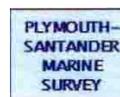


2007 BISCAY CETACEAN SURVEY



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Sea Watch Foundation
Dec 2007

Cover: *Maren Reichelt & Peter Evans*

REPORT
on
2007 BISCAY CETACEAN SURVEY

Editors:
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1. Introduction

The southern Bay of Biscay is well known for its rich cetacean fauna (Fletcher, 1995; Williams *et al.*, 2000; Cresswell & Walker, 2001; Walker & MacLeod, 2003), due in large part to the range of habitats from shallow coastal bays to deep canyons. Within 20 nautical miles of the north Spanish coast, depths exceeding 2,500 m can be found, and this attracts oceanic species such as the large baleen whales and beaked whales.

In recent years, beaked whales (family Ziphiidae) have been a focus of research interest following a series of mass stranding events associated with the use of military sonar, affecting particularly Cuvier's beaked whale (*Ziphius cavirostris*) but also various *Mesoplodon* species (Evans & Miller, 2004; Cox *et al.*, 2006). Previously, our knowledge of this family was rudimentary mainly because of their life style, being deep divers that can remain below the surface for more than one hour, and tending to live in deep-sea canyons far from the coast. However, the Spanish coast of the Bay of Biscay is one of the few areas in the world where beaked whales, particularly Cuvier's beaked whale, can be seen within easy reach of a port (Williams *et al.*, 1999; Cresswell & Walker 2001, 2003; Walker *et al.*, 2004; Vazquez *et al.*, 2004).

Between 2nd and 28th July 2006, a systematic survey was conducted of the Torrelavega Canyon north of Santander using the Seamark Trust's vessel "Blue Fin of Hamble", with research emphasis on beaked whales (Swift & Vazquez, 2006).

2. Objectives

The aim of the present study conducted between 2nd and 21st July 2007, was to extend eastwards the survey coverage of July 2006, in order to sample areas at the western margin of the Cap Breton Canyon, between Santander and Bermeo. Some degree of overlap with the 2006 survey was included in the present survey. As with the previous survey, emphasis was placed on assessing the distribution, relative abundance and habitat preferences of Cuvier's beaked whale. Wherever possible, photography would be used both on Cuvier's beaked whales and other cetacean species (e.g. bottlenose dolphin and long-finned pilot whale) to identify individuals with unique markings. All images of sufficient quality would then be made available for inclusion in local photo-ID catalogues.

3. Methods

3.1 Survey Area

The area selected for the systematic survey was bounded on its western margin by longitude 04°00'W and on its eastern margin by longitude 02°40'W, and from the Spanish coast (around 43°20'N) to latitude 43°45'N (see Fig. 1 for map of study area, and Fig. 3 for track-lines). This included the ports of Santander, Santoña, Bilbao, and Bermeo. Depths in the survey area ranged to 3,000 m, falling away steeply between 10 and 15 nautical miles from the coast (Fig. 2).

Two additional transects were run in parallel from longitude 02°40'W north-eastwards across the Cap Breton Canyon to 02°00'W (Fig. 3).

