

Inshore boat-based surveys for cetaceans: Addendum



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Cover image: North Mayo coastline in sea-state 1, photographed during the northwest inshore survey © DAHG

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Summary

A single platform line transect survey using distance sampling was carried out off the northwest coast on 13 July 2011. This was a repeat survey of that carried out in 2010 by Ryan *et al.* (2010) as conditions in 2010 were not suitable for surveying throughout the survey period. Sea conditions were very good during the present survey with 48% of survey effort carried out in sea-state 2 and 40.4% in ≤ 1 .

A total of eight marine mammal sightings were recorded, comprising 13 individuals of five species. These included two harbour porpoise sightings, one sighting of a group of Risso's dolphins, a single minke whale, and both common and grey seals. Sightings of cetaceans and seals were generally made towards the centre of the survey block offshore between Downpatrick and Benwee headlands, with seal sightings slightly more spread out.

Cetacean relative abundance was low, despite excellent survey conditions. Given the small number of sightings the species diversity was relatively high. The sighting of a group of Risso's dolphins was noteworthy but was anticipated as although their distribution is patchy in Ireland, regular sightings occur off the northwest coast and in Broadhaven Bay during the summer, 30km to the south of the survey area.

Harbour porpoise occurrence recorded off the northwest coast during the survey was very similar to that recorded during a similar survey in 2010 despite less favourable sea conditions during the former survey. Passive Acoustic Monitoring (PAM) was also carried out during the survey using a towed hydrophone array. A total of 198km was surveyed with only a single acoustic detection of a group of Risso's dolphins. This acoustic detection was simultaneous to the visual sighting and therefore on this occasion PAM added no additional detections to the overall survey.

These surveys are aimed at filling gaps in coverage to obtain a better understanding of the distribution and abundance of cetaceans in Irish waters. They can also provide good baselines for monitoring purposes and may enable the identification of areas with a higher relative abundance of cetaceans and potentially important habitats for these species.

Introduction

Waters within the Irish Exclusive Economic Zone (EEZ) are known to be some of the most important in Europe for cetaceans (Berrow *et al.* 2001). While there has been a steady increase in cetacean research in Ireland, dedicated surveys to estimate the abundance of cetaceans in a defined area are limited to date and are presently insufficient to detect population trends (O'Brien *et al.* 2009a).

Since 1994 there has been a concerted effort to map the distribution and relative abundance of all cetacean species occurring within the Irish EEZ largely using platforms of opportunity. These surveys including initiatives such as European Seabirds at Sea (ESAS) research, ISCOPE and PReCAST have attempted to include seasonal coverage, especially of offshore waters (Pollock *et al.* 1997; Ó Cadhla *et al.* 2004; Wall *et al.* 2006; 2011; Berrow *et al.* 2006; 2010).

The first dedicated double-platform cetacean survey in Ireland was SCANS-I (Small Cetacean Abundance in the North Sea) carried out during summer of 1994, but it only covered the Celtic Shelf region of the Irish EEZ (Hammond *et al.* 2002). During 2000, the SIAR survey covered both inshore and offshore waters of the western seaboard using a double-platform visual survey technique from which the abundance of common and white-sided dolphins was estimated (Ó Cadhla *et al.* 2004). In summer 2005, a second SCANS survey (SCANS-II, 2008) was carried out which this time included all Irish continental shelf waters and the Irish Sea. Abundance estimates for a variety of species including harbour porpoise, common, bottlenose and white-beaked dolphin and minke whale were derived (SCANS-II, 2008). In 2007, a survey of species in European Atlantic waters beyond the continental shelf (CODA) was carried out offshore and provided abundance estimates for common, striped and bottlenose dolphins and long-finned pilot, sperm, minke, fin whales and beaked whales (Hammond *et al.* 2010).

Small scale dedicated surveys were carried out at eight survey locations since 2007 in coastal waters and bays using a single-platform line transect technique to estimate the abundance of harbour porpoises (Berrow *et al.*, 2008a; 2008b; 2009; Ryan *et al.* 2010). Land-based surveys through ISCOPE attempted to record and monitor cetacean's inshore (Berrow *et al.* 2010). However, there are still many gaps in coverage (see Wall, 2010).

