Cruise report for research projects conducted from R/V *Song of the Whale* in French and UK waters of the English Channel, 23rd May– 25th June 2011:

(1) Acoustic and visual survey to evaluate the presence and distribution of harbour porpoise in the English Channel

(2) Recordings of ship acoustic profiles and ISO methodology evaluation

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1. INTRODUCTION – BACKGROUND TO THE RESEARCH

Two pieces of research were undertaken by the MCR International team from R/V *Song of the Whale* during May and June 2011; the first was a visual and acoustic survey for harbour porpoises (*Phocoena phocoena*) of French and British waters of the English Channel. The second project was focused on making field recordings of the sound levels emitted by large ships. Both projects were conducted with funding from the International Fund for Animal Welfare. This report summarises the background, methods and initial findings for both of these projects.

Channel Harbour porpoise survey

There is considerable concern for the conservation status of harbour porpoises in the North Sea and adjacent waters. This concern has arisen from substantial incidental mortality in fishing operations (Carlström & Berggren, 1997; Lowry & Teilmann, 1995; Tregenza *et al.*, 1997; Vinther & Larsen, 2004), from variation in stranding records (Haelters & Camphuysen, 2008; Smeenk, 1987) and from encounter rates in coastal waters. Porpoises in European waters are protected by both national legislation and international agreements including the EU Habitats Directive and the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), and their status has been subject to much discussion and concern within the Scientific Committee of the International Whaling Commission (IWC). In some areas the total bycatch of harbour porpoises has been well above a level deemed acceptable (e.g. ASCOBANS, 1997). Indeed, a marked increase in the number of stranded porpoises showing lesions indicative of bycatch along the Dutch and Belgian coast has been noted in recent years with up to 60% of carcasses showing signs of entanglement (Haelters & Camphuysen, 2008; Leopold & Camphuysen, 2006; Smeenk *et al.*, 2004). Small numbers of porpoises are also bycaught in French waters (e.g. Morizur *et al.* 2010). Additional pressures on porpoise populations may be presented by anthropogenic noise, for example the construction noise associated with offshore renewable energy projects (Carstensen *et al.*, 2006; Nedwell & Howell, 2004; Tougaard *et al.*, 2003).

Following a serious decline in the presence of porpoises in European coastal waters in the first half of the 20th century, sightings and stranding reports increased from the 1990's. In the last few years, some observations and studies indicate a shift of harbour porpoise distribution in European waters, from northern regions of the North Sea to the southern North Sea, English Channel and Celtic Sea (Winship, 2009). This shift may include a return of harbour porpoise around the coasts of the Netherlands, Belgium and France (Camphuysen, 2004; Jung *et al.* 2009; Thomsen *et al.*, 2006). The European-wide SCANS surveys reported no harbour porpoise sightings in the English Channel in 1994, and just a few isolated sightings of harbour porpoises in the English Channel from aerial surveys in 2005 (Hammond & Macleod, 2006). Conversely, over the last decade opportunistic surveys conducted aboard passenger ferries travelling from the UK to France and across the Bay of Biscay have shown high concentrations of harbour porpoises, especially in the western part of the English Channel and Western Approaches (Kiszka *et al.*, 2007) and off the continental shelf edge in waters <200 metres. In addition, opportunistic research by Jung *et al.* (2009), showed a recent increase of sightings and strandings (between 1997 and 2007) of harbour porpoises in the English Channel and north of Brittany (Kiszka *et al.*, 2007). Sightings in the English

Channel are thought to occur all year around (Jung *et al.*, 2009), with a higher presence of harbour porpoises in the English Channel in summer months (Macleod *et al.*, 2009).

Marine Conservation Research International (MCR International), conducted a visual and acoustic survey to investigate the presence and distribution of harbour porpoises in the Channel during May and June 2011. There have been few dedicated research surveys for harbour porpoises in the English Channel, in part possibly due to high densities of shipping which present a major challenge to navigation and to following pre-determined transect lines. Distribution data for the region are based mostly on opportunistic sightings, bycatch and stranding records, and the SCANS aerial surveys. Thus, survey results from the project reported here will contribute to baseline data on the summer distribution of porpoises in the English Channel, provide novel data to update the SCANS-II survey in 2005, and will supplement on-going research and conservation work in the region (for example, data will be contributed to the JNCC Joint Cetacean Protocol project to investigate the status of cetaceans within the ASCOBANS area). Additionally, as efforts are currently underway to derive abundance estimates from joint visual-acoustic surveys, a further aim was to derive abundance estimates from the survey data using distance-sampling techniques.

Thus, the primary aims of survey work in the English Channel were to:
1. Detect harbour porpoises both visually and acoustically.
2. Investigate the summer presence and distribution of porpoises.
3. Collect dual-platform sightings data in areas of high density to estimate g(0).
4. Derive estimates of relative abundance.