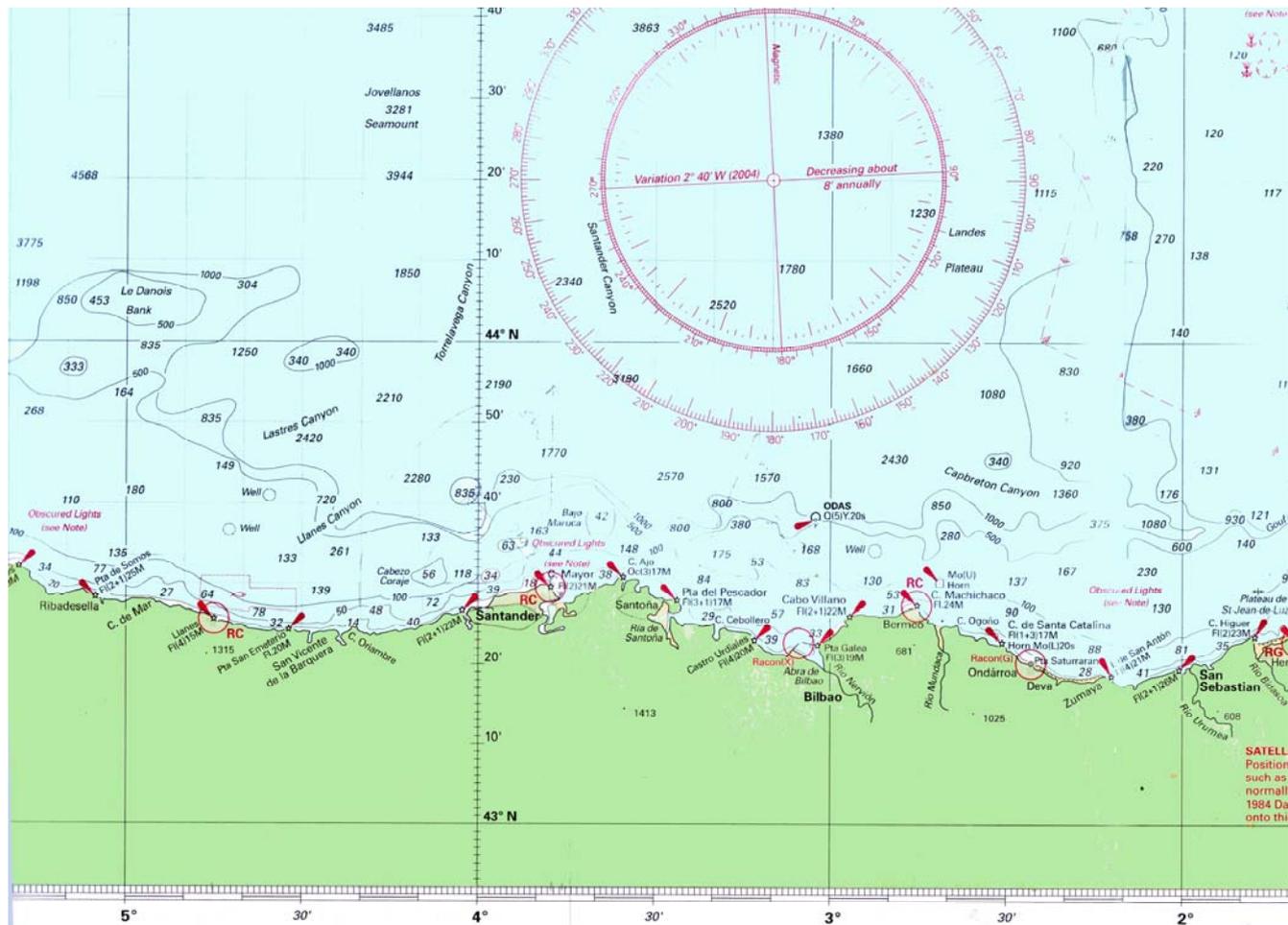


Fig. 1. Map of Survey Area

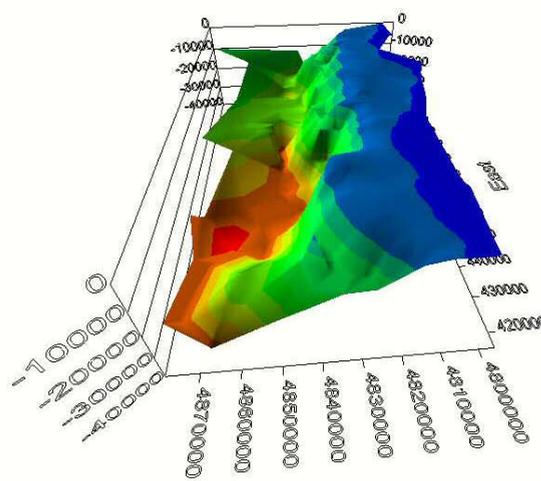


Fig. 2. Bathymetry of the Southern Bay of Biscay (shallowest areas are blue, deepest areas are red)

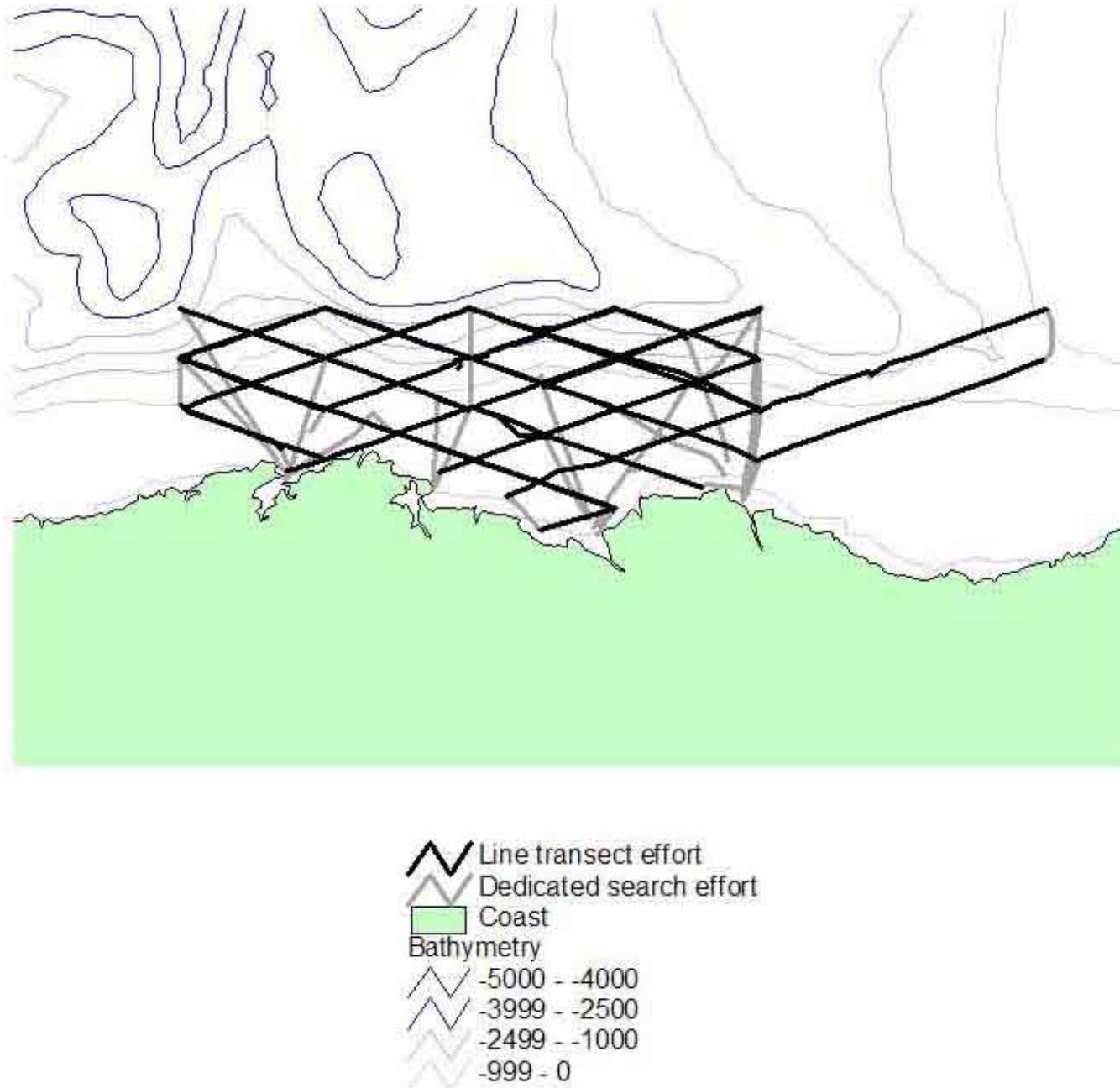


Fig. 3. Map showing track-lines & bathymetry



Plate 1. Survey vessel: Bluefin of Hamble

3.2 Survey Vessel

The vessel used for line transect surveys was the “BlueFin of Hamble”, a 60-foot ketch rigged Moody owned and operated by the Seamark Trust (Plate 1). The vessel was powered by twin Perkins diesel engines with twin self-furling propellers. In addition, a small rigid inflatable boat was carried aboard, and used mainly for transport between the larger vessel and port.



