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Common bottlenose dolphin (*Tursiops truncatus*) occurrence, distribution and conservation status in Madeira Archipelago (Portugal): a preliminary analysis

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ABSTRACT

Common Common bottlenose dolphins are one of the best known cetacean species of the world. It has a cosmopolitan distribution and can be found in most of the world's warm temperate to tropical seas, in coastal as well as offshore waters. In the Northeast Atlantic is present from the west coast of Africa to the North of Scotland, including the Macaronesia region. Genetic studies that compared samples from Madeira Archipelago with the neighboring archipelago of Azores, Portugal-mainland and the region of Western North Atlantic indicates that common bottlenose dolphins of North Atlantic belong to a large oceanic population and that levels of gene flow are high among these units. In order to access species distribution and occurrence in Madeira archipelago, systematic nautical surveys (2001-2002, 2004; 2007-2008, 7,759 km) were conducted, as well as photo-identification studies (1997-2007) and data on stranding records (1997- February 2009) was collected. A total of 43 sightings for surveys and 10 strandings records were recorded. For surveys common bottlenose dolphin was one of the three most abundant species during surveys, together with Atlantic spotted dolphin (*Stenella frontalis*) and common dolphin (*Delphinus delphis*). Monthly sighting index (sightings/100km) for systematic nautical surveys ranged between 0,00 (March) and 2,18 (December). Fifty-five photo-identification events allowed building a catalog with 170 individuals, including 21 with one or more annual resightings. Strandings for common bottlenose dolphin represents 9% of total stranding records and *post-mortem* exams reveal that 20% of deaths were related with anthropogenic causes. The distribution shows that the north of Porto Santo island has the highest sighting index (1,33) and that the species occurs more in inshore waters, up to 1000m depth and 11km offshore. Regional conservation status for this species is Least Concern (LC) and the IUCN is Data Deficient (DD). All data combined shows that Madeira Archipelago is an important area for this species, with year-round presence, high occurrence and heterogeneous distribution within the archipelago which indicates the existence of important sub-areas used for feeding, nursing and resting. This paper represents preliminary results and further analysis will be done to clarify and corroborate the hypothesis considered.

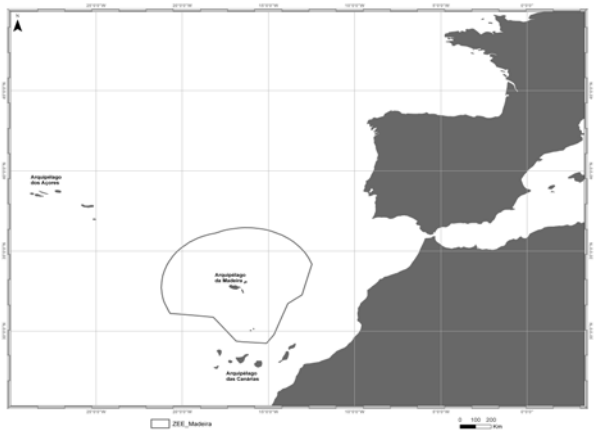
KEYWORDS: **COMMON BOTTLENOSE DOLPHIN, ATLANTIC OCEAN, SURVEY-VESSEL , PHOTO-ID, DISTRIBUTION**

1. INTRODUCTION

Common bottlenose dolphins are arguably the best known of all cetaceans (Wells and Scott, 2002). Common bottlenose dolphins tend to be primarily coastal but can also be found in pelagic waters and in oceanic islands (Wells and Scott, 2002). In the oceanic archipelago of Madeira little is known about the biology and ecology of common bottlenose dolphins. Since 2001 Madeira Whale Museum (MWM) has been conducting dedicated surveys and established a stranding network on the archipelago in order to gain knowledge for conservation and management of common bottlenose dolphins and other cetacean species that occur in these waters. This study used data from line transect surveys, photo-id surveys and strandings and presents preliminary analysis for occurrence, distribution and site-fidelity of common bottlenose dolphins in Madeira archipelago.