To maximise efficiency through the project, secondary aims included:
1. Taking photographs of porpoise encounters from the A-frame using calibrated lens's enabling accurate range measurements to be made to correct distance estimates.
2. Recording sighting information and acoustic recordings for all species of marine mammal in the study areas.
3. Recording the distribution of odontocetes using acoustic detectors.
4. Collection of information on distribution of seabirds, turtles, sharks and sunfish.
5. Continuous logging of Automatic Identification System (AIS) information reporting on the presence distribution and identity of ships
6. Collecting photo-id images of priority species (for partner organisations such as Association GECC and MarineLife) including bottlenose dolphins, if time allowed.

Ship noise measurements

Following the harbour porpoise survey, the MCR International team carried out research and field work on the development of a low-cost portable recording methodology to establish the noise signature of individual ships. The new EU Marine Strategy Framework Directive has identified shipping noise as one of the pressures that need to be controlled to achieve the good environmental status of European waters. The European Commission and the Member States are developing criteria and methodological standards for defining good environmental status in relation to several descriptors including underwater noise. One of the criteria under development requires Member States to monitor shipping noise levels and ensure that they will not increase. The ship noise measurements collected will also input into the work of the International Maritime Organisation (IMO) and contribute to current international efforts to reduce the impact of ship noise on marine life. In 2010, the Marine Environmental Protection Committee (MEPC) of the IMO invited the International Standards Organisation (ISO) to develop a standard for the measurement and reporting of underwater sound radiated from merchant ships. The ISO methodology (ISO/TC8/SC2) was designed anticipating measurements would most likely be made during sea trials after construction. The study described here is however, aimed at testing low-cost portable field systems for recording and measuring the sound of ships in the field. Such measurements will also assist governments in complying with their international commitments under the IMO and EU regimes and in identifying the ships which would benefit most from ship quieting technology.

There is a paucity of data on the variability of ship noise under real operating conditions and it is largely unclear how factors such as loading, speed and vessel type combine. The literature gives spectra for individual ships but there is little information on the variance between vessels.

The aims of the project focused on recording ship noise off France and the Channel Islands included:

1. Making repeated calibrated recordings of the same vessels (i.e. ferries).
2. Making recordings of single vessels ideally within 100m.
3. Making recordings in areas with high densities of vessels.

2. METHODOLOGY

Acoustic and visual survey for harbour porpoises

The survey was conducted in the English Channel between 23rd May and 25th June 2011 on *R/V Song of the Whale,* a 21 metre auxiliary-powered cutter-rigged sailing research vessel, owned by the International Fund for Animal Welfare and operated by Marine Conservation Research Ltd. (MCR Ltd).

The English Channel survey area was treated as two survey blocks to correspond with International Council for the Exploration of the Sea (ICES) fishery subdivisions (essentially bisecting the Channel into eastern and western blocks). Using the programme *Distance 6.0* (Thomas *et al*., 2010), randomly generated tracklines were planned to provide equal coverage probability within each block (see Figure 1). The tracklines crossed perpendicular to the Channel's shipping lanes (coordination with the relevant UK and French Vessel Transport Scheme coordinators was established). While on survey effort a single hydrophone array was towed approximately 100 metres behind the research vessel. Acoustic surveys took place for 24 hrs/day in sea conditions up to Beaufort 6.

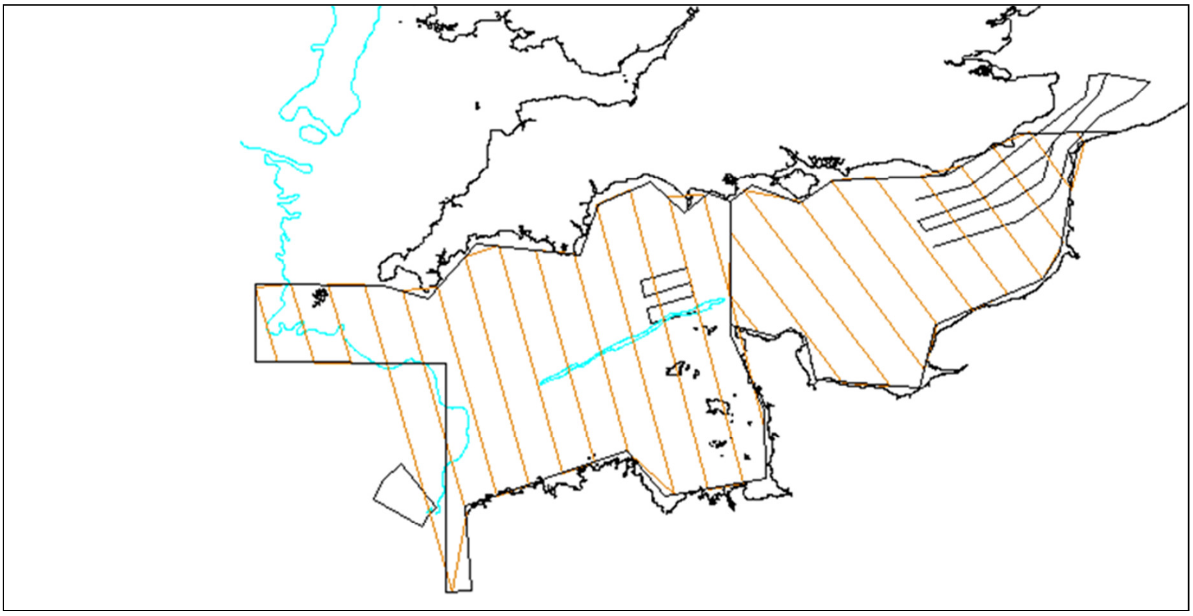

Figure 1: The English Channel was divided into two blocks displayed as black outlines boxes; an eastern and a western block. The randomly distributed survey tracks are displayed in orange and the parallel black lines outline the Dover, Casquette and Ushant Traffic Separation Schemes (from Right to Left). The turquoise lines represent the 100 metre depth contour.