The Irish Whale and Dolphin Group (IWDG) and the Galway-Mayo Institute of Technology (GMIT) were contracted to carry out a concurrent visual and passive acoustic survey off the northwest coast. This was a repeat survey of that carried out in 2010 but in more favourable sea conditions as conditions in 2010 were at sea-state <3 for only one-third of survey time which was not favourable for cetacean surveys and outside that contracted by the National Parks and Wildlife Service..

Objectives

As in 2010 the objectives of the present survey were to:

- (a) Determine the occurrence of cetacean species and other marine species of interest;
- (b) Determine species relative abundance (no. of sightings/individuals per unit effort);
- (c) Determine cetacean species abundance, where possible (i.e. population/density estimation).

Methods

Survey blocks

The inshore survey block off the northwest coast is shown in Figure 1. The block was 336 nm² (1152 km²) in surface area with a perimeter of 48nm by 7nm and was located between 6nm and 12nm from shore off the north coast of Counties Mayo and Sligo.

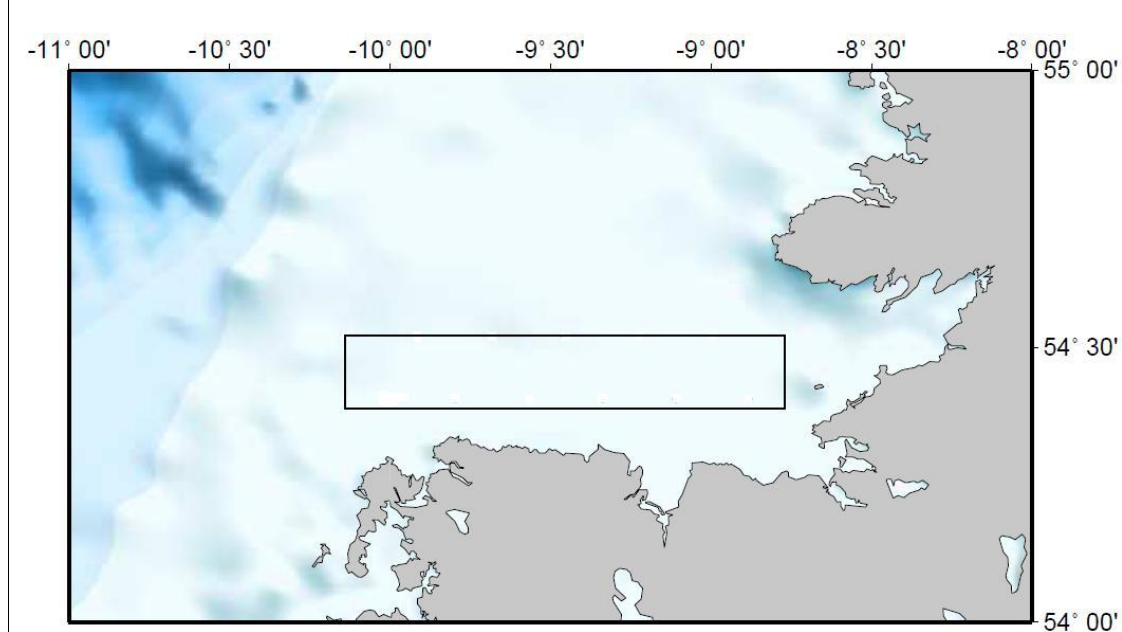


Figure 1. Map of Ireland showing the location of the northwest survey block.

Survey platform

The vessel *MV Smoothhound* was chartered for the survey. *MV Smoothhound* is a 11m Vigilante with flying bridge and capable of speeds up to 25kts. It was chartered by IWDG in 2008 (Berrow *et al.* 2008) and 2010 (Ryan *et al.* 2010) and provided a good platform height above sea level (i.e., 3m) and the capability of transiting fast to the start of the survey area.



Fig. 1 *MV Smoothhound*.
Note: flying bridge on
wheelhouse

Survey methodology

A conventional single platform line-transect survey was carried out along pre-determined track lines supplied by the NPWS. The same track lines as used by Ryan *et al.* (2010) were surveyed.

During survey effort, the vessel travelled at a speed of 12-16 km hr⁻¹ (8-10 knots), which was 2-3 times the average speed of the species most likely to be encountered (e.g., common dolphin, minke whale, bottlenose dolphin, harbour porpoise) as recommended by Dawson *et al.* (2008). Two primary observers were positioned on the flying bridge. Primary observers were experienced in cetacean visual surveys and species identification in Irish waters. Observers watched with naked eye from dead ahead to 90° to port or starboard depending on which side of the vessel they were stationed. Opticron 10x50 marine binoculars with reticle eyepieces were used to confirm species identification and assist in distance estimation. In addition, sightings of seals and any other marine megafauna (e.g., basking shark, sunfish) were also recorded.