2. STUDY AREA AND METHODOLOGY

The archipelago of Madeira is located about 670 km west of the North African coast (Fig.1). It comprises two main islands separated by a few dozens of kilometres, Madeira and Porto Santo; and two sub-archipelagos, Desertas and Selvagens. Although, the Selvagens were covered, data from that survey were not included in this study.



2.1 Surveys

Systematic nautical surveys were made in two distinct periods: 2001-2002 (A) and 2007-2008 (B). Some sectors were surveyed in June and July of 2004, to fill a gap from the previous surveys. In each area the starting point of the transect-line was randomly chosen, and transects followed "Equal Spaced Zig-Zag" pattern generated by Distance4 software. In the period of 2001-2002 a vessel of 12m long and a cruise speed of 5knots, with three observers scanning with naked eye on a 3m height platform. For the periods of 2004 and 2007-2008, a 19m long sail boat, with a cruise speed of 6,5knots was used. During transects three observers searched the area from the bow to 90º in each side and up to the horizon, with naked eye and using 7x50 binoculars. The front observer covered the central line up to 20º in each side. A fourth person recorded weather, effort and sighting information (species identity, number of individuals, presence of calves and behavior) on a laptop using Logger2000 software connected to a GPS (information collected every 10sec) and a fifth person was on the helm. All 5 observers changed position every hour. On both surveyed periods zig-zag shaped transects were used. The area was divided in eight sectors (Fig.2). All sectors combined totaled 4 818 Km^2. Surveys covered all moths of the year and coverage was made whenever sea state was 3 or less in the Beaufort scale.

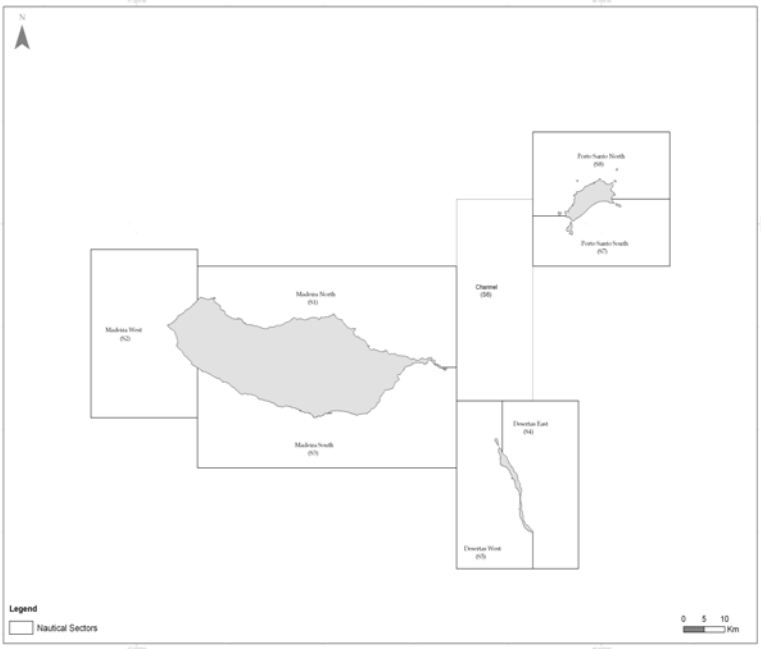


Figure 2 – Map of the sectors around Madeira, Porto Santo e Desertas

2.2 Photo-id

Photo-id data was obtained from the line transect surveys and from random dedicated surveys. Until 2004 photographs were taken with Nikon LSR-Cameras using elit chrome kodak 200 ASA films. From 2004 onward Digital Nikon D2H was used. Both cameras were equipped with 70-300mm and 80-200mm lenses. The slide photographs were digitalized and all photos were processed using the Corel Photo-Paint 9 and Adobe Photoshop CS2 software. The good quality images were sorted following Arnbom (1987), based on the shape and marks of the dorsal fin. The matching analysis was manual and individuals cataloged in Europhlukes software database. Effort was manly conducted on the south coast due to the good weather conditions on this area.