Observer effort followed distance sampling protocols. In daylight hours and in sea states below four, two visual observers with binoculars were positioned on a platform 5.5 metres above sea level to record any cetacean sightings; observers were not prompted by acoustic cues and/or deck observers. In higher sea states, observers kept a lookout from deck. Sightings were logged to a database via the Logger software (IFAW). Environmental and GPS data were logged automatically to the same database, including date, vessel position (lat-long), sea surface temperature (°C) and wind speed (knots). Manual updates of other environmental variables (such as sea state, wave and swell height) and survey effort (numbers of observers at which positions) were made hourly to the database.

Visual observers scanned out to 90 degrees either side of the trackline, and from close to the boat out to the horizon with binoculars. Accurate distance and angles to sightings were recorded using reticule / compass binoculars fixed to an adapted monopod, with a camera to record a second measurement of the sighting angle relative to the ships heading. Whenever possible, a third observer took images from the A-frame of porpoise encounters to calculate range independently.

Figure 2: For every sighting from the observation platform a photograph was taken of the lines on the floor while the binoculars were pointing towards the sighting. Therefore an accurate calculation of the bearing to the sighting could be made from the angle of the lines on the A-frame in the photograph.

Seabirds were also logged through visual scans every 15 minutes to provide a snap shot of local distribution.

Acoustic surveys were conducted using a 100 metre towed two-element broadband hydrophone array (SEICHE Ltd.). Continuous stereo 500 kHz recordings were made via a SEICHE buffer box passing signals to a National Instruments USB-6251 sound card. The buffers were configured to give a variable frequency response and the response of the system was 2 to 200 kHz (10 dB). However, in the bandwidth of interest for harbour porpoise clicks (approximately 115 to 180 kHz; (Villadsgaard *et al*., 2006), the response of the system was approximately flat. Recordings were made using PAMGUARD (Passive Acoustic Monitoring Guardianship) and written to hard drive as two-channel 16 bit wav files. As typical harbour porpoise clicks are distinctive high frequency, narrowband signals with a long duration (100 µs), a peak frequency of around 130 kHz, an inter-click interval of around 60 ms and a maximum source level of 172 dB re 1µPa pp @ 1 m (Møhl and Andersen, 1973; Akamatsu *et al*., 1994; Teilmann *et al*., 2002), it is possible to detect and extract potential harbour porpoise clicks from background noise using click detection algorithms. Thus, acoustic signals were monitored in real-time using a PAMGUARD click detector whereby sounds with significant energy (> 8 dB above background noise) in the 100 to 150 kHz band were classified as potential harbour porpoise clicks.

A more thorough investigation of potential clicks will be conducted post-process on the recorded audio files. During post-processing, clicks will be classified as harbour porpoise clicks if they have significant energy in the 100 to 150 kHz energy band, have a waveform resembling that of published data for harbour porpoises, have a relatively flat structure revealed in a Wigner plot and form part of a click train, i.e. seven or more clicks on a similar bearing with regular inter-click intervals.

Ship noise measurements

The R/V *Song of the Whale* was based off the Channel Island of Alderney for one week in June, in order to take measurements of ship noise near the Casquettes traffic separation scheme. In addition, due to poor weather conditions during the main period of field work in the Channel, some further ship noise recordings were made in the Minch, Scotland, 16th to the 21st August, to collect additional data.

The aim of this project was to assess the ISO methodologies under "normal" operating conditions and later in a ship's life, with a comparison of noise output from different classes of vessel. The SOTW research team collected ship noise profiles from vessels which varied in size, speed, age and cargo weight and under a variety of weather conditions.

The main ship noise measurements were made using a calibrated omni-directional RESON TC4032 hydrophone deployed from R/V *Song of the Whale* with a frequency response of ±2.5dB between 10Hz and 80kHz. Recordings were made with a sound recording device (*PAMGUARD*) sampling at 96 kHz with 16 bit resolution. A second hydrophone and recorder was suspended from a free-floating autonomous buoy to support the measurements, allowing closer passes and a distance comparison with the recordings made from SOTW (this buoy was not used during the August recordings). This buoy recorded the data at 96 kHz and 16 bit resolution to M-Audio recorders attached to the buoy and had its own radar reflector and AIS transponder. Passing vessels were also alerted to the buoys presence via regular VHF radio securité broadcasts.