During the transect the position of the survey vessel was tracked continuously through a GPS receiver fed directly into a laptop while survey effort, including environmental conditions (sea-state, wind strength and direction, glare etc.) were recorded directly onto LOGGER software (©IFAW) every 15 minutes.

When a sighting was made the position of the vessel was recorded immediately and the angle of the sighting from the track of the vessel and the radial distance of the sighting from the vessel were recorded. These data were communicated to the recorder in the wheelhouse via two-way radio. The angle was recorded to the nearest degree via an angle board attached to the vessel immediately in front of each observer. Accurate distance estimation is essential for distance sampling. Distance sticks were made for observers using the Heinemann Equation (Insert reference) which were used to aid distance estimation.

Relative abundance

Sightings rate was calculated as the number of sightings per km travelled or hour of survey effort, while relative abundance was calculated as the number of animals recorded per km of transect or per hour of coverage. Both measures were restricted to observations made in sea state ≤3.

Passive Acoustic Monitoring

Passive Acoustic Monitoring (PAM) was carried out using a towed hydrophone at a distance approximately 200m astern of the survey vessel and at a depth of c.2 to 5m beneath the sea surface.

The towed hydrophone array consisted of a 200m-long cable containing two high frequency hydrophone elements (HP-03) situated 25cm apart in a fluid filled tube at the end of the cable. The hydrophone was connected to a MAGREC HP-27 buffer-box which was connected to a National Instrument DAQ-6255 USB soundcard run through a laptop computer. The track-line of the acoustic survey effort was recorded using an external GPS receiver, which provides NMEA data to PAMGUARD software (version 1.6.01 Beta). A dedicated acoustic observer continuously monitored the incoming audio stream both visually (audio-spectrogram) and aurally using PAMGUARD. Acoustic detections of cetacean vocalisations (both clicks and whistles) were noted, described and their time and GPS locations recorded. Raw recordings were saved continuously as .WAV files and backed-up daily on an external hard-drive.

An acoustic encounter was considered a separate encounter, when a silent period of 10 minutes was recorded between acoustic detections. This followed the method used by Aguilar de Soto *et al.* (2004) and the protocol established under PReCAST (Pierini, 2010). Harbour porpoise echolocation clicks are characterized as being narrow-band, high frequency between 110 and 150kHz, with an average click duration of 2µs and a mean source level of 150dB. In comparison, dolphin clicks are characterized as being broadband ranging in frequency from 200Hz and 150kHz.

Maps were created using Irish Grid (TM65_Irish Grid) with ArcView 3.2 and using SeaTurtle.org Maptool© while design coordinates for the survey areas were obtained from NPWS. Data related to transects, effort, location of visual and acoustic detections, abundance and density estimates were stored in a single MS Access database, which was queried from within the GIS to produce maps.

Results

The entire survey block was surveyed on 13 July 2011 in sea-state ≤ 3 , as per NPWS specifications (Fig. 2). Nearly half (48%) of all survey effort was carried out in sea-state 2 and 40.4% in ≤ 1 , with just under an hour (52 minutes: 8.5% of effort) in sea-state 0 (Table 1). The visibility was 15-20km or greater, with no precipitation and swell height was ≤ 1 m for the duration of the survey. A total transect length of 173km was surveyed.

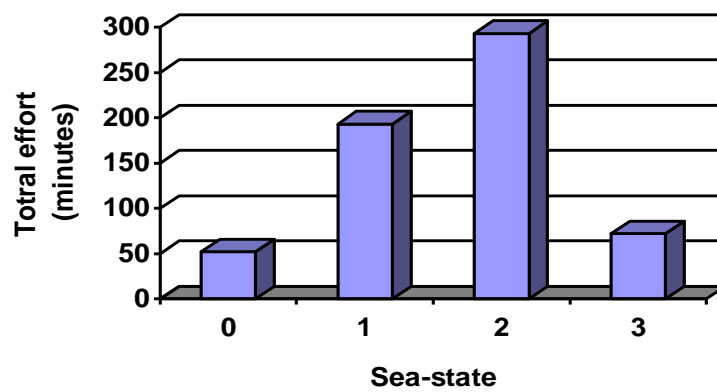


Figure 2. Sea state conditions for the survey of the northwest survey block.