2.3 Strandings

Stranding data is being collected since 1991, with some older records from the Natural History Museum of Funchal, included in MWM database (since 1986). In 1995, a stranding network was established with several partnerships with Municipalities, Funchal Natural History Museum, sea tours operators and fishermen (professional and amateurs). Whenever a stranding was reported and the carcass was recovered, *post-mortem* exams were made and tissue, bone and organs samples were collected and send to analysis.

2.4 Data analysis

Surveys

Sighting index (SI) was number of sightings per 100km surveyed. Data collected in the 2004 surveys were treated together, in spite a different platform was used. SI was presented by months and sectors. Relative abundance index (sightings*mean group size/100km) and mean group size were also calculated.

Photo-id

The good quality images were sorted following Arnbom (1987), based on the shape and marks of the dorsal fin. The matching analysis was manual and individuals cataloged in Europhlukes software database.

Strandings

The stranding reports were analyzed in order to assess occurrence and anthropogenic threats.

3. RESULTS

Surveys

In the A surveys a total of 4,682 Km were covered and 21 sightings were registered. SI was 0,47. For the B surveys, 3,077 Km were covered and 21 sightings were registered and sighting index was 0,68. Relative abundance was 4,71 in the A surveys and slightly higher (4,97) on the B surveys (Table I). Mean group size was 21,41 and 23,67 for A and B surveys, respectively.

Table I – Total sightings, sighting index and relative abundance index for both periods

Surveys	Total sightings	Sighting index	Relative abundance index
A	22	0,47	4,71
B	21	0,68	4,97

For monthly distribution in the A surveys, common bottlenose dolphin was sighted on seven months of the year and in every season. May was the month with the highest SI, with a value of 1,25. In the B surveys this species was sighted on nine months of the year, also on every season, and December was the month with the highest value, with 2,18 (Fig.3). For spatial distribution in the A surveys, common bottlenose dolphin was sighted on all sectors, except 7. Sector 4 was the one with a higher value for SI. In the B survey this species was sighted in all sectors, being 8 the one with the highest SI (Fig.4).

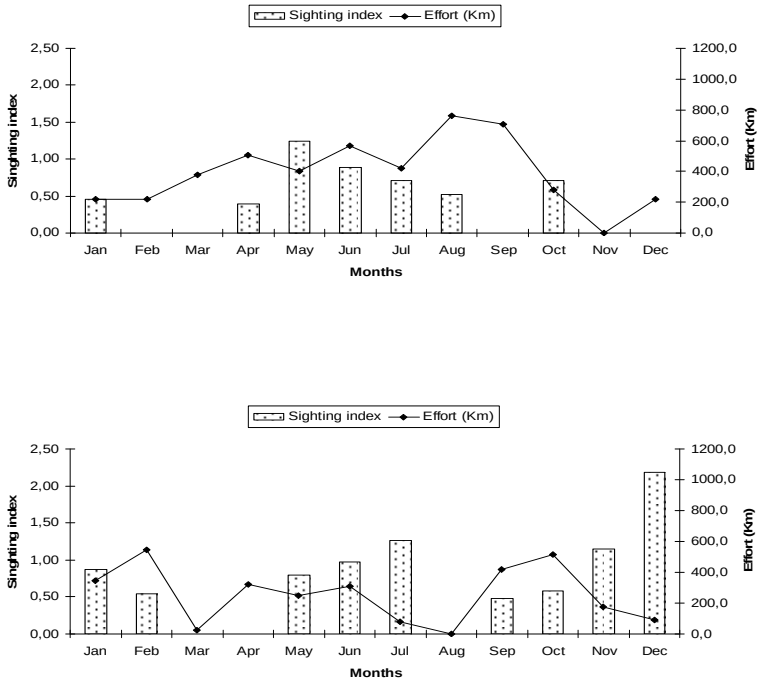


Figure 3 – Monthly SI and effort for the A survey (above) and B survey (below)