R/V *Song of the Whale* was hove-to during recordings (engine off) with the depth sounder and all other unused electrical equipment turned off. Thirty metres of hydrophone cable were deployed vertically from the aft davits using a weight system and inclinometer, aiming for a deviation from vertical of less than 5° (ideally at or below the level of the draught of the target ship and below 20m). GPS locations of both hydrophones were taken from the R/V's main GPS and from the AIS beacons on the data buoy. Communications were established between the measurement vessel (SOTW) and the target ship throughout the recording period, primarily to ask them to pass as close as safely possible but also to collect information regarding the target vessel's operational state.

Before any measurements took place, the recording system and both hydrophones were calibrated (the main hydrophone was calibrated using a G.R.A.S. 42AP piston-phone, the second hydrophone was calibrated using comparative techniques). Additionally background noise measurements were recorded (for at least 2 minutes) before and after each measurement, if possible, when the target vessel was >5nm away from the recording elements. AIS details of all vessels in the area were continuously recorded. Gain and filter settings used during the recording were noted before and after the recording and were not changed during the recording. High pass filters were positioned at their lowest settings.

Before starting the measurements AIS information was collected for the target vessel and logged in the *Logger* forms, including: MMSI number, speed over ground, heading over ground, direction of longitudinal axis and length and breadth of the vessel, this information was supplemented by post survey information from the IMO vessel list, to include the Shipyard, year constructed, IMO number, classification, main engine type and power, number of shafts, number of propeller blades and tonnage. Where possible, additional information was collected during communications with the Bridge of the target vessel including: normal sea-going speed, RPM's at this speed, RPM's at the present speed, load of cargo, conditions of ballast and draught (fore and aft) during measurements.

Additionally, environmental information was collected including: depth of the water, water temperature, water salinity, wave and wind direction and speed and rain conditions. These were supplemented post measurement by information about the current speed and direction, sediment type and distance from shore.

While the measurements were taking place it was essential to note the distance between the target vessel and the buoyed hydrophone / SOTW hydrophone accurately. For an accurate sound profile measurement it was planned that one of the hydrophones would be within 100 m of the target vessel or the length of the target vessel (whichever is longest). Ideally the target vessel remained on a straight path throughout the measurements and the measurements were taken perpendicular to the vessel. Recordings were continuous throughout the procedure to be truncated to just four lengths of the target vessel post survey. Ideally the measurements would take place twice on the starboard and twice on the port side of the target vessel, but this was not possible in field conditions where the objective is to make the noise measurements without any significant disruption to the normal operations of the target vessel. Just one measurement of each vessel was obtained.

Post survey analysis will calculate accurate estimates of the various target vessels noise signatures through background noise adjustment and distance normalisation. The analysis will be conducted using narrow band (1Hz) analysis in the frequencies between 20 Hz and 2 kHz and third octave band analysis up to 20 kHz.

3. RESULTS

Channel Porpoise survey

The total log for the harbour porpoise research cruise was 4243 km of which 2749 km was 'on track' with at least acoustic effort (Figure 3). Of the 397 hours of total cruise time, almost 37% (147 hours) included visual effort; visual effort increased to 44% (100 hours) of the 228 hours spent on the survey track (Table 1).

