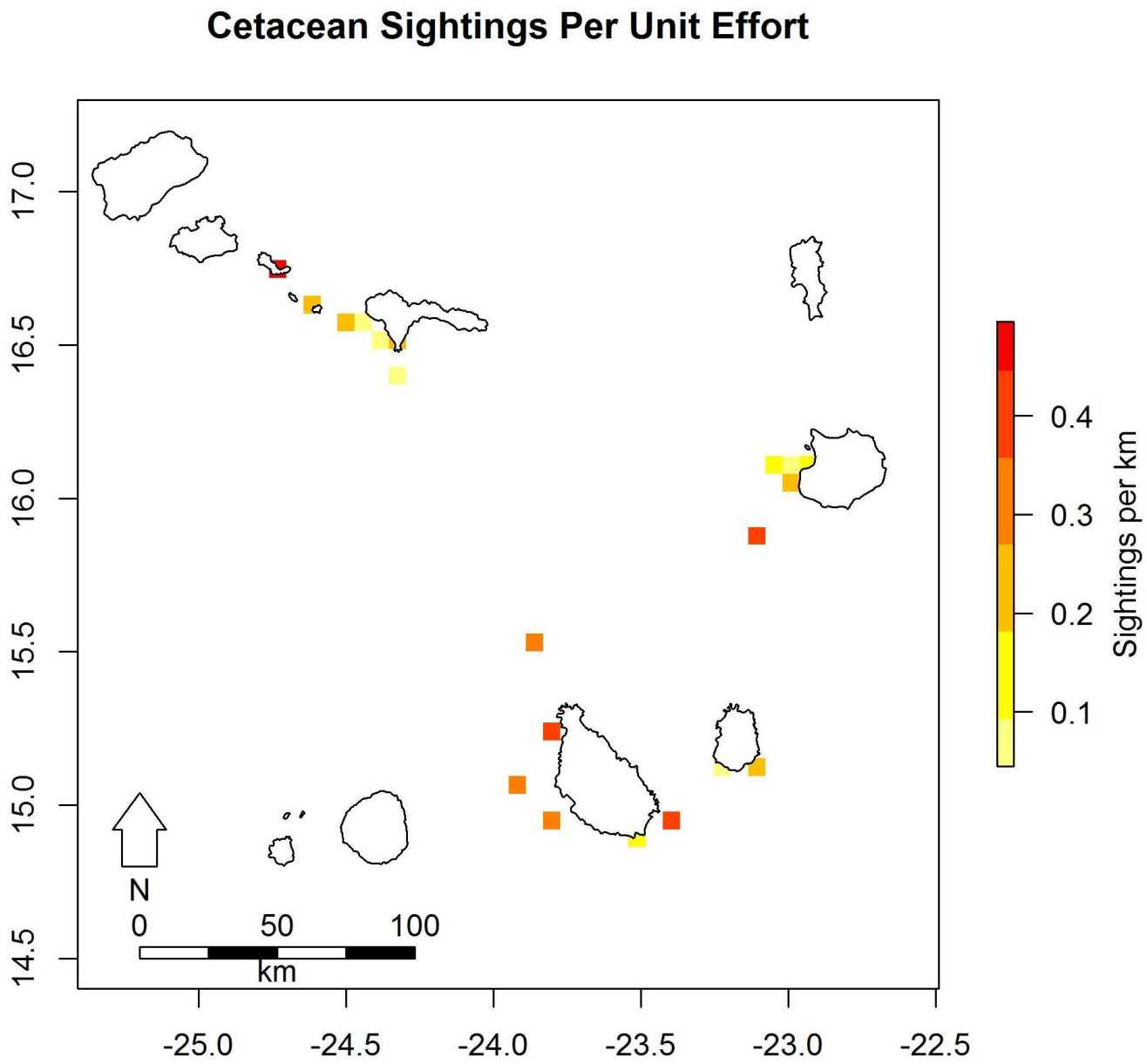
at the end of the expedition with Vanda Monteiro to update her on the work and the significance of Cape Verde for humpback whales and other cetacean species.