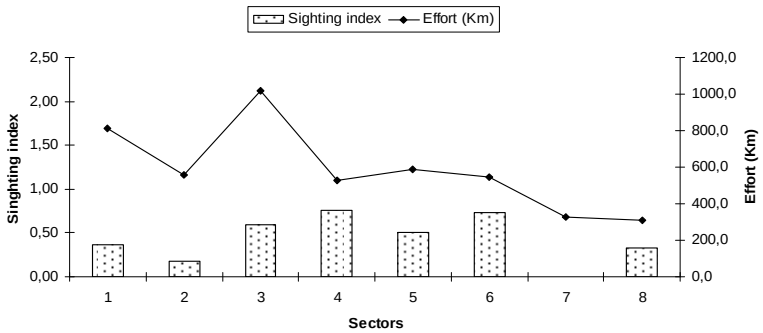


Figure 4 –SI and effort for the A survey (above) and B survey (below) by sectors.

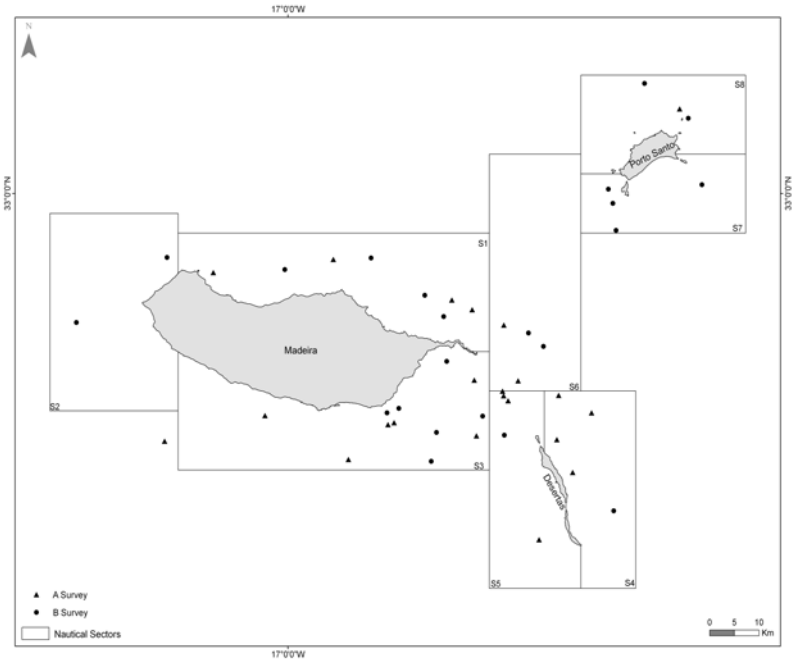


Figure 5 – Common bottlenose dolphins sightings during both surveys

Common bottlenose dolphins were sighted in all sectors, but seem to have a higher occurrence on the east side of Madeira Island and around Porto Santo (Fig. 5).

In the A surveys data, bathymetry and distances to coast were compared and the majority of sightings occurred within 500m depth and up to 11Km offshore.

Photo-id

Photo-id data was collected in an opportunistic way since 1997 and from 2004 onwards dedicated surveys for photo-id were conducted. The curve grows rapidly until 2006 when the adding of new individuals starts to

decrease. Effort increased in 2004 and had a slightly decrease in 2006. From 55 events, 170 individuals were identified and catalogued (Fig. 6). From this total, 21 individuals were resighted annually: 17 once, two twice and also two at three occasions (table II).