Plate 2. Members of the Biscay Survey team (from L to R): top – Peter, Pia, Mick, & Maren; centre – Phil, Dave, Laura, & Anne; bottom – Nigel, Pia & Mick, Matt, and Matt with Dave & Laura

3.3 Personnel

A total of eight volunteer observers participated in the survey, split between two periods (Table 1; Plate 2). Five persons (Peter Evans, Pia Anderwald, Mick Baines, Maren Reichelt, and Phil Coles) joined the vessel at the start of the cruise on 1st July. Three of these (Peter Evans, Pia Anderwald, and Phil Coles) left on 11th July, and were replaced by Dave Curtis, Laura Mandleberg and Anne Schoer. All observers had several years experience of line transect surveys. Two of these (Phil Coles and Anne Schoer) had participated in the 2006 survey, and one (Dave Curtis) had long experience of surveys in the Biscay area, as organizer of the Plymouth – Santander ferry surveys.

The vessel was skippered by Nigel Greenyear, and crewed by Matt Raine (who also acted as cook), both of whom had briefly worked on Bluefin of Hamble previously.

Table 1. Survey Team

Name	Organisation	Period
Peter Evans	Sea Watch Foundation	02-11 July
Pia Anderwald	Sea Watch Foundation	02-11 July
Mick Baines	Sea Watch Foundation	02-21 July
Maren Reichelt	Sea Watch Foundation	02-21 July
Phil Coles	ORCA	02-11 July
Dave Curtis	Santander Ferry Survey	11-21 July
Laura Mandleberg	HWDT	11-21 July
Anne Schroeer		11-21 July
Nigel Greenyear	[Skipper]	02-21 July
Matt Raine	[Mate/Cook]	02-21 July

3.4 Methodology

Transect lines were drawn up to systematically survey the study area, and surveys were conducted on every day logistically possible between 2nd and 20th July. An induction session was conducted at the start of each ten-day period. Surveys ran from 07:00 until 20:00 h, and were carried out only when conditions were favourable (Beaufort sea state 4 or less).

The survey was conducted using line-transect methodology and application of DISTANCE sampling, the vessel maintaining a constant speed of between 6 and 7 knots. The survey operated largely in passing mode, with the exception of beaked whale encounters and occasions when photo-ID opportunities arose, when closing mode was used.

Only visual survey was undertaken. It had been hoped that an acoustic survey could be run alongside the visual survey, as in 2006, but all acoustic equipment available was tied up in the large-scale CODA survey running at the same time. A single observation platform was used, with an eye height of about 3 metres above sea level. A rota was operated with two observers on watch for one-hour periods and a third recording effort and environmental conditions, the remaining two members of the team being off-watch.

Watches were conducted from an elevated position on either side of the centre cockpit. This position was chosen in preference to closer to the bow because it offered better viewing, and provided consistency, since it could be maintained safely when weather conditions became less favourable. All observations were made visually, using naked eye scans 180 degrees (270-090 degrees) ahead of the vessel, with the port side observer watching 005-270 degrees, and the starboard observer from 355-090 degrees. Any cue or potential sighting was investigated with binoculars. Radial distances were estimated by eye and the angle to the sighting recorded in degrees (to the nearest degree) using an angle board. A laptop computer linked to a GPS continuously logged positions, whilst environmental data and back-up GPS positions were recorded at regular intervals by a third person.

Survey effort type was recorded as LT = Line transect, DS = Dedicated Search (but not in Line-transect mode), and CW = Casual Watch.

Ship speed and course over ground were read directly from the GPS.

Environmental data included assessments of sea state, swell height, visibility (including precipitation & glare), and a count of all vessels by type in view. A new record was taken when environmental conditions changed and with every course change.

For every sighting, a radial distance and angle was taken, and the identity of the species, group size (best, minimum and maximum estimates), age (adults, juveniles, calves), behaviour, heading, reaction to vessel, associated seabirds, and observer name were all recorded.

Photo-ID was conducted when conditions allowed, and the species encountered was amenable (with a portion of the population individually identifiable by unique markings such as nicks in the dorsal fin or pigmentation patterns). Most photography was conducted by one or more of four persons – Mick Baines, Maren Reichelt, Pia Anderwald, and Peter Evans, using their own individual cameras. Digital SLR cameras were used for the purpose, either a Canon EOS 20D (Peter & Pia) equipped with Canon 18-85mm or 75-300mm zoom image stabilized lenses, or a Nikon D100 (Mick & Maren), with 80-400mm VR zoom lens and 300mm telephoto lens. Those persons off watch during the encounter took priority for taking ID shots, but primary observers also took pictures when opportunities allowed.

All images taken were subsequently downloaded on computer and sorted by species, photographer, picture quality and encounter. They were then cropped and labeled, arranged into left, right and other aspects, and sorted into files by encounter number, for later incorporation in local photo-ID catalogues. Where necessary, these derived images were adjusted for brightness and contrast using Adobe Photoshop. All images above a certain quality were archived, and back-up copies made of those selected for catalogue integration.

A Canon XL1 digital video camera belonging to Peter Evans was taken on the first ten days for use with beaked whales, but encounter conditions were never suitable for its deployment.

Attempts were also made during encounters with beaked whales to record dive behaviour using focal follow recording forms specially designed for the purpose. These could rarely be used, however, either because encounters were too brief, or sea conditions prevented one being confident that the same individual was being tracked.

4. Results

Line-transect surveys were conducted on sixteen out of twenty of the days available, with a total of 153.25 hours (1,703 km) of effort, 101.25 hours (1,212 km) in line-transect mode, and 48.5 hours (491 km) in dedicated search; 3.5 hours was spent in casual watching mode (Tables 2 & 3).

Table 2. Summary of Survey Effort, 2-20 July 2007

Date	Start & End Time	Total No. of hrs	LT Effort	DS Effort	CW Effort	Sea state
2/7	11:45-21:48	10h 03m	07h 30m	02h 33m	00h 00m	2 - 4
3/7	08:35-17:00	08h 25m	06h 00m	00h 00m	02h 25m	1 - 4
5/7	07:18-21:30	14h 12m	11h 43m	02h 29m	00h 00m	1 - 2
6/7	07:30-20:15	12h 45m	08h 58m	03h 47m	00h 00m	1 - 3
7/7	07:32-20:00	12h 28m	09h 14m	03h 14m	00h 00m	2 - 3
8/7	07:22-20:00	12h 38m	07h 52m	04h 46m	00h 00m	0 - 4
11/7	07:00-13:51	06h 51m	04h 09m	02h 42m	00h 00m	2 - 4
12/7	07:50-14:45	06h 55m	02h 43m	04h 12m	00h 00m	1 - 5
13/7	07:25-15:00	07h 35m	06h 53m	00h 42m	00h 00m	1 - 4
14/7	06:55-18:50	11h 55m	08h 41m	02h 43m	00h 31m	2 - 4
15/7	07:30-16:23	08h 53m	02h 15m	06h 00m	00h 38m	1 - 5
16/7	07:30-18:47	11h 17m	06h 13m	05h 04m	00h 00m	1 - 3
17/7	13:40-17:36	03h 56m	03h 19m	00h 37m	00h 00m	2 - 4
18/7	07:00-19:36	12h 36m	09h 45m	02h 51m	00h 00m	1 - 3
19/7	07:15-16:23	09h 08m	05h 16m	03h 52m	00h 00m	1 - 4
20/7	11:03-14:40	03h 37m	00h 40m	02h 57m	00h 00m	2 - 4
Total		153h 14m	101h 11m	48h 29m	03h 34m	

Sea conditions during the survey were generally not very good with only one day out of sixteen having sea states less than 3 for the whole day, and on more than half the survey days, sea states reached 4-5 at some point. Forty percent of effort was in sea states of 3 or more (Table 3). In addition, swell conditions were often unfavourable, swell height frequently reaching 2 metres or more, due to storm conditions prevailing north of the study area. These large swells not uncommonly occurred even when there was little wind, making it difficult in particular to locate inconspicuous species like beaked whales.

Table 3. Survey effort at different sea states

Sea state	DS km	LT km	Total km	%
0	2.0	6.4	8.3	00.49
1	97.3	278.3	375.5	22.05
2	157.0	460.5	617.5	36.27
3	80.5	379.7	460.2	27.03
4	129.8	86.9	216.7	12.73
5	24.4	0.0	24.4	01.43
All	491.0	1211.8	1702.7	100.00

A total of 71 sightings of six cetacean species were made, comprising 1,013 individuals (Table 4). Around 60% of encounters involved either striped dolphin (*Stenella coeruleoalba*) or bottlenose dolphin (*Tursiops truncatus*), and these made up 86% of the total number of individual animals counted. Third most common and frequently encountered was the long-finned pilot whale (*Globicephala melas*). A total of thirteen sightings (of 29 individuals) were of beaked whales, seven of which could confidently be ascribed to species and were identified as Cuvier's beaked whale (*Ziphius cavirostris*). There were possible sightings of both Sowerby's beaked whale (*Mesoplodon bidens*) and northern bottlenose whale (*Hyperoodon ampullatus*), usually as distant breaches, but they were brief and could not be located subsequently to confirm species identity.

Table 4. Total number of sightings & individuals for all cetacean species encountered

Species	Number of sightings			Number of individuals		
	Total	Line transect	Other effort	Total	Line transect	Other effort
Bottlenose dolphin	19	12	7	312	156	156
Common dolphin	2	2	0	6	6	0
Striped dolphin	23	21	2	563	508	55
Common or striped dolphin	3	3	0	12	12	0
Risso's dolphin	1	0	1	1	0	1
Long-finned pilot whale	9	6	3	89	65	24
Cuvier's beaked whale	7	6	1	21	16	5
Unidentified beaked whale	6	3	3	8	4	4
Unidentified small whale	1	1	0	1	1	0
Total	71	54	17	1013	768	245

Short-beaked common dolphin (*Delphinus delphis*) and Risso's dolphin (*Grampus griseus*) were the only other cetacean species encountered, with two and one sighting respectively, although three encounters were either common or striped dolphin. No baleen whale species or sperm whales were encountered. Sunfish was the only non-cetacean species observed. Plate 3 gives illustrations of the

main species observed. Most cetacean sightings (of all species) occurred offshore with very few sightings on the coastal shelf itself (Figure 4).



**Plate 3. Marine Wildlife Species observed during survey (L to R):
 Top – Bottlenose Dolphin & Cuvier's Beaked Whale
 Centre – Striped Dolphin & Long-finned Pilot Whale
 Bottom – Short-beaked Common Dolphin & Sunfish**

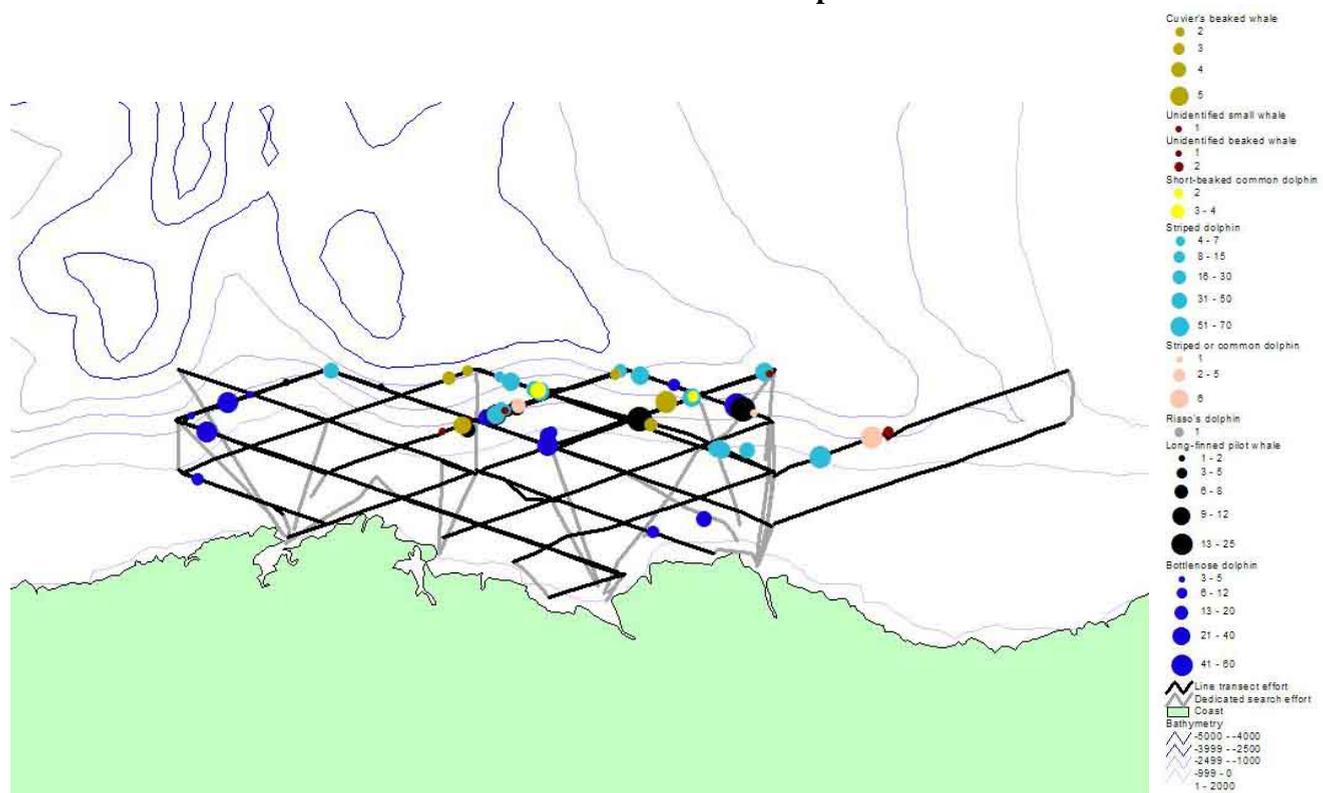


Fig. 4. Map of track-lines with cetacean sightings overlaid

Cuvier's beaked whale All seven sightings of Cuvier's beaked whale (as well as all the unidentified beaked whale sightings) occurred at least 10 nautical miles from shore on the southern slopes of the Torrelavega and Cap Breton Canyons, in waters of 1,000–2,500 metres depth (Figure 5). Average group size was 3.0 (minimum 2, maximum 5). Of six unidentified beaked whale sightings, four were of single animals and two of two animals.

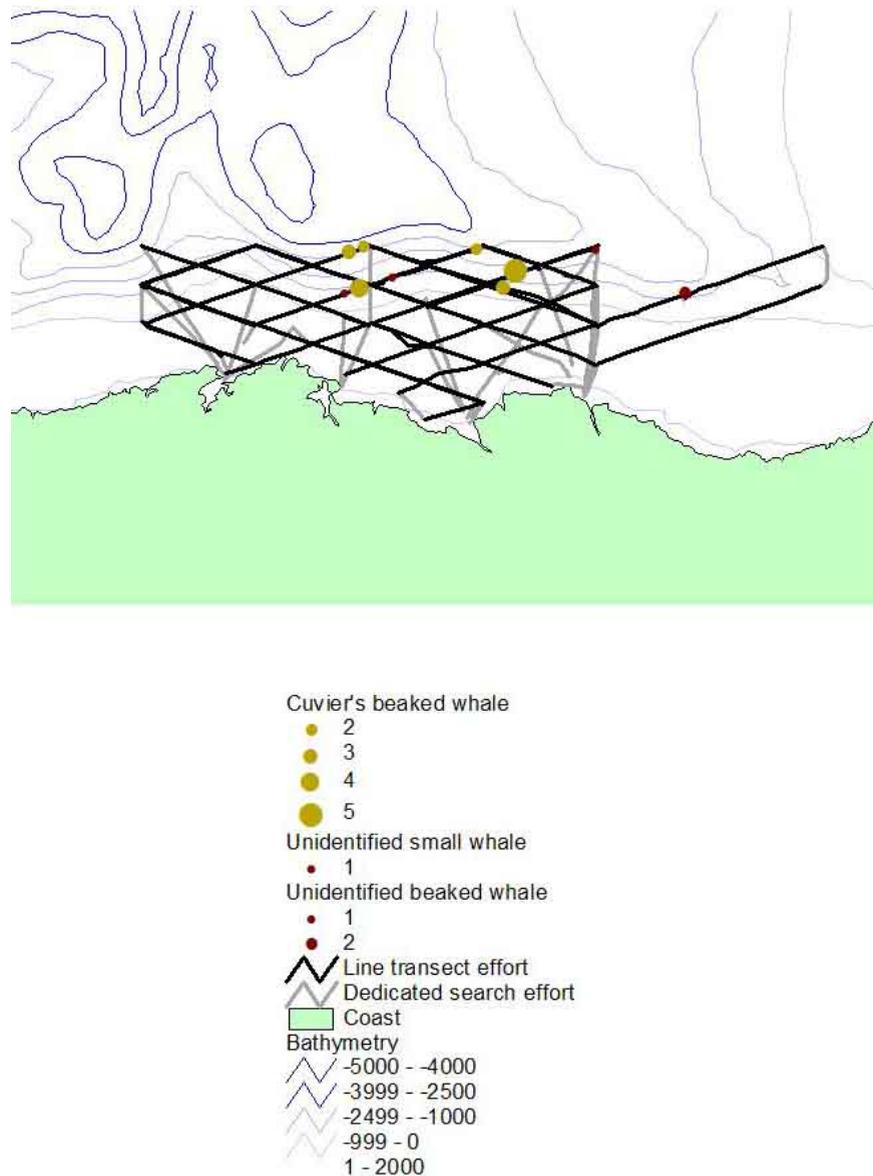


Fig. 5. Distribution of Cuvier's Beaked Whale & Unidentified Beaked Whale Sightings

Measurements of dive patterns were attempted wherever possible, but most encounters were brief with sea conditions hindering re-location of the animals. After an initial sighting, attempts were made to position the vessel as close as possible to the location at which the animals were last seen. On 5 July, a tight group of three individuals, one of which was a calf, was sighted close to the boat at 13:48h. They dived synchronously and re-surfaced 15 minutes later 300 metres away, followed immediately by a dive lasting 18 minutes. They then surfaced 500 metres away, followed by a dive, at which point they were lost from view. On the same day at 15:00h, two individuals were spotted swimming together. They surfaced twice in rapid succession and then dived out of sight and were not seen again.

On 15 July, two individuals were seen together at 11:21h. They dived synchronously, re-surfacing 16 minutes later, then again 19 minutes later (at which point they were 400 metres from the boat), and

finally 21 minutes later, when they were 800 metres away. On this occasion, one individual performed a full breach, whereupon they were lost from sight. At the same time as this encounter, at 11:27h, a group of 5 (possibly 6) individuals was also seen. They all dived at 11:31h, re-surfacing 16 minutes later 300 metres from the boat. They remained at the surface for five minutes before diving again and were then not seen again. At 13:16h, two probable Cuvier's beaked whales (species not confirmed) were seen at the surface, diving two minutes later and were not seen again.

On 19 July, a group of three was seen together at 09:33h. They remained at the surface for 5 minutes, then dived for 9 minutes, surfacing again for a further 3 minutes before diving and were not sighted again. On the same day, a group of four was seen together at 15:25h until 15:28h when they dived. Twenty minutes later they re-surfaced, with four surfacings in succession over a period of 5 minutes, before diving again at 15:53h, at which point they were not seen again.

Encounter duration ranged up to 56 minutes, but only one other encounter exceeded 30 minutes. Although encounters were brief, they followed a similar pattern with all groups sighted diving synchronously, dives lasting between 15 and 21 minutes, and surfacings between 1 and 5 minutes.



Plate 4. Photo-ID Images of Cuvier's Beaked Whales

Photo-ID was conducted on Cuvier's beaked whales whenever opportunities allowed (only one of the seven encounters). Examples of some of the better images are shown in Plate 4. All images will be incorporated in the local Photo-ID catalogue maintained by the Spanish NGO, AMBAR.

Long-finned pilot whale There were nine sightings of long-finned pilot whale, totalling 89 individuals. All sightings occurred in a fairly narrow band in the eastern sector of the Torrelavega Canyon, 10-15 nautical miles from shore at depths ranging from 1,000 to 3,000 metres (Figure 6). Group sizes varied between one and 25 individuals (mean = 9.9, median = 5.).

Photo-identification was conducted at four encounters, and sample images of marked individuals are illustrated in Plate 5. At least one well-marked individual was recognized from the 2006 survey (P. Coles, *pers. comm.*). The same animal was seen on two separate days during the 2007 survey, on both occasions in groups associated with bottlenose dolphins. As with Cuvier's beaked whale, all images will be incorporated in the local Photo-ID catalogue maintained by AMBAR. This may reveal further re-sightings.

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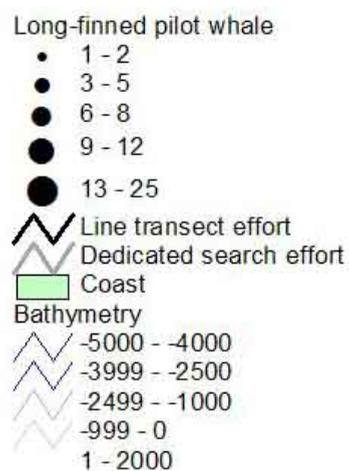
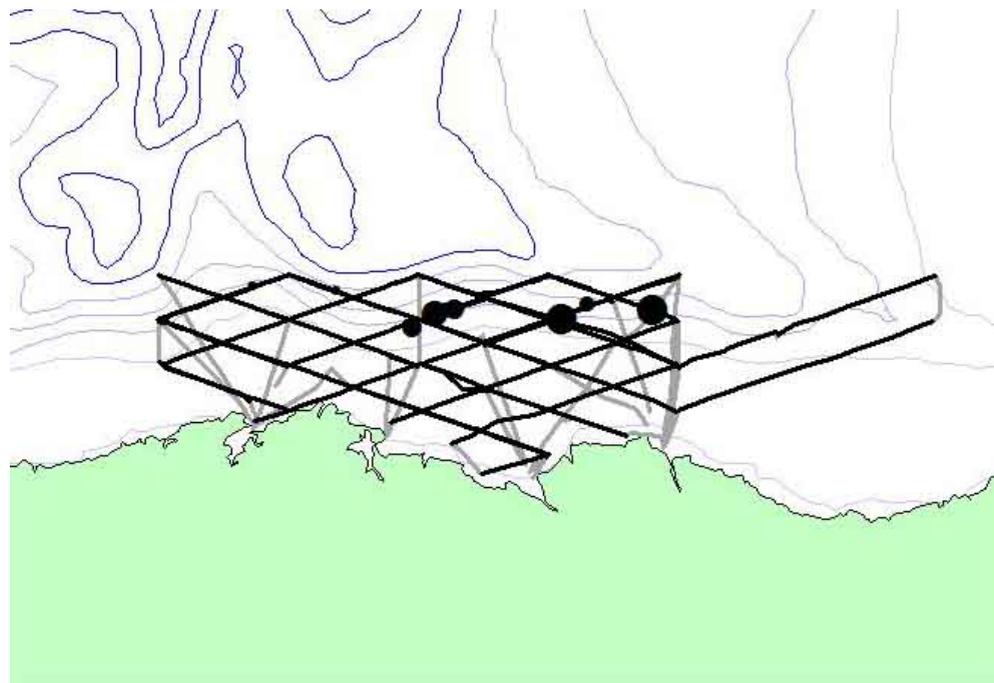


Fig. 6. Distribution of Long-finned Pilot Whale Sightings



Plate 5. Photo-ID Images of Long-finned Pilot Whales

Bottlenose dolphin There were nineteen sightings of bottlenose dolphin, totalling 312 individuals. Bottlenose dolphin encounters occurred throughout the survey area (Figure 7), with sightings both close to the coast up to 15 nautical miles away, at depths ranging from 100 to 1,500 metres. Group sizes varied between 3 and 60 individuals (mean 17.5, median 12). Three bottlenose dolphin encounters were in association with long-finned pilot whales.

Photo-identification was conducted at eight encounters, and sample images of marked individuals are illustrated in Plate 6. Several individuals were well-marked with nicks in the dorsal fin. All images will be incorporated in the local Photo-ID catalogue maintained by AMBAR

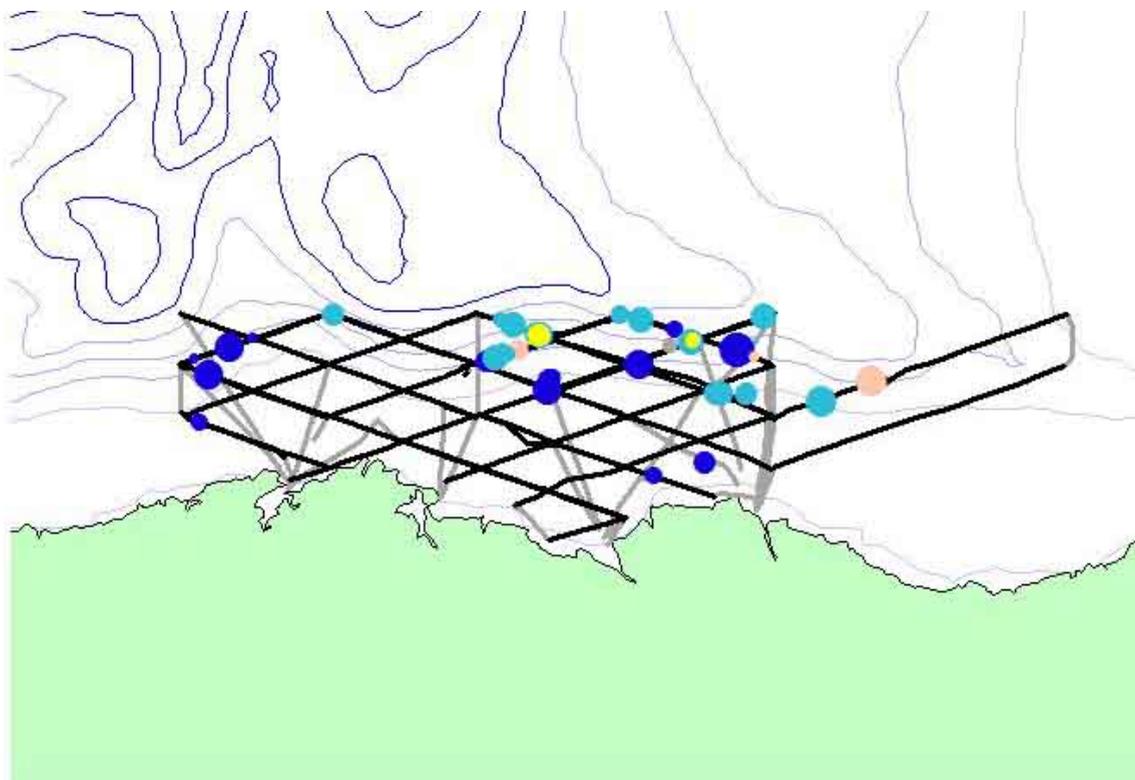


Fig. 7. Distribution of Dolphin Sightings



Plate 6. Photo-ID Images of Bottlenose Dolphins

Striped dolphin There were 23 sightings of striped dolphins, totalling 563 individuals. Sightings were distributed across a band of sea, 10-15 nautical miles from shore at depths ranging from 1,000 to 3,000 metres (Figure 6). Their distribution was very similar to that of long-finned pilot whale except that sightings extended both further west and further east. Group sizes varied between four and 70 individuals (mean = 24.5, median = 20.). In two encounters, short-beaked common dolphins were associated, whilst there were three sightings that were either striped or common dolphins but whose species identity could not be confirmed.

Short-beaked common dolphin There were just two confirmed sightings of common dolphins, comprising a total of 12 individuals. These occurred around the 1,000 metre contour, both associated with striped dolphins. Group sizes were 2 and 4 respectively.

Risso's dolphin One sighting of Risso's dolphin was made: a single individual was seen 15 nautical miles from the coast at a depth of 1,000 metres.

Large Fish One medium-sized shark, thought to be porbeagle shark (*Lamna nasus*), was seen north of Santander on 2 July; and there were three sightings of lone ocean sunfish (*Mola mola*) on 7, 8 and 18 July.

5. Discussion

The main purpose of the survey was to extend coverage of the area of southern Biscay surveyed in 2006, with particular attention to investigating the distribution of beaked whales. The depths over which beaked whale sightings were made was very similar to the 2006 survey, occurring primarily on the southern slopes of canyons at depths of 1,000-2,500 metres. There appeared to be a preference for areas with gentle contours. Since the maximum depth within the survey area was 3,000 metres, it is difficult to judge whether the species can be found at similar frequencies at greater depths. However, surveys from the Pride of Bilbao and Santander ferries indicate the species to occur throughout the southern basin to depths of 4,000 metres (Williams *et al.*, 1999; Cresswell & Walker, 2001, 2003; Walker *et al.*, 2004; D. Curtis, unpubl. data). Elsewhere in Europe, most sightings in the Northwest Mediterranean occurred over depths of 750-2,000 m [Moulins *et al.* 2007], but in Greece, the species occurred along the shelf slope in slightly shallower waters 650-1,000 m deep [Pulcini & Angradi 1994, Pulcini 1997]. In the most extensive analysis of habitat preferences to date, Moulins *et al.* (2007) found that Cuvier's beaked whale encounter rates were greatest on shallow slopes (gradient between 11 and 31 m/km), and between depths of 1,389 and 2,021 m, although 48% of animals counted were seen at depths of 756-1,389 m.

It is possible that Cuvier's beaked whales will occur over slopes at depths ranging between 500 and 4,000 metres, although dives to those depths have not yet been recorded. A D-Tag telemetry study in the Ligurian Sea indicated that dives can last up to 85 min and reach depths up to 1,990 m (Tyack *et al.*, 2006). They found the average foraging dive duration to be 58 min, and average depth to be 1,070 m. Echolocation was used in the deepest part of the dives, normally deeper than 500 m, and the duration of the vocal phase averaged 33 min (Johnson *et al.* 2004, Tyack *et al.* 2006). Foraging dives were usually interspaced by a series of shorter (mean of 15 min) and shallower (mean of 250 m depth) dives with no vocal activity. The function of these intermediate dives is still unknown but it has been suggested that it may relate with the processing of lactic acid produced during the long foraging dives (Tyack *et al.* 2006). The average duration of the surfacing intervals is just 2 min, although on rare occasions they may stay on the surface for long periods and before foraging dives usually surface for some 4-5 minutes (Evans *et al.*, 2008). Our brief observations of dive patterns from the present survey fit in with those more general findings. It is assumed that longer foraging dives were not recorded because of the difficulty to re-sight the animals in anything but the calmest of sea conditions.

From the above, we might expect the most favoured habitat for Cuvier's beaked whale to be gradual slopes of 500 to 2,000 m depths. Group sizes ranged from 2 to 5 (mean 3.0), and this corresponded with what has been observed elsewhere (range 1-12, occasionally up to 25 – see refs in Evans *et al.*, 2008). Mean group size in the NW Mediterranean was 2.3 (range 1-11), based upon 247 sightings (Moulins *et al.*, 2007).

The most abundant cetacean species by far was the striped dolphin, accounting for more than one half of the total number of individuals of all species observed, and one-third of all encounters. Next came the bottlenose dolphin, and some way below that, the long-finned pilot whale. All other species (including common dolphin) were uncommon, with less than ten encounters comprising less than 25 individuals in total. Ferry surveys have shown that common dolphins are more abundant in the northern part of the Bay than in the southern part, whereas striped dolphins become more abundant in the southern Bay (Brereton *et al.*, 1999; Cresswell & Walker, 2001, 2003).

During the July 2006 survey of Torrelavega Canyon, common dolphins were much more abundant than we found, and in greater frequency (even more abundant and more frequently encountered than the striped dolphin). In that year, the survey team found that numbers of common (and striped) dolphins

increased in the second half of July, and inferred that this was the result of a movement into the area of large shoals of fish (Swift & Vazquez, 2006). We had no such experience. However, our survey lasted one week less, with the last transect on 20 July. Second most common species in July 2006 was the striped dolphin, followed by bottlenose dolphin. Long-finned pilot whales were recorded less frequently and in lower numbers than during the 2007 survey, despite the higher coverage. On the other hand, Cuvier's beaked whales were recorded more frequently and in higher numbers in 2006 (mean 0.41 encounters/100 km and 1.23 indivs/100 km in 2007, compared with 0.71 encounters/100 km and 1.70 indivs/100 km in 2006). However, such comparisons, particularly for the less common species, should be viewed with caution given differences in survey timing, duration, coverage, and sea conditions.

6. Conclusions & Recommendations for Future Research

The findings of this short survey can obviously only be considered preliminary, but they largely correspond with findings from previous surveys of adjacent areas in the southern Bay of Biscay. Striped dolphin was the most abundant species followed by bottlenose dolphin and long-finned pilot whale, with more than 90% of sightings of all species occurring at depths of 500 metres or more. Information gained from encounters with Cuvier's beaked whales also followed our previous knowledge of that species, with sightings concentrated in a band of sea over gradual contours at depths ranging from 1,000 – 2,500 metres. Such contours occur within 15-20 nautical miles of the coast, and thus within daily reach of a research vessel like a yacht that can rarely attain speeds above 7 knots, without need to stay out overnight. This was one of the logistical difficulties encountered in 2006, west of the 2007 study area, where the shelf does not start to slope down to depths of 1,000 metres or more and until 25-30 nautical miles from the coast. From Santander eastwards as far as the Cap Breton Canyon, there exists suitable beaked whale habitat within easy reach of port. Bluefin of Hamble is an excellent platform in many ways, and provided comfortable accommodation. However, if future research were to focus upon beaked whales it would be better to use a medium-sized (12-15 m) sports fishing boat with fly bridge, which can readily cruise at 10-12 knots, and attain speeds of 20 knots, thus providing greater flexibility. This was a recommendation also made by Swift & Vazquez (2006).

A future survey would also benefit by having a towed hydrophone, as was possible in 2006. Not only has this the potential to provide better detection rates for inconspicuous species like beaked whales, but also it is largely independent of weather. Real-time acoustic surveillance also can alert observers to the presence of a species in the vicinity, which if one is trying to maximize encounter rates for tagging or photo-ID, has a clear benefit.

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