Biopsy samples of humpback whales in Baia de Sal Rei, Boavista © Pedro López Suárez and Branco © Joanne O'Brien

Discussion

This was the first dedicated cetacean survey of the Cape Verde archipelago during late summer. It was very successful, resulting in 25 sightings of at least seven species and possibly ten including rare sightings of beaked whales and dwarf sperm and killer whales. These records constitute only the third sighting of *Mesoplodon* species in Cape Verde, the fourth sighting of killer whales and the first sighting of a *Kogia* species. Records of melon-headed and short-finned pilot whales also contribute to our understanding of "blackfish" around Cape Verde. This group is important as there are still reports of these species being captured or exploited when stranded for consumption or to supply the curio trade (Britto and Carvalho 2012). Sighting rate per unit effort was highest around Santiago and St Luzia compared to São Nicolau, Maio and Boavista. The waters around St Luzia are a marine protected area and this status should be considered for other areas around Cape Verde based on high densities and species diversity. An analysis of sightings data and survey effort around Cape Verde would be useful to try and identify sites with high densities or critical habitats.

The main objective of this survey was to try and locate humpback whales, which was achieved with nine sightings of 12 whales. As well as sightings, good fluke shots suitable for photo-identification were obtained from two individuals and two biopsy samples were also obtained. The sighting rate during two weeks surveying around almost the entire archipelago was comparable to similar surveys in the boreal spring (Berrow *et al.* 2003; 2006) which suggests humpback whales may be quite abundant around Cape Verde during the boreal summer/autumn. Although not confirmed the evidence suggests that these whales are not from the humpback whale population summering in high latitudes of the northern hemisphere but southern hemisphere whales that have crossed the equator to breed north of their typical breeding grounds. The nearest known breeding grounds to the south are off Sáo Tome and Gabon around 3000 km south of Cape Verde (Carvalho *et al.* 2014). Genetic analysis will be needed to confirm this hypothesis but if this is supportive then Cape Verde is a new breeding ground for southern hemisphere humpback whales. This population (Breeding Stock B'-BSB) is distributed from the Gulf of Guinea to western South Africa and its population is considered healthy and increasing. It is possible that as this population increases individuals may disperse into new breeding areas. However there are historical records of humpback whales in Cape Verde in the autumn (Reeves *et al.* 2002) but whaling records suggests that few encounters were made south of Cape Verde until the Gulf of Guinea.



This survey has made a major contribution to our knowledge of the occurrence, distribution and abundance of cetaceans in Cape Verde at a time of year with few records. It has confirmed the occurrence of humpback whales during late summer and autumn. Pending results of the genetic analysis it will confirm whether Cape Verde supports breeding humpback whales from two hemispheres making it the only such site in the North Atlantic. This research project has increased the conservation importance of Cape Verde for humpback whales as well as for other poorly known species.

Summary and Recommendations

In summary, this survey has achieved:

1. A total of 25 sightings of at least seven and up to ten species were recorded
2. Rare sightings of beaked whales (third record of Mesoplodon), killer whales (third documented record for Cape Verde) and a *Kogia* (first reported sighting) were recorded
3. Nine sightings of at least 12 humpback whales were recorded.
4. Two fluke shots suitable for photo-identification were obtained and two biopsy samples
5. All humpback whales observed close to the boat lacked the white pectoral fins characteristic of whales breeding in Cape Verde in the boreal spring
6. HD filming of expedition for use in the future
7. Meetings with officials from government agencies to share findings and
8. Engagement and promotion of cetaceans in Cape Verde

We recommend the following:

1. Further surveys in September for humpback whales to collect additional sightings, photo-id images and biopsy samples
2. Encourage systematic monthly land-based sighting projects to record whale sightings, especially from Boavista and Maio to determine seasonal abundance.
3. Mariners (yacht charters, scientists) should be encouraged to report sightings of large whales during the summer and autumn and to contribute to photo-identification catalogues
4. Cape Verde should be encouraged and supported to conserve and enhance its marine biodiversity

Melon-headed whales in Baia de Sal Rei, Boavista © Beatrice Jann

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