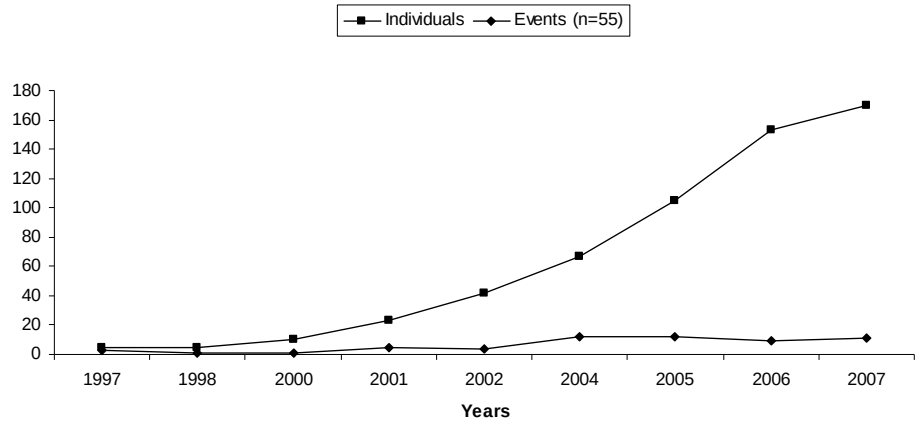


Figure 6 – Cumulative curve of individuals for the total sampling period (1997-2007) and the number of events over the years.

Table II – Individuals that were resigted annually since 1998 until 2007. x = certain; x= possible

	1997	1998		2001		2002				2004			2005					2006			2007	
	Out	Mar	Abr	Mai	Ago	Jul	Ago	Jun	Jul	Ago	Set	Fev	Abr	Mai	Jun	Set	Fev	Mai	Jun	Ago	Ago	Set
Tt009			x			x							x									x
Tt011					x	x							x									
Tt016			x			x																
Tt019	x	x																				
Tt032						x		x		x			x									
Tt037						x			x													
Tt040										x								x				
Tt043											x		x									
Tt044											x							x				
Tt046											x		x									
Tt053												x									x	
Tt056						x							x									
Tt058													x							x		
Tt063							x						x			x						
Tt073															x		x					
Tt074															x	x						
Tt076															x				x			
Tt084						x												x				
Tt086						x																x
Tt089											x							x				
Tt101																x			x			

Strandings

Since 1997 ten strandings of common bottlenose dolphins were reported. For a total of ten strandings *post-mortem* exams were conducted for seven of them, while three carcasses were lost. The year with more common bottlenose dolphins stranding records(3) was 1998, followed by 2008 and 2009 with 2 records strandings each

(Fig.7). February was the month with more stranded animals (40%) followed by March and April, both with 20% (Fig7). The winter months are the ones with higher percentage of strandings (Fig. 7).

From a period of 13 years, there are six recorded strandings of common bottlenose dolphins (Fig. 7). Through the examination of the stranded animals it was possible to determine that 30% of the common bottlenose dolphins deaths were due to natural causes, 10% due to anthropogenic reasons, 10 % due to suspicion of anthropogenic reasons and 50% of all the deaths were not determine (Fig.7). There is only one confirmed dead due to anthropogenic reasons (bycatch: long line fishing gear) in February 2009 in Porto Santo Island.

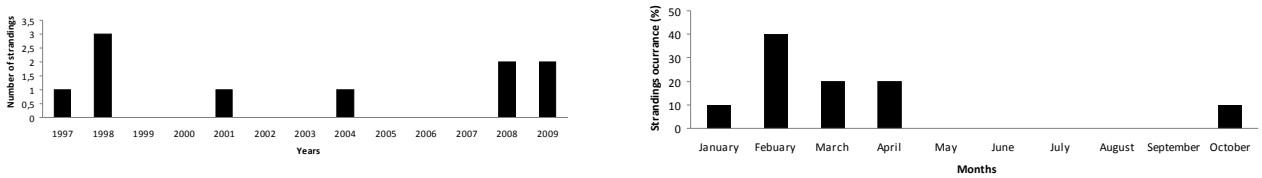


Figure 7 –Annual and seasonal occurrence of common Bottlenose dolphin strandings.