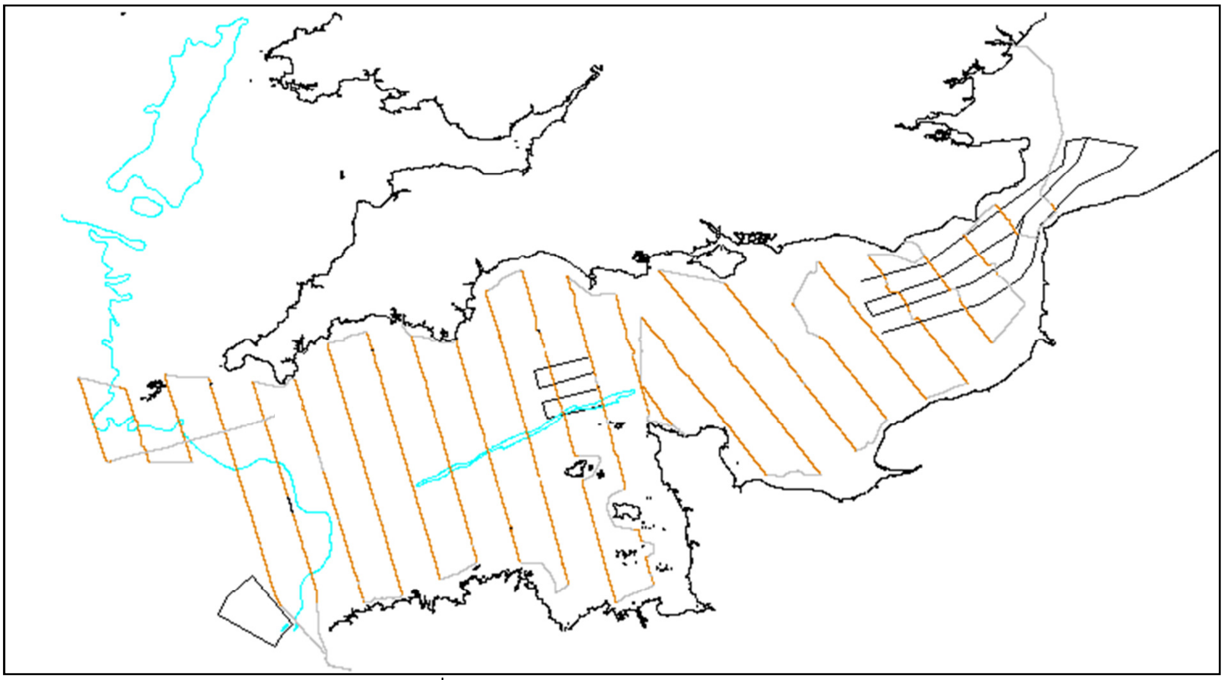

Figure 3: Survey effort from 23rd May to 15th June 2011. The cruise log was 4243 km of which 2749 km was on track with acoustic effort. The orange line shows effort on-track and the grey effort off-track.

Table 1. Summary of research effort during the harbour porpoise survey and ship noise measurements.

	Nautical Miles	**Km**	**Time (hhh:mm)**
Total Track	2291	42243	369:10
Passage	209	387	40:45
Passage + acoustic	269	499	44:44
Passage + visual	49	92	7:30
Passage + acoustic + Visual	241	446	38.22
Track + acoustic	828	1523	126:56
Track + visual	8	14	1:07
Track + acoustic + visual	656	1214	98:56
Other	11	21	3:11
SHIP NOISE			
Passage	199	369	46:04

A total of three species of cetacean were identified visually in 16 separate encounters both on and off the survey trackline (Figure 4); common dolphins (*n* = 1 sighting), white-beaked dolphins (*n* = 1), harbour porpoise (*n* = 13) and unidentified dolphin (n=1).

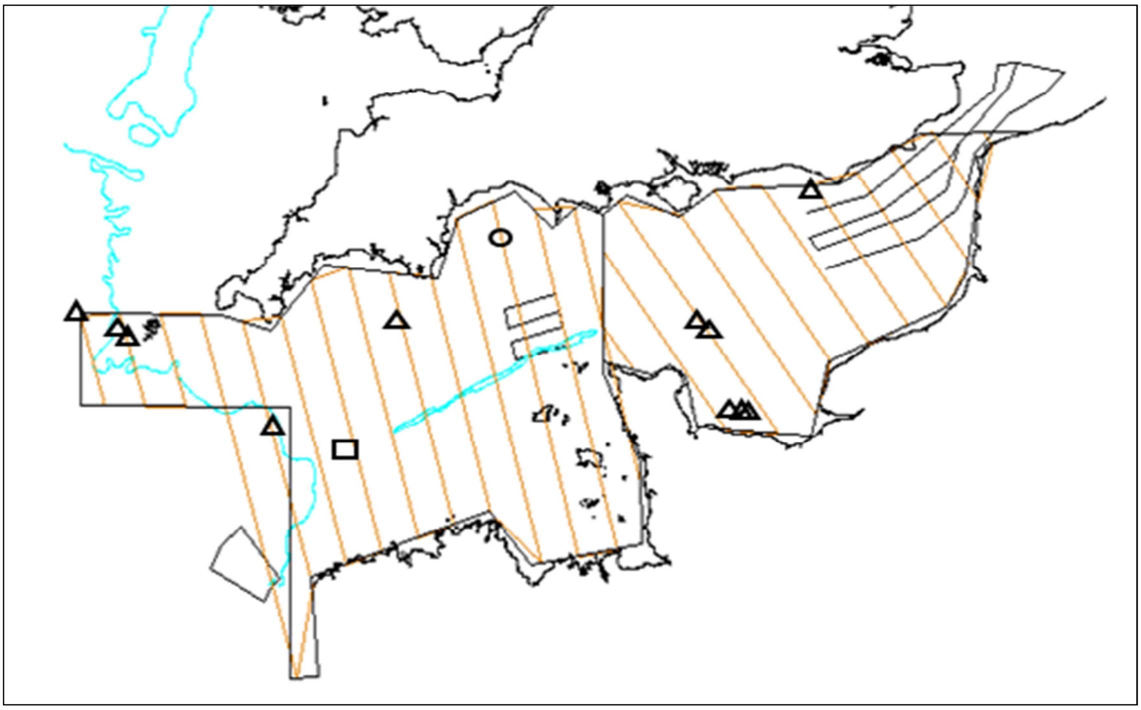

Figure 4: All 16 visual encounters with cetaceans during the survey; harbour porpoise= triangle, white beaked dolphin= circle and common dolphin= square.

The number of individuals in each encounter was variable, but typically the harbour porpoises were in small groups of one to two individuals whilst the dolphins were typically in groups of 5 or more.

Additionally, there was one sighting of an unidentified turtle in the centre of the Channel, close to the Casquettes Traffic Separation scheme. The animal was small and not a leatherback turtle and may have been a loggerhead. A sighting of an unidentified shark species also occurred close to the Isles of Scilly, western Channel. The shark was not a basking shark, which are common around the south west of England during summer months, but thought to possibly be a blue shark due to its pointed dorsal fin and size.

