

Marine Institute Cetacean Monitoring

Cetacean Distribution and Relative Abundance Survey
During the Western European Shelf Pelagic Acoustic Survey

9th June – 20th July 2021

Lead Agency: Marine Institute

Lead Partners: National Parks and Wildlife Service,

Authors: Irish Whale and Dolphin Group

Citation: Judge, J. (2021). Cetacean Monitoring undertaken during the Western European Shelf Pelagic Acoustic Survey (WESPAS). June-July 2021. Report to the Marine Institute Ireland.

Operational Programme	European Maritime and Fisheries Fund (EMFF) Operational Programme 2014-2020
Priority	Union Priority 1 Sustainable Development of Fisheries Union Priority 6 Fostering the implementation of the Integrated Maritime Policy
Thematic Objective	TO 6 - Preserving and protecting the environment and promoting resource efficiency
Specific Objective	UP1 SO1 - Reduction of the impact of fisheries and aquaculture on the marine environment, including the avoidance and reduction, as far as possible, of unwanted catch. UP1 SO2 - Protection and restoration of aquatic biodiversity and ecosystems. UP6 SO1 - Development and implementation of the Integrated Maritime Policy
Measure	Marine Biodiversity Scheme
Project No.	MB/2019/09
EMFF Certifying Body	Finance Division, Department of Agriculture, Food and the Marine
Managing Authority	Marine Agencies & Programmes Division, Department of Agriculture, Food and Marine
Specified Public Beneficiary Body	Marine Institute
Grant Rate	100%
EU Co-Financing Rate	50%
Legal Basis	Article 29, 40 & 80 EMFF
Details	Report to the Marine Institute Irish Whale and Dolphin Group

This project or operation is part supported by the Irish government and the European Maritime & Fisheries Fund as part of the EMFF Operational Programme for 2014-2020

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Executive Summary

Irish waters represent one of the most important marine habitats for cetaceans in Europe and are utilized by a wide range of cetacean species. However, the abundance, distribution and conservation status of many of the species occurring in Irish waters remains poorly understood. Under the EU Habitats Directive, there is a requirement on member states to conduct surveillance of cetaceans occurring within their waters. The Irish Whale and Dolphin Group (IWDG), contracted by the Marine Institute Ireland, conducted a cetacean survey from the RV Celtic Explorer during the annual Western European Shelf Pelagic Acoustic Survey (WESPAS), running from 9 June to 20 July 2021.

A single Marine Mammal Observer (MMO) was aboard the Marine Institute's research vessel 'Celtic Explorer' for 6 weeks, compiling both legs of the research cruise. The role of the MMO was to record any sightings of cetaceans during daylight hours of the survey. A standard, single platform line transect survey methodology was employed by the MMO with additional visual point sampling at oceanographic sampling stations. Survey transects were undertaken at speeds of 5-11 knots, with fishing activity being conducted at speeds of 3-5 knots. The MMO's survey effort was maximized during periods of sea state ≤ 6 and with visibility of ≥ 1 km. A total of 38 days of surveying was possible, amounting to 301 hours of survey time. Sea state was relatively good during survey days (≤ 3 at 74.8% of effort recordings) and visibility was also favourable (> 5 km at 85.6% of effort recordings).

A total of 106 separate sightings of cetaceans were recorded. Recorded species were: harbour porpoise (*Phocoena phocoena*); grey seal (*Halichoerus grypus*); common seal (*Phoca vitulina*); short-beaked common dolphin (*Delphinus delphis*); bottlenose dolphin (*Tursiops truncatus*); Risso's dolphin (*Grampus griseus*); white-beaked dolphin (*Lagenorhynchus albirostris*); Atlantic white-sided dolphin (*Leucopleurus acutus*); long-finned pilot whale (*Globicephala melas*); minke whale (*Balaenoptera acutorostrata*); humpback whale (*Megaptera novaeangliae*); fin whale (*Balaenoptera physalus*); and 'probable' false killer whales (*Pseudorca crassidens*). Other non-cetacean species recorded were: ocean sunfish (*Mola mola*), leatherback turtle (*Dermochelys coriacea*) and blue shark (*Prionace glauca*).

Introduction

In the waters of Ireland's Exclusive Economic Zone (EEZ), 25 species of cetacean (whales, dolphins and porpoise) have been recorded to date. Eleven of these species are thought to calve in Irish waters. As such, the Irish government declared Irish waters within the EEZ as a cetacean sanctuary in 1991 (Rogan and Berrow, 1995). However, despite this designation there is limited knowledge on the distribution and relative abundance of cetaceans within the Irish EEZ (NPWS, 2013; Table 1). Under the EU Habitats Directive, there is a requirement on member states to conduct surveillance of cetaceans occurring within their waters. Marine mammals in Ireland are also protected under the EU Habitats Directive. All cetaceans are listed under Annex IV of the Directive as species requiring strict protection in their natural range (Article 12, EC Council Directive 92/43/EEC). The harbor porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Delphinus delphis*), together with both seal species occurring in Irish waters, the grey seal (*Halichoerus grypus*) and the common seal (*Phoca vitulina*), are listed in Annex II and further protected under Article 3 of the Directive, as species whose conservation requires the designation of Special Areas of Conservation (SAC).