A total of eight sightings comprising 13 individuals of five marine mammal species were recorded (Table 1). These include two harbour porpoise sightings, one sighting of a group of Risso's dolphins, a single minke whale, and both common and grey seals (Table 2). The track-line was broken at the end of line 5 when a group of Risso's dolphins was observed in an attempt to obtain photo-identification data, however no images suitable for photo-identification were obtained.

Table 1. Date, effort, sea-state and number of sightings in the northwest survey block

Date	No. of track lines completed	Total proportion of survey in sea-state ≤ 3	Number of sightings	Total No. of mammals
13 July, 2011	12	100%	8	13

Sightings of cetaceans and seals were generally made towards the centre of the survey block offshore between Downpatrick and Benwee headlands (Fig. 3).

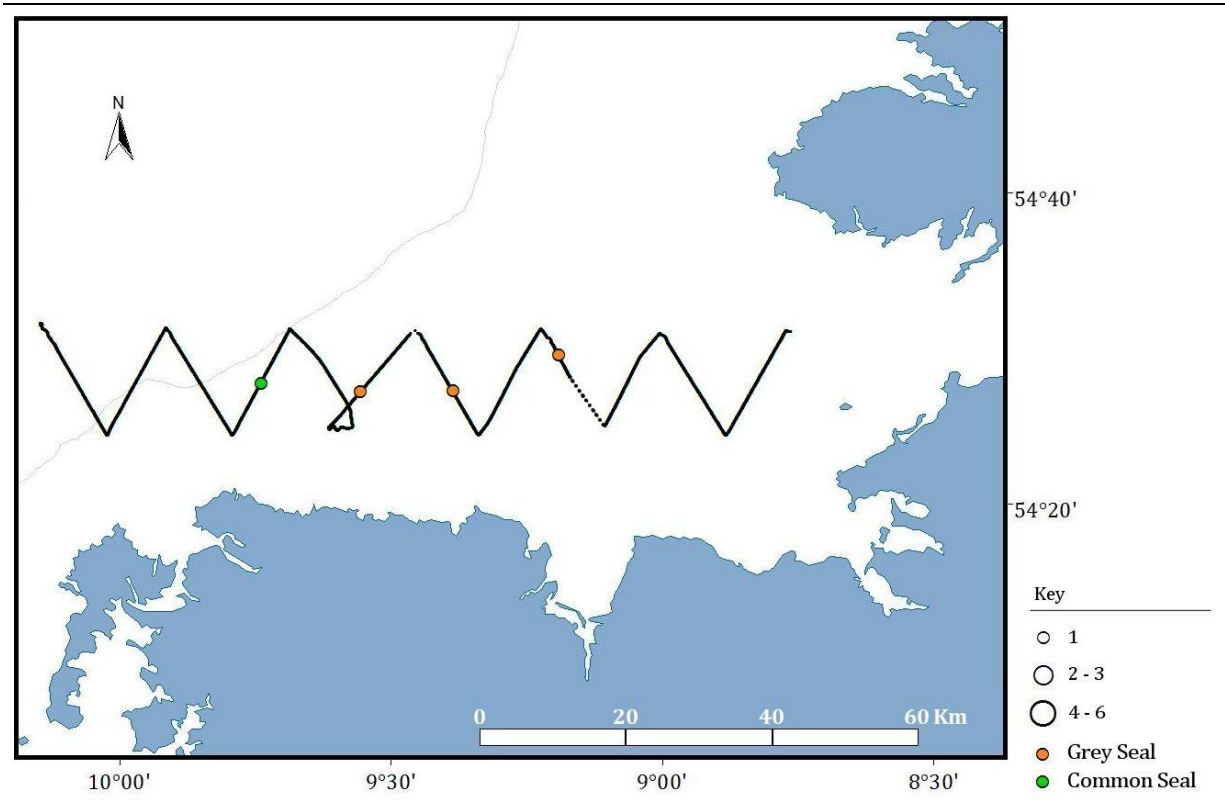
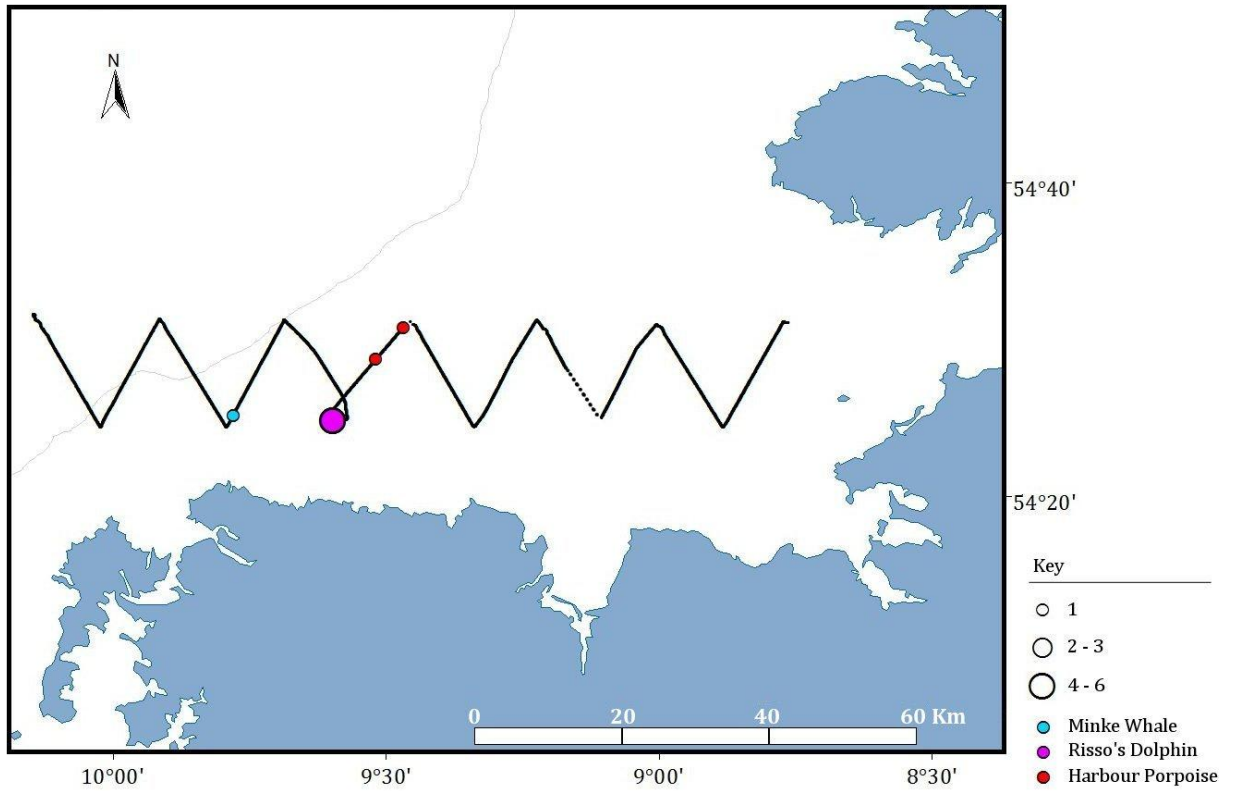


Figure 3. Location of cetacean and seal sightings made during the survey in July 2011.
 (Note: GPS failed for a period on track-line 9 but environmental conditions were recorded throughout)

Table 2. Species present in the northwest survey block during 2011

Species	Sightings	Individuals	Mean Group Size
Harbour porpoise	2	2	1
Minke whale	1	1	1
Risso's dolphin	1	6	6
Grey seal	3	3	1
Common seal	1	1	1

Relative abundance

Cetacean relative abundance recorded during the survey was low despite excellent survey conditions, with only four sightings of a total of nine individuals. In addition there were four sighting of seals of two species. Given the small number of sightings the species diversity was quite high. Sighting rates ranged from 0.005 sightings per km of transect surveyed for Risso's dolphin, minke whale and common seal to 0.015 sightings per km for grey seal. Risso's dolphin was the most numerous species with 0.30 individuals per km or 0.60 per hour of survey effort.

Table 4. Relative abundance of cetaceans and seals in the northwest survey block.

	No. of sightings	No. of individuals	Sightings per km	Numbers per km	Sightings per hour	Numbers per hr
Harbour porpoise	2	2	0.010	0.010	0.197	0.197
Risso's dolphin	1	6	0.005	0.030	0.098	0.589
Minke whale	1	1	0.005	0.005	0.098	0.098
Grey seal	3	3	0.015	0.015	0.294	0.294
Common seal	1	1	0.005	0.005	0.098	0.098

No absolute abundance estimates could be calculated from the present survey as the number of sightings were too few.