In addition to continuous recording, the signal from the hydrophone array was monitored every 15 minutes (approximately 1.45 nautical miles at the average survey speed of 5.8 knots) for animal and ship noise. The number of animals heard during the monitoring sessions was limited to just a few odontocete clicks, although more are expected to be found during analysis of acoustic data. Ship noise was a very obvious factor during the listening periods; however the louder ship noise was limited to shipping lanes and approaches to and from the shipping lanes.

Ship acoustic profile measurements

Three days of measurements were made close to the Casquettes Traffic Separation Scheme allowing measurement of 19 vessels; however as many vessels were grouped together it was not always possible for individual ship noise signatures to be recorded. As such, only 16 of the recordings could be considered of good enough quality with measured sound levels being more than 3 dB above background noise levels (Table 2). Post-analysis is presently taking place to calculate ship noise signatures for these vessels.

Table 2: Summary of vessels recorded from *Song of the Whale* near the Casquets TSS in June 2011. Underwater sound levels L_{pdn} of the target ships are presented as RMS averages of one-third octave bands from 20 to 20,000 Hz with distance normalization referenced to 1m. Those recordings with background noise considered to be disproportionately high (within 3 dB of the target ship's sound level) are marked with an asterisk (*). Measurements from the August data collection are still being analysed.

Ship	Class	RMS of L_{pdn} dB re 1μPa @1m ($^1/_3$ octave 20-20000 Hz)	Speed over Ground (kn)	Draft aft (m)	Draft fore (m)	Tonnage (gross)	Tonnage (dry weight)	Length (m)	Beam (m)
Libelle	Tanker	167.9	16	7.1	7.4	8067	13050	146	20
Linda Dream	Cargo	165.4	13	15.1	15.1	90092	180180	282	45
Tern	Cargo	163.0	14	9.7	9.0	27986	50209	190	32
Good Hope Max	Cargo	161.6	15	13.7	13.7	40039	76739	225	32
Burgtor	Cargo	160.8	12	4.6	4.6	2351	3414	87	13
Aral*	Tanker	157.8	13	8.2	8.2	5285	8915	115	16
Cape Talara	Tanker	157.6	15	8.0	6.2	42010	73371	228	32
MSC Nora	Cargo	156.5	18	10.7	9.7	39892	43567	244	32
Summer*	Tanker	156.5	16	8.2	8.2	8539	13023	128	20
Condock 5	Cargo	156.2	14	3.6	3.6	6763	4762	107	19
Northern Light	Tanker	155.6	14	8.7	6.7	30053	50930	183	32
Egbert Wagenborg	Cargo	154.7	14	7.3	7.3	6549	9150	135	16
Nairobi	Cargo	154.1	21	8.0	4.8	28892	41624	202	30
Drait	Cargo	151.5	12	5.2	5.2	2218	3650	89	12
Clipper Mari	Tanker	149.0	12	7.8	8.3	11792	19355	147	24
Catalina	Cargo	148.1	15	4.4	3.3	5581	7578	108	18
Burhou I	Cargo	146.3	10	3.7	3.1	674	953	58	10
Gluecksberg*	Cargo	144.7	20	9.2	8.3	18485	23711	176	28

4. DISCUSSION

Throughout the Channel survey there were 13 sightings of harbour porpoises and one re-sighting, totalling 16 animals. Although there were three groups of porpoises within the sightings, two in the west of the eastern block and one in the far west of the western block close to the Isles of Scilly, this clustering is not thought to be representative of distribution due to the poor weather conditions throughout the survey, limiting sightings in other areas. All sightings of harbour porpoises occurred in good weather conditions under sea state 3.5 with the majority (n=11) occurring in conditions under sea state 2. Palka (2006) suggests that detection probability of harbour porpoises decreases by 50% between Beaufort 0 and Beaufort 3 and continues to decrease substantially as sea state degrades. With limited periods of calm sea state during our survey, the small number of harbour porpoise sightings was expected. Post survey analysis of the acoustic recordings for harbour porpoises will likely reveal more detections. As harbour porpoises vocalise almost constantly (Villadsgaard *et al.*, 2006) to detect prey, navigate and communicate, it is assumed that any animals passing within 250 metres of our vessel should be detected regardless of the environmental conditions.

MCR have been collaborating with other organisations (e.g. Association GECC, Marine Life and ORCA) which work in the Channel in order to supplement and compare previous harbour porpoise sightings with the data collected during this survey. Figure 5 shows harbour porpoise sightings recorded from *R/V Song of the Whale* (marked as blue dots); these were reported from areas of the Channel which were rarely covered from the other opportunistic surveys (such as from ferry routes etc.). Therefore these sightings demonstrate the importance of a dedicated survey such as this to provide data on the status of the harbour porpoise across the entire region.