Since 1991, the Irish Whale and Dolphin Group (IWDG) have been monitoring cetacean distributions and abundances in Irish and Northern Irish waters. Surveys on board the Marine Institute's research vessel (Celtic Explorer) have been undertaken by IWDG since 2003 and these surveys have helped to provide vital data on cetacean density and distribution in Irish, UK and EU waters. These data will contribute to the identification of important habitats for European cetacean populations and to help devise programs for their long term conservation and protection.

Studies on the presence, distribution and abundance of cetacean species have been conducted in Ireland since 1994 (e.g. Pollock et al. 1997; Ó Cadhla et al. 2004; Wall et al. 2013; O'Brien et al. 2016). Since 2003 the Marine Institute has facilitated the surveillance of cetaceans in Irish waters by accommodating marine mammal observers onboard national research vessels (RV Celtic Explorer and RV Celtic Voyager) during research surveys (Oudejans 2014). Fisheries acoustic surveys are particularly suited to the conduction of cetacean surveys as the vessel spends the majority of the survey travelling at a steady speed along pre-determined survey tracks (e.g. Figure 2).

The WESPAS survey is an amalgamation of two previously existing surveys: the Malin Shelf herring acoustic survey and the boarfish acoustic survey, with both species now targeted on a single survey across two legs. Originally, the Malin Shelf herring acoustic survey was carried out annually since 2008 between Scotland and the north and west of Ireland. The boarfish acoustic survey was carried out annually since 2011 between the west coast of France and Scotland. Since 2016, both surveys have been carried out on a single survey (WESPAS) aboard the RV Celtic Explorer culminating 42 days and covering continental shelf waters from 47°30'N northwards to 58°30'N.

Conducting marine mammal observations onboard the WESPAS survey presents a highly advantageous opportunity to record cetaceans in several key areas of Ireland's EEZ (e.g. large areas of the continental shelf waters), and neighboring UK waters. The oceanic waters of Ireland's EEZ are highly productive due to the upwelling of nutrient-rich waters which in turn support an array of species assemblages (Mackey et al. 2004). This, coupled with the complex bathymetry and hydrology of the Atlantic margin create rich habitats for cetaceans (Wall et al. 2006).

Table 1: Marine mammal species occurring in Irish waters and their conservation status (Sources: Wall et al. 2013; Whooley 2016; Temple et al. 2007)

Common name	Scientific name	Occurrence	Conservation Status (IUCN Europe)
Baleen whales			
Humpback whale	<i>Megaptera novaeangliae</i>	May-Aug	Least concern
Blue whale	<i>Balaenoptera musculus</i>	July-March	Endangered
Fin whale	<i>Balaenoptera physalus</i>	All year	Near threatened
Sei whale	<i>Balaenoptera borealis</i>	All year	Endangered
Northern minke whale	<i>Balaenoptera acutorostrata</i>	All year	Least concern
Northern right whale	<i>Eubalaena glacialis</i>	Vagrant	Critical
Bowhead whale	<i>Balaena mysticetus</i>	Data deficient	Not assessed
Toothed whales and dolphins			
Sperm whale	<i>Physeter macrocephalus</i>	All year	Vulnerable
Pygmy sperm whale	<i>Kogia breviceps</i>	Vagrant	Not assessed
Killer whale	<i>Orcinus orca</i>	All year	Data deficient
False killer whale	<i>Pseudorca crassidens</i>	June-Nov	Not assessed
Long-finned pilot whale	<i>Globicephala melas</i>	All year	Data deficient
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	May-Aug	Least concern
Northern bottlenose whale	<i>Hyperoodon ampullatus</i>	May-Aug	Data deficient
Gervais' beaked whale	<i>Mesoplodon europaeus</i>	Vagrant	Data deficient
Sowerby's beaked whale	<i>Mesoplodon bidens</i>	All year	Data deficient
True's beaked whale	<i>Mesoplodon mirus</i>	All year	Data deficient
Beluga	<i>Delphinapterus leucas</i>	Vagrant	Not assessed
Risso's dolphin	<i>Grampus griseus</i>	March-July	Data deficient
Common bottlenose dolphin	<i>Tursiops truncatus</i>	All year	Data deficient
Short-beaked common dolphin	<i>Delphinus delphis</i>	All year	Data deficient
Striped dolphin	<i>Stenella coeruleoalba</i>	May-Sept	Data deficient
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	All year	Least concern
Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>	All year	Least concern
Porpoises			
Harbour porpoise	<i>Phocoena phocoena</i>	All year	Vulnerable
Seals			
Grey seal	<i>Halichoerus grypus</i>	All year	Least concern
Common (harbour) seal	<i>Phoca vitulina</i>	All year	Least concern

Methodology

During this survey cetacean observations were conducted by a single Marine Mammal Observer (MMO) during daylight hours between 05:30 and 12:00, and from 13:00 to 21:30 (times adjusted on some days for environmental conditions and feasibility of surveying). On average (average taken over 'full days' available to survey), 8 hours and 45 minutes were spent watching for cetaceans each day (Figure 1). The area scanned during observations was from the ship's bow and 90° to either side. This area was constantly scanned during watch hours with roughly 60% of scans conducted using binoculars (Bushnell Marine 7x50 with compass and reticle) and the remainder by eye.

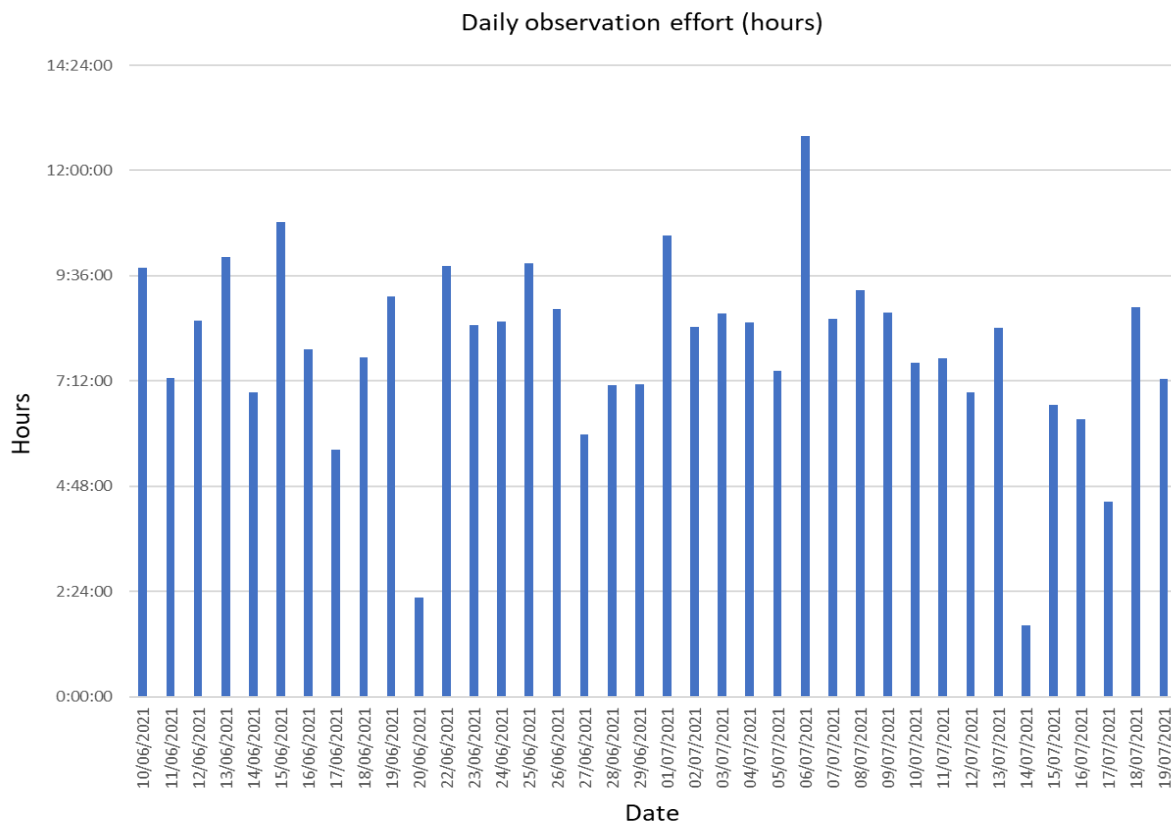


Figure 1. Daily observation effort during survey.

Observation platform.

Observations were conducted primarily from the ships crow's nest located at a height of 18 meters above sea level and access to this platform was possible up to sea state 6, moderate swell conditions and Beaufort 7. Where environmental conditions exceeded those outlined, access to crow's nest was restricted and further observations were conducted from the monkey island (13 meters above sea level) when safe to do so. When unsafe to do so, observations continued inside from the ship's Bridge as have done on previous surveys.

Data collection and recording.

Bearings to sightings were measured using an angle board and distances were estimated with the aid of distance measuring stick. Environmental data were recorded every 30 minutes using Logger 2000 software (IFAW 2000). Sightings were also recorded using Logger 2000. Automated position data were obtained through a laptop computer linked to a GPS Receiver Unit.

Line transect survey methodology.

The vessel travelled at an average speed of 10 knots when steaming (except where restricted due to heavy weather). The vessel stopped on a regular basis to conduct CTDs or fishing trawl samples. During these times the vessel remained stationary for up to 1½ hours at a time (when in deep water) or reduced speed (3-5 knots) while trawling. As the focus of this vessel’s survey was to sample fish stocks, surveys of cetaceans were conducted in ‘passing mode’ and cetaceans sighted were not approached. Sightings were identified to species level where possible, with species identifications being graded as definite, probable or possible. Where species identification could not be confirmed, sightings were downgraded (e.g. unidentified dolphin / unidentified whale / unidentified beaked whale etc.) according to criteria established for the IWDG’s cetacean sightings database (IWDG 2021).

Results

Environmental conditions.

The 2021 WESPAS survey’s proposed survey transects spanned 4,986 nautical miles from the coast of France to the Outer Hebrides, Scotland (Figure 2).

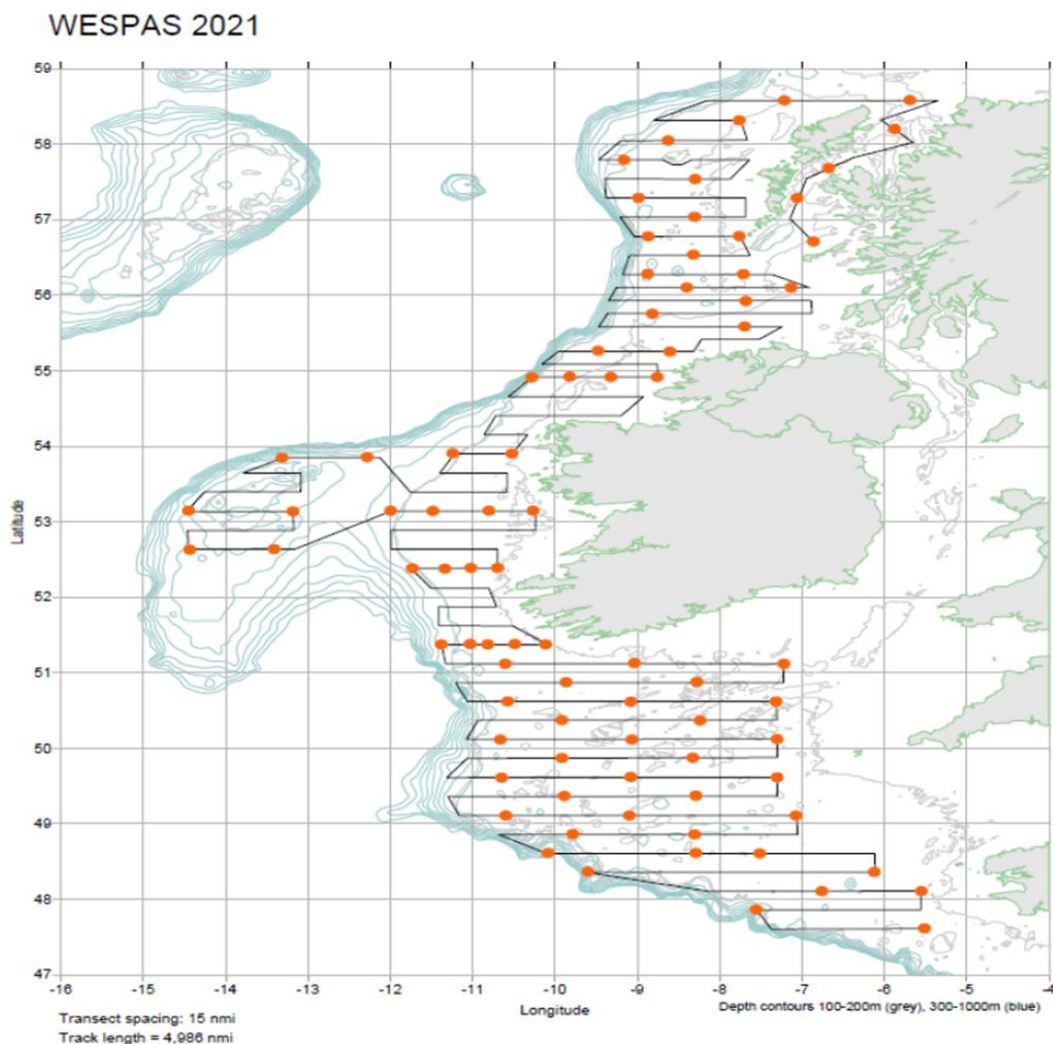


Figure 2. WESPAS 2021 proposed survey track with CTD stations.

Environmental data were collected at 680 stations. A total of 1 full day (i.e. 30 June) and 4 half days (i.e. 17 and 20 June; 14 and 17 July) surveying were lost due to bad weather, where surveying was not possible due to impossible survey conditions.

Mean wind speed during survey effort was 13 knots. Sea state was ≤ 3 at 74.8% of environmental stations (25.2% sea state 4-6). Visibility was good ($>5\text{km}$) at 85.6% of stations, moderate (1–5km) at 9.6% of stations and poor ($<1\text{km}$) at 4.8% of stations - discounting periods during which surveying was suspended due to dense fog or heavy rain (visibility $<500\text{m}$). A heavy swell (2m+) was recorded at 7.7% of stations. Rainfall was recorded at 10.7% of stations, and fog/mist at 11.8% of stations (Figures 3-5).

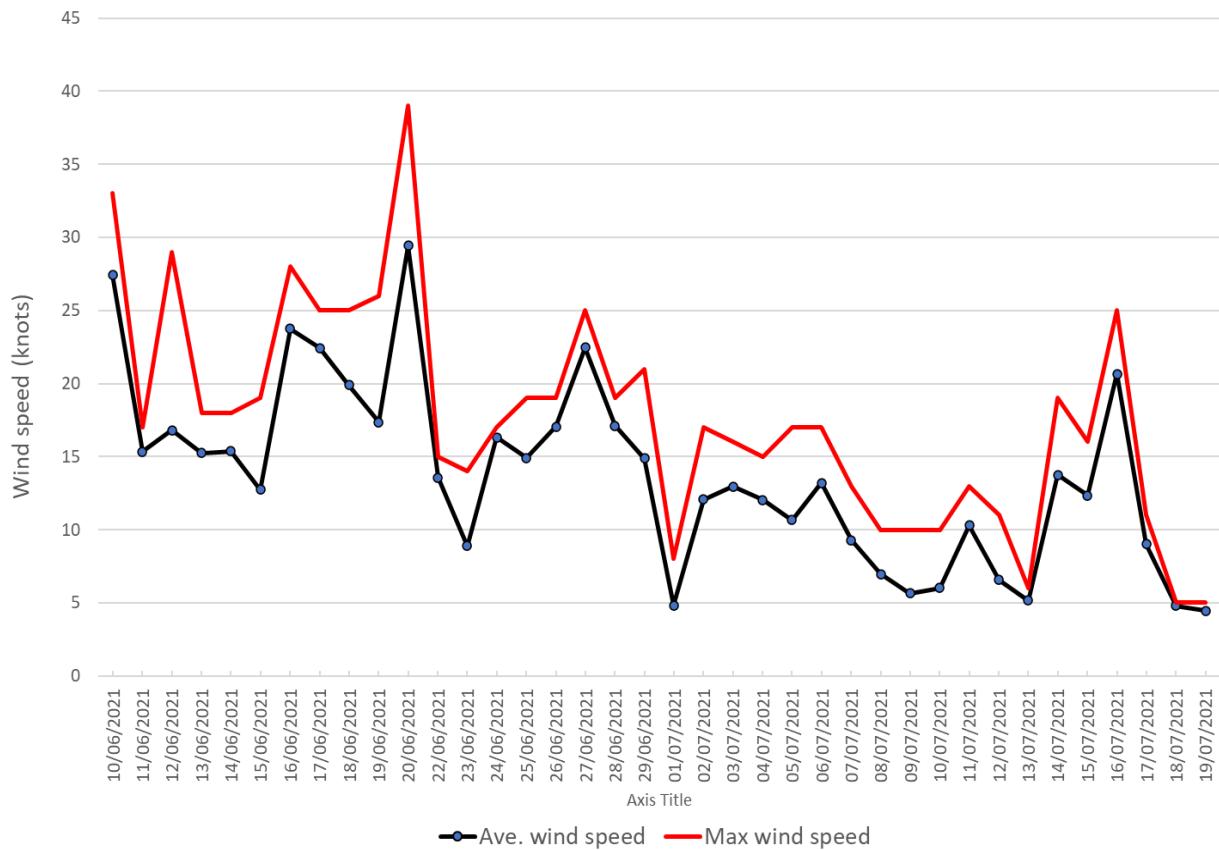


Figure 3. Average and maximum daily wind speed recorded during survey hours.

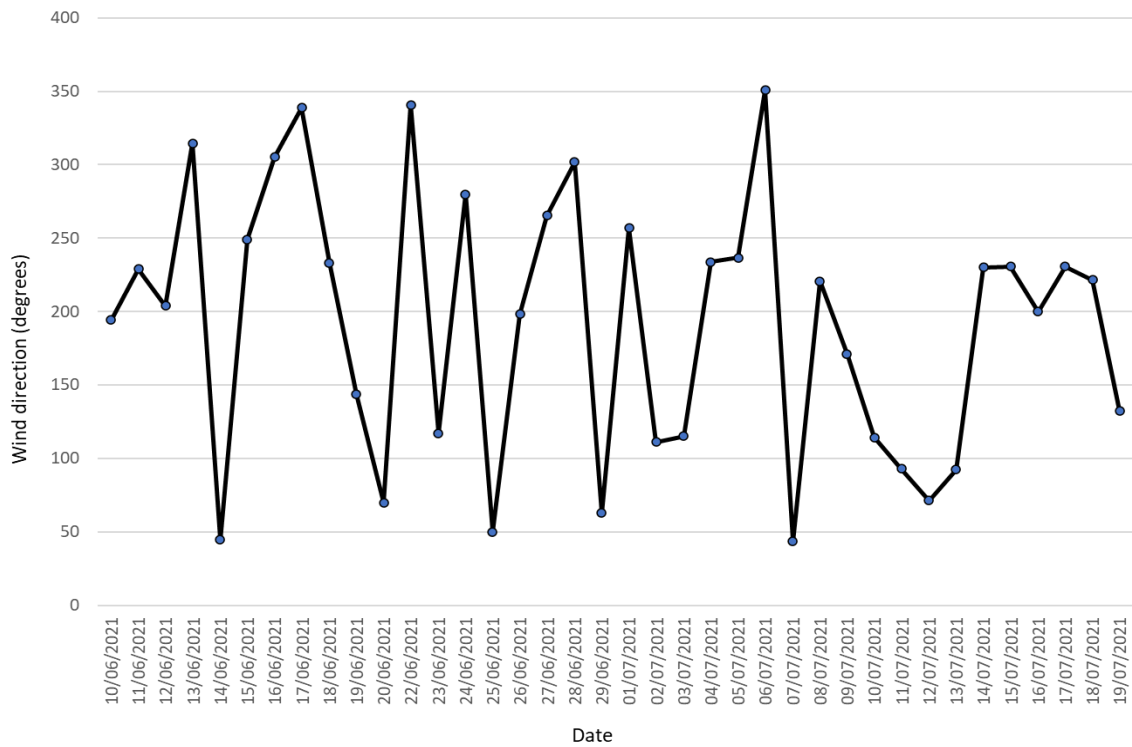


Figure 4. Average daily wind speed direction recorded during survey hours.

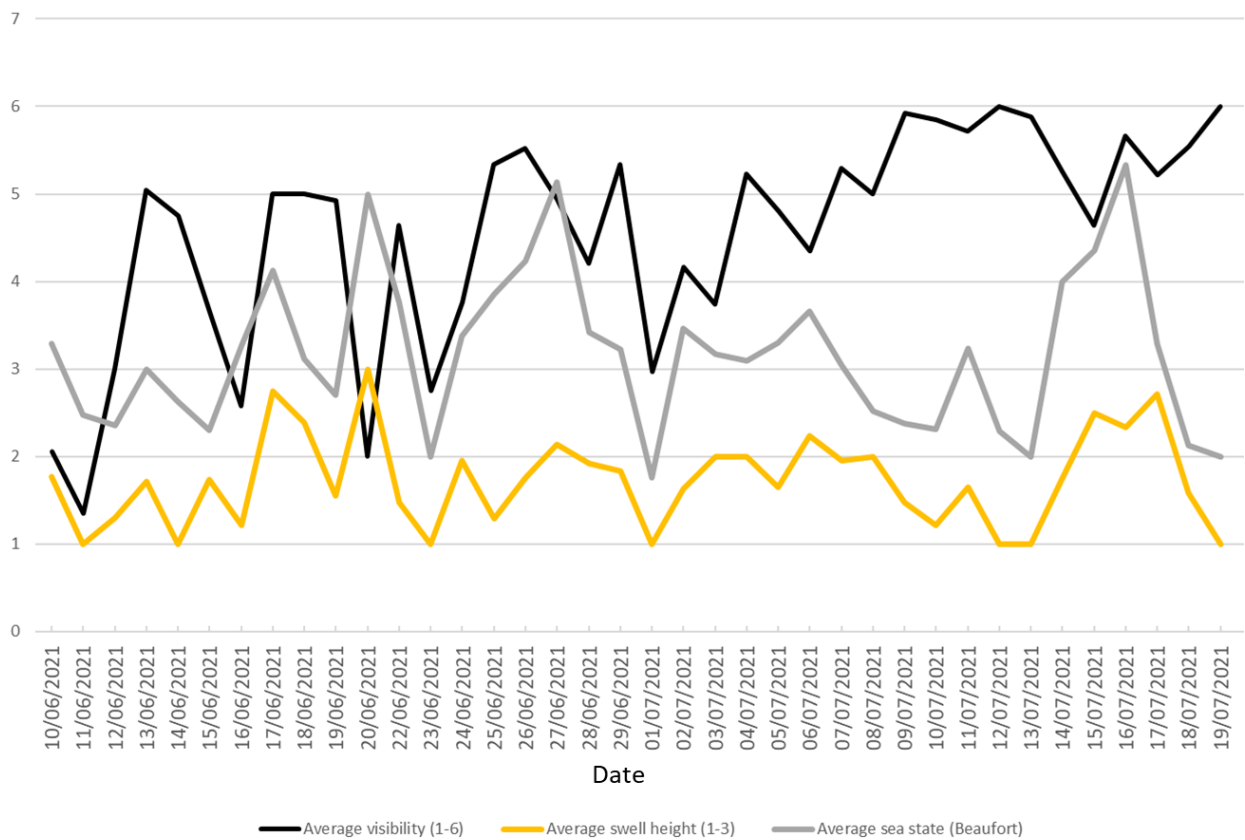


Figure 5. Average daily visibility, swell height and sea state recorded during survey hours.

Cetacean Survey Results

In total, 38 days were spent surveying with 301 hours of survey time logged (Figure 6). Sea state varied between 1 and 6 across the survey duration with <5 accounting for 91.6% of surface conditions.

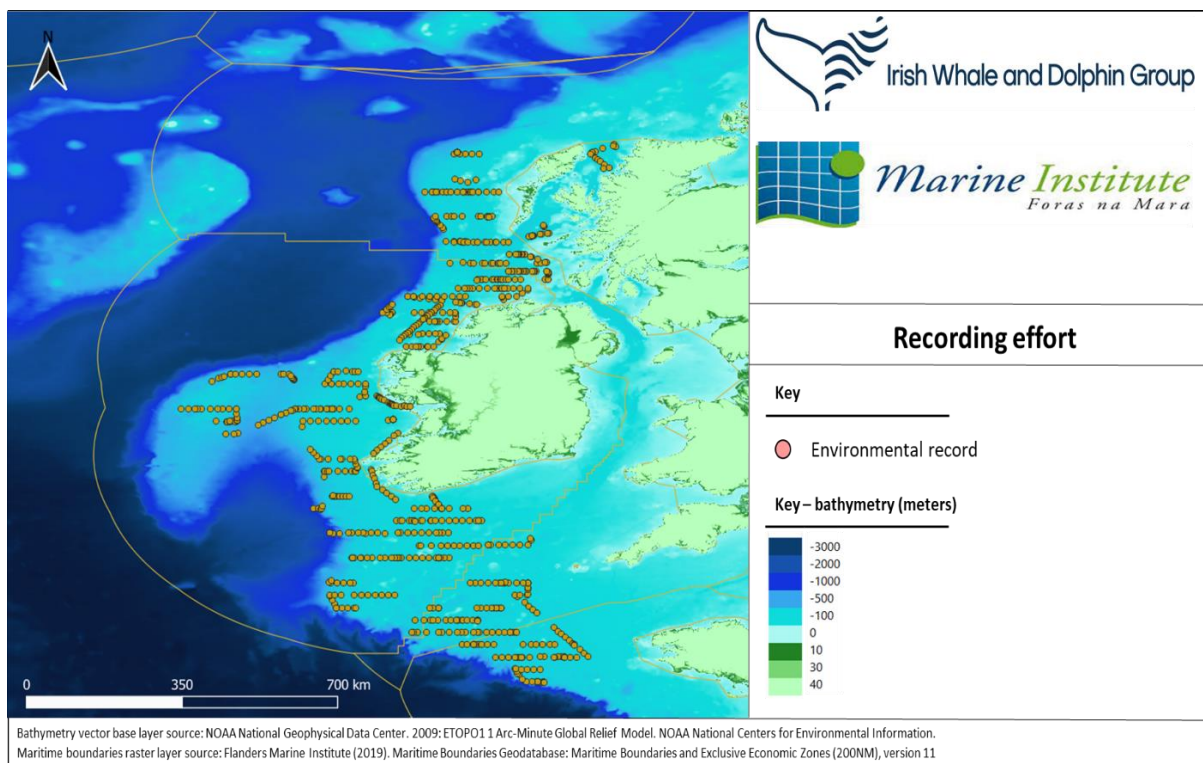


Figure 6. Survey effort from 10/06/2021 – 19/07/2021.

Thirteen cetacean species were encountered during the survey i.e. harbour porpoise (*Phocoena phocoena*); grey seal (*Halichoerus grypus*); common seal (*Phoca vitulina*); short-beaked common dolphin (*Delphinus delphis*); bottlenose dolphin (*Tursiops truncatus*); Risso's dolphin (*Grampus griseus*); white-beaked dolphin (*Lagenorhynchus albirostris*); Atlantic white-sided dolphin (*Leucopleurus acutus*); long-finned pilot whale (*Globicephala melas*); minke whale (*Balaenoptera acutorostrata*); humpback whale (*Megaptera novaeangliae*); fin whale (*Balaenoptera physalus*); and 'possible' false killer whales (*Pseudorca crassidens*). Other non-cetacean species recorded were: ocean sunfish (*Mola mola*), leatherback turtle (*Dermochelys coriacea*) and blue shark (*Prionace glauca*) (Table 2).

Additional sightings were made of unidentified dolphins and whales (thought to be various dolphin species and an unidentified large whale) at various locations on the continental shelf as well as at the shelf edge. Sightings of dolphin species occurred on the continental shelf whereas pilot whale sightings occurred at the continental shelf edge, which is considered one of the preferred habitats for this species. Sightings of larger whale species (i.e. fin whales, humpback whales and an unidentified large whale) all occurred in shelf waters. Due to the number of sightings recorded over both legs of the survey, graphical representations of sighting locations are presented in separate figures for legs 1 and 2 (Figures 7 & 8).

Table 2: Summary of all sightings recorded on the survey, including primary, auxiliary and incidental sightings of all megafaunal groups.

Common name	Scientific name	No. of Sightings	No. of Individuals	Group Size Range
Harbor porpoise	<i>Phocoena phocoena</i>	1	2	2
Grey seal	<i>Halichoerus grypus</i>	5	5	1
Harbor seal	<i>Phoca vitulina</i>	1	1	1
Common dolphin	<i>Delphinus delphis</i>	27	502	2-100
Bottlenose dolphin	<i>Tursiops truncatus</i>	8	92	1-30
Risso's dolphin	<i>Grampus griseus</i>	8	46	1-12
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	2	7	2-5
Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>	1	25	25
Long-finned pilot whale	<i>Globicephala melas</i>	5	20	1-7
Minke whale	<i>Balaenoptera acutorostrata</i>	27	44	1-5
Humpback whale	<i>Megaptera novaeangliae</i>	3	10	1-4
Fin whale	<i>Balaenoptera physalus</i>	5	12	1-3
False killer whale	<i>Pseudorca crassidens</i>	1	2	2
Unidentified small whale		1	1	1
Unidentified whale		3	2	1
Unidentified dolphin		5	49	5-20
Unidentified cetacean		2	4	1
Blue shark	<i>Prionace glauca</i>	1	4	4
Leatherback turtle	<i>Dermochelys coriacea</i>	1	1	1
Ocean sunfish	<i>Mola mola</i>	8	8	1
	Totals	115	837	

A single sighting of 2 probable false killer whales occurred over the Porcupine Bank, close to the shelf edge. The animals were seen twice within the same sighting but high winds and sea state meant they could not be positively identified nor was it possible to capture photographs. However, comprehensive analysis of observed morphological characteristics using identification keys led to the conclusion, by process of elimination, that the probability of species identification was such.

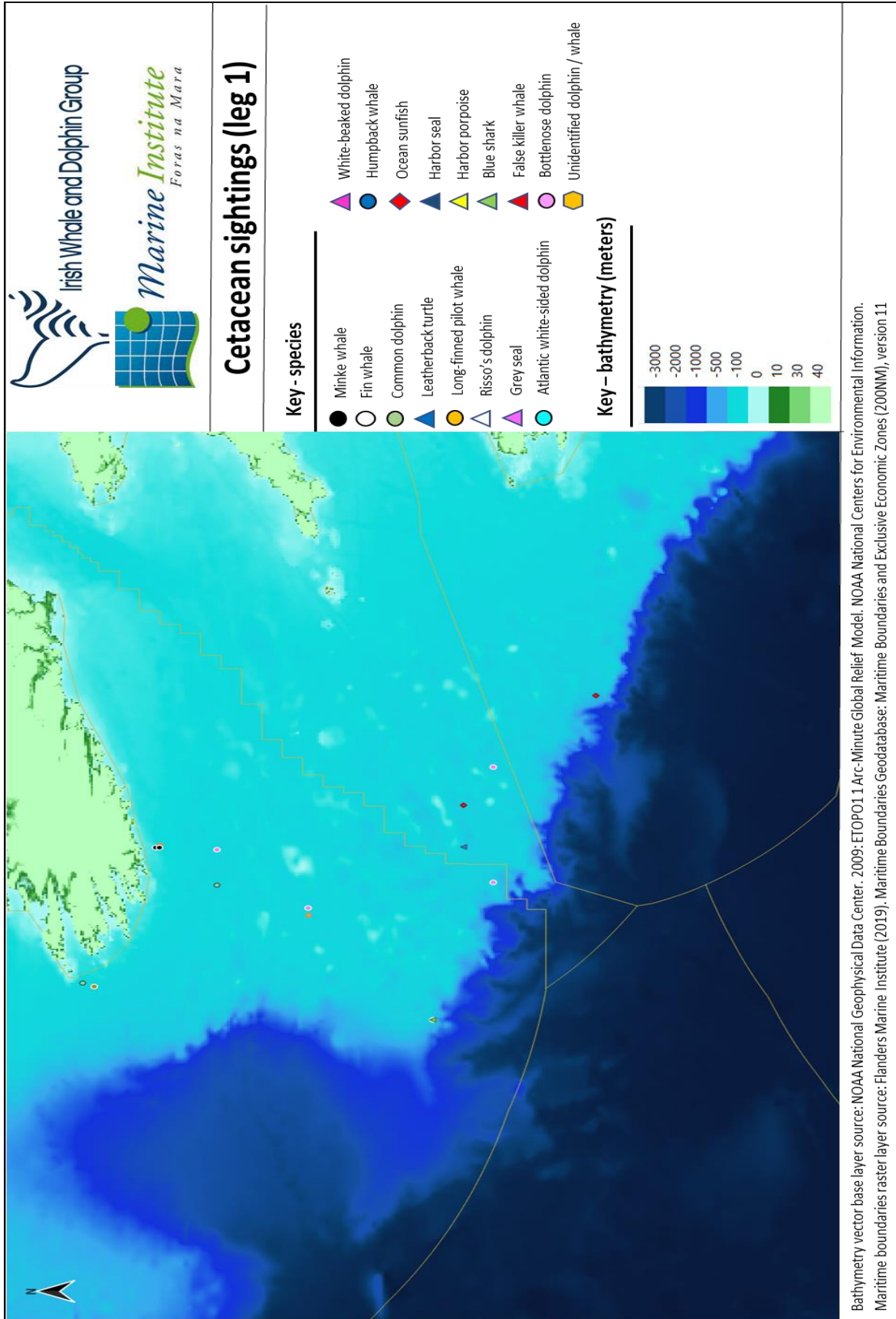


Figure 7. Locations of cetacean sightings during WESPAS survey leg 1.