Acoustic Detections

Only a single acoustic event was logged during the survey, and this was of the Risso's dolphin group for which we broke track to photograph. The duration of the encounter exceeded 8 minutes, mainly because we were following the group. This group was sighted visually before any acoustic detections were logged, and were within 800m of the hydrophone before clicks and whistles were logged on the hydrophone. The visual sightings of harbour porpoise were not logged acoustically.

Where concurrent visual and acoustic (clicks and whistles) observations were made of dolphins, species identification was more precise as was the case for the Rissos dolphins. This was the only acoustic event

recorded over the survey duration (198km, Fig. 4), despite two visual sightings of harbour porpoise being recorded. A summary of acoustic detections is presented in Table 5.

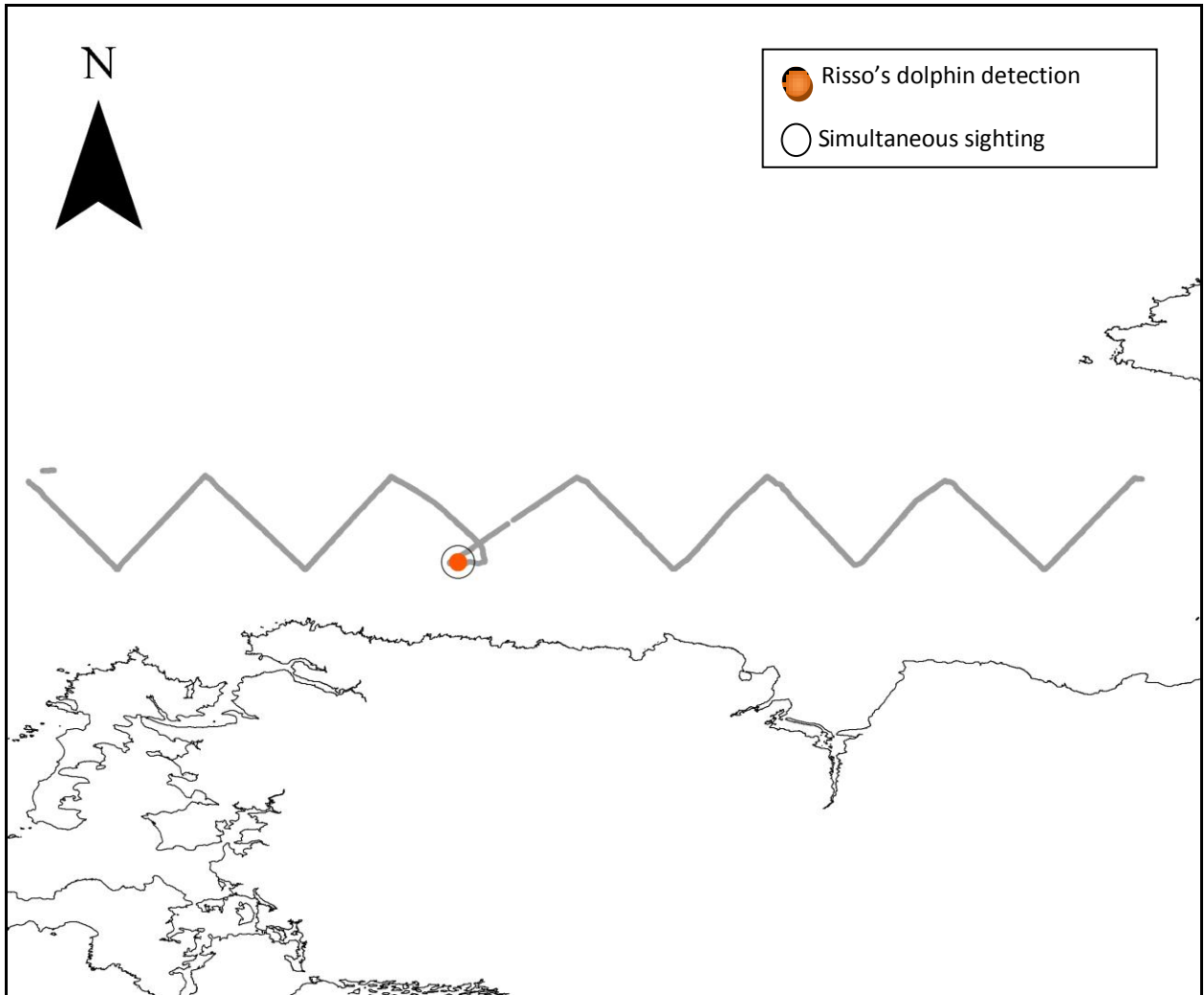


Figure 4. Acoustic survey track (solid line) and the location of a Risso's dolphin acoustic and visual detection during the survey

Table 5: Summary of acoustic detections within the survey block

Survey block	Date	Clicks	Whistles	Total detections	Range of Duration min-max (secs)	Mean encounter duration (secs)
NW	13/07/2011	Y	Y	1	502	502

Discussion

This repeat survey in 2011 was carried out in very suitable sea conditions, however the number of sightings was low but similar to that recorded in 2010 by Ryan *et al.* (2010). Only eight marine mammal sightings were recorded but this involved five different species, suggesting species diversity was quite high relative to sightings rate.

Harbour porpoise and minke whale are widespread in coastal waters of Ireland during the summer (Berrow *et al.* 2010) and may have been expected to occur in this area but only three sightings of single individuals were recorded. The sighting of a group of Risso's dolphins was noteworthy but was anticipated. Although the distribution of this species in Ireland is patchy (Reid *et al.* 2003; Berrow *et al.* 2010), regular sightings occur off the southeast (Saltee Islands), southwest (especially around the Blasket Islands) and off the northwest as far east as Donegal Bay. Risso's dolphins have been regularly reported in Broadhaven Bay in the summer in groups of 1-10 individuals (Visser *et al.* 2010). The sighting in the present survey was only around 30km northwest of Broadhaven Bay.

We may have expected to observe bottlenose dolphins (*Tursiops truncatus*) during the survey. A sighting of a group of bottlenose dolphins to the east of the survey area, in Donegal Bay was reported during the present survey but these animals were not observed either during the survey or while on transit to/from the survey area. Bottlenose dolphins are known to use coastal areas off Counties Mayo and Sligo (Berrow 2008; Oudejans *et al.*, 2008; Ó Cadhla *et al.*, 2003; Visser *et al.*, 2010) and some may be part of one or more highly mobile groups, several individuals of which have been widely recorded around the Irish coast (O'Brien *et al.* 2009b).

Relative Abundance

Data on the relative abundance of small cetaceans recorded during similar surveys elsewhere in Ireland are comparatively limited but broad comparisons can be made between this survey and similar surveys carried out during 2010 and 2011.

Harbour porpoise abundance off the northwest during 2011 was very similar to that recorded in 2010 by Ryan *et al.* (2010) despite less favourable sea conditions during 2010. The abundance was less than that recorded off the southwest in 2010 and much less than that recorded in the Irish Sea during 2011 (Berrow *et al.* 2011). The low sighting rates recorded during surveys off the northwest coast during 2010 and 2011, especially during 2011, when sea conditions were very favourable, suggest harbour porpoise may not be as abundant in this area as at other sites in Irish coastal waters.

Minke whale relative abundance off the northwest was similar to that recorded in the southern Irish Sea during 2011 (Berrow *et al.* 2011) but only half that recorded off the southwest during 2010 and much less than that recorded in the Northern Irish Sea in 2011 (Ryan *et al.* 2010; Berrow *et al.* 2011).

Visual and Acoustic Detections

Although PAM on this occasion did not provide additional detections to the overall survey it does suggest that no odontocetes, especially dolphins, were missed during the survey.

The low sighting rate resulted in low relative abundance suggesting that cetaceans are not plentiful in this area although given the low number of sightings the species diversity was relatively high. There has been considerable survey effort in Broadhaven Bay and adjacent waters in recent years in connection with the Corrib Gas Project. The results of these surveys suggest a high species diversity in the area (e.g., Oudejans *et al.*, 2008; Visser *et al.* 2010) though it is difficult to compare relative abundance between the studies due to the different methodologies and analysis carried out.

These surveys can provide good baselines for monitoring purposes with future repetition of survey effort, and may enable the identification of areas with a higher relative abundance of cetaceans and potentially important habitats for these species.

Clearly this is a long-term commitment but the present surveys are an important first step in fulfilling this objective.

Acknowledgements

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