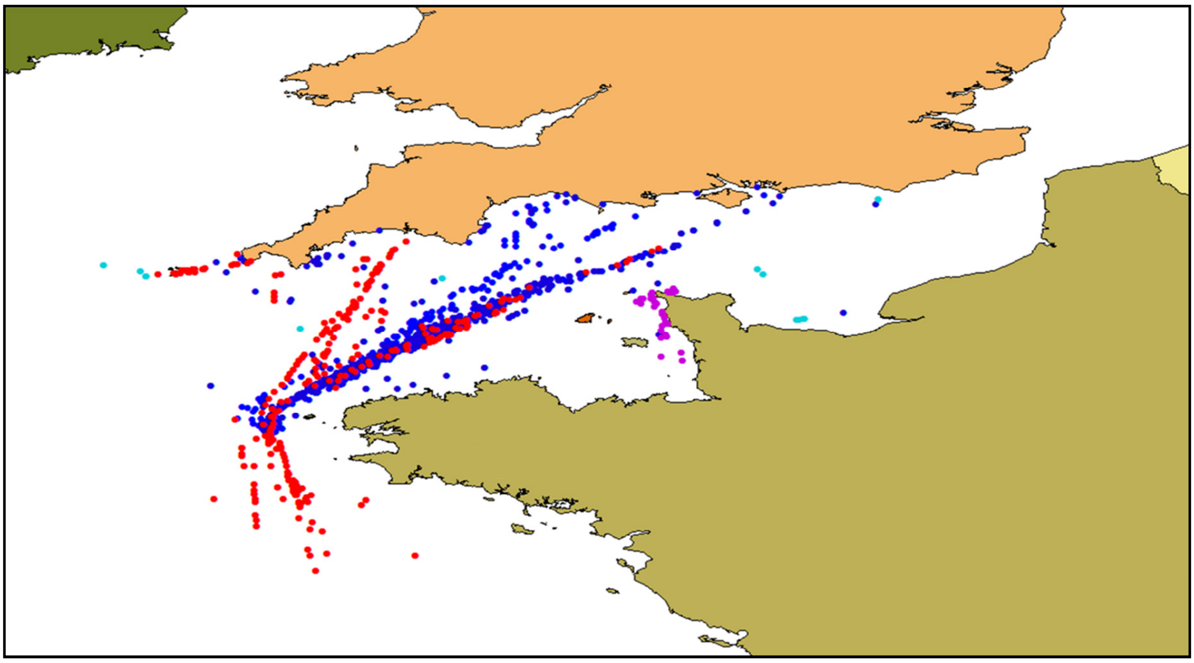

Figure 5: Sightings of harbour porpoise in the Channel from data contributed by ORCA (1998-2010 - marked in red), Association GECC (2008-2011 - marked in purple), MarineLife (2003-2010 - marked in dark blue) and MCR's recent harbour porpoise survey (May – June 2011 marked in light blue).

One sighting of white-beaked dolphins, *Lagenorhynchus albirostris,* occurred within Lyme Bay, Dorset, of five animals which bow-rode the *R/V Song of the Whale*. White-beaked dolphins are common in cooler, deeper (>50m) often more northerly British waters (MacLeod *et al.*, 2008) however, opportunistic sightings of white-beaked dolphins are frequent in Lyme Bay, southern England, year around (Brereton *et al*., 2010). It is thought that Lyme Bay is the most southerly known site that White-beaked dolphins regularly occur and may be one of the most important sites in the English Channel for White-beaked dolphins (Brereton *et al*., 2010), possibly due to the predominantly deep, stratified waters, sandy sediment (Edwards, 2010), high numbers of whiting and reduced fishing fleets (Brereton *et al*., 2010). Pre- and post- sighting, the dolphins were acoustically detected with recordings made of click trains and buzzes (Figure 6). White-beaked dolphins make a variety of whistles up to a frequency of 35 kHz, and clicks with a peak frequency at 115 kHz (Rasmussen and Miller, 2002).