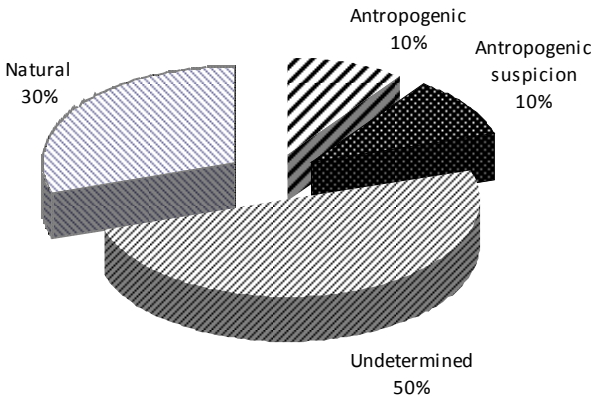


Figure 8 – Causes of death determined from the *post-mortem* exams.

4. DISCUSSION

From the 28 species that can be sighted in Madeira archipelago (Freitas *et a*l, submitted), common bottlenose dolphin is the species with the highest number of sightings recorded by whalewatching operators (Ferreira, 2007). Common bottlenose dolphin was the second most sighted species of both surveys (A and B) together with Atlantic spotted dolphin (*Stenella frontalis*). Monthly SI indicates that this species does not occur seasonally but year-round in the archipelago. It seems that in early summer and in early winter there is an increase in the sighting rate as suggested by figure 3 analysis. It was observed at sea the presence of much larger groups and individuals on those periods which may indicate the presence of big pelagic groups of common bottlenose dolphins in the archipelago.

The mean group size found in this study was considerably higher that the ones reported on other areas (Shane et al, 1986). The pelagic pattern of the individuals found in Madeira can explain the high value found for group size. Connor *et al* (2000) refers, that dolphins that inhabit more open and pelagic habitats generally form larger groups. Distribution and abundance of food resources, risk of predation in open habitats and physical characteristics of habitat are known to influence group size of cetacean populations (Norris and Dohl, 1980; Wells *et al*, 1980).

Common bottlenose dolphin was found in all sectors, although they appear to be more frequent in east coast of Madeira Island and around Porto Santo Island. When sighting data was related to bathymetry and distance from the coast it showed that common bottlenose dolphin occurs in more inshore waters. Several factors are known to

influence the spatial and temporal distribution of cetaceans, including the characteristics of the habitat (e.g., temperature, salinity and bathymetry), system productivity, distribution of competitors, predators and prey, population size and structure, and human disturbance (Bowen & Sniff, 1999), however the precise role and importance of each factor is often difficult to understand.

From the 170 individuals identified only a small number (21) had inter-annual resightings. Silva (2007) described for the archipelago of Azores, the existence of a small number of dolphins that shows site-fidelity and can be classified as residents and, the existence of transient individuals that are photographed and never seen again. The same seems occur in Madeira archipelago although it remains unclear if this is a seasonal pattern or year-round residence in Madeiran waters. Common bottlenose dolphins exhibit a large spectrum of movements, including seasonal migrations, year-round home ranges, periodic residency and a combination of long-range movements and repeated local residency (Shane et al, 1986; Well and Scott, 1999).

Of a total of 110 stranded cetaceans, the common bottlenose dolphin represents a small percentage (9%). The winter months had the highest number of strandings in comparison with the remaining seasons. The highest number of strandings occurred in the east coast of Madeira Island and Porto Santo Island is in line, with the highest number of sightings in those areas. The *post-mortem* exams revealed that 10% of deaths had anthropogenic origin, however this corresponded to one individual in an almost 13 year period, indicating a low threat level.

The IUCN global status for this species is Data Deficient (DD) and the regional conservation status for Madeira is Least Concern (LC) (Queiroz *et al*, 2005).

Genetic studies that compared samples from Madeira Archipelago with the neighboring archipelago of Azores, Portugal-mainland and the region of Western North Atlantic indicates that common bottlenose dolphins of North Atlantic belong to a large oceanic population and that levels of gene flow are high among these units (Querouil *et al*, 2007). All data combined shows that Madeira Archipelago is an important area for this species within pelagic North Atlantic context, with year-round presence, high occurrence and heterogeneous distribution in the archipelago which may indicate the existence of important sub-areas used for feeding, nursing and resting.

This paper represents preliminary results and further analysis will be done to clarify and corroborate the hypothesis considered.

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