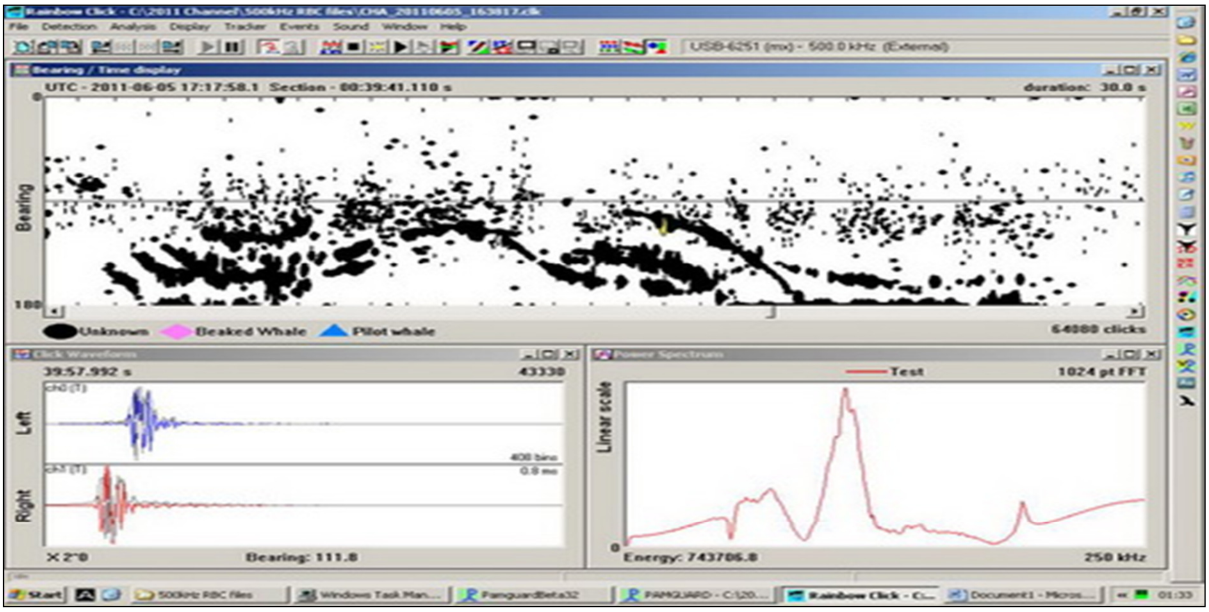

Figure 6: The output from Rainbow Click software displaying some of the clicks recorded from the white-beaked dolphin encounter.

Later in the survey, on the 10th June a single sighting of a group of Common dolphins, *Delphinus delphis*, occurred in the centre of the western Channel. Between 5 and 10 animals were observed bow riding the survey vessel. The limited number of sightings of Common dolphins throughout our survey may be due to summer – winter fluctuations in occupancy between shelf and deeper waters of the Bay of Biscay. Macleod *et al.* (2009) found trends from ferry based data collection indicating increased occupancy of common dolphins in the winter months within the English Channel and low occupancy in summer months, although it should be noted that the ferry routes covered very little of the eastern English Channel survey block. There was no acoustic detection of these animals from initial analysis, which is not unexpected as common dolphins are not thought to continuously vocalise.

Five species of marine turtle have been recorded in UK and Irish waters (Pierpoint, 2000); however, only one species, the leatherback turtle, *Dermochelys coriacea*, is reported annually and is considered a regular member of British marine fauna. The loggerhead turtle, *Caretta caretta*, and Kemp's Ridley turtle, *Lepidochelys kempii*, occur less frequently, mostly in winter and spring (Pierpoint and Penrose, 1999) and are thought to be carried north from their usual habitats by adverse currents (Mallinson, 1991; Pierpoint, 2000). Most loggerhead and Kemp's Ridley turtles seen in British waters are juvenile having been washed ashore on the south and south-west coasts following stormy periods. Stormy weather preceded the sighting of a small, unidentified turtle from SOTW.

Further refinement of detection algorithms may allow species identification of cetaceans from acoustic recordings, thus allowing future surveys (and retrospective analysis) to ascertain odontocete habitat partitioning. Additional surveys of the English Channel would be extremely beneficial to the understanding of cetacean distribution in the area as a whole, as no previous dedicated boat based survey has been carried out across the area. Analysis of acoustic data is now underway and further results will be available in due course.

Survey results from the project will contribute to baseline data on the summer distribution of porpoises in the English Channel and will provide novel data to update the SCANS-II survey in 2005 and to supplement on-going research work in the region. Additionally, data collected in the western English Channel will be fed into the Channel Integrated Approach for Marine Resource Management (CHARM III) project to help establish a database of cetacean distribution throughout this area. All sightings and effort data will also be contributed to the JNCC coordinated Joint Cetacean Protocol (JCP) project.

Although detailed analysis of ship noise data is on-going, trialling the ISO methodology for ship noise profile data collection in the field identified several aspects of the standard that could be improved:

1) Using the methodology outlined within the ISO document, it was rarely possible in real-field conditions to get the inclinometer consistently below 5° error due to wind pushing the vessel / buoy. Wind forced movement of the vessel was not corrected by increased weight as this resulted in increased drag, exacerbating the angle. In future, if the methodology were to remain the same it may be wise to try using a depressor weight designed to reduce drag. However, it is suggested instead of a minimum angle for the hydrophone being stated in the ISO methodology, a minimum depth for the hydrophone is stipulated, as this would be easier to keep to and is ultimately what the inclinometer data is used for.
2) Background noise measurements in the ISO methodology call for the target vessel to be more than 5 nm away and noise to be less than 3 dB. Two problems were experienced with this; measurements made at >5 nm from a target vessel still detected the signature noise from the target vessel and therefore cannot be considered accurate measurements of background noise. Secondly, due to the study area being extremely busy with shipping, the background noise level was rarely less than 3 dB.
3) The ISO methodology asks for repeated measurements of each vessel at least twice on each side, port and starboard, of the target vessel. In field conditions, where the measurements are very much opportunistic, it is unlikely that the same vessel will ever be measured in the same location on each side twice. One measurement of the vessel following the ISO methodology could be considered sufficient.

These limitations of the methodology will be illustrated with data and presented along with the ship noise profiles at a later date.

Further analysis of the acoustic recordings for both harbour porpoises and ship noise is presently underway and will be reported at a later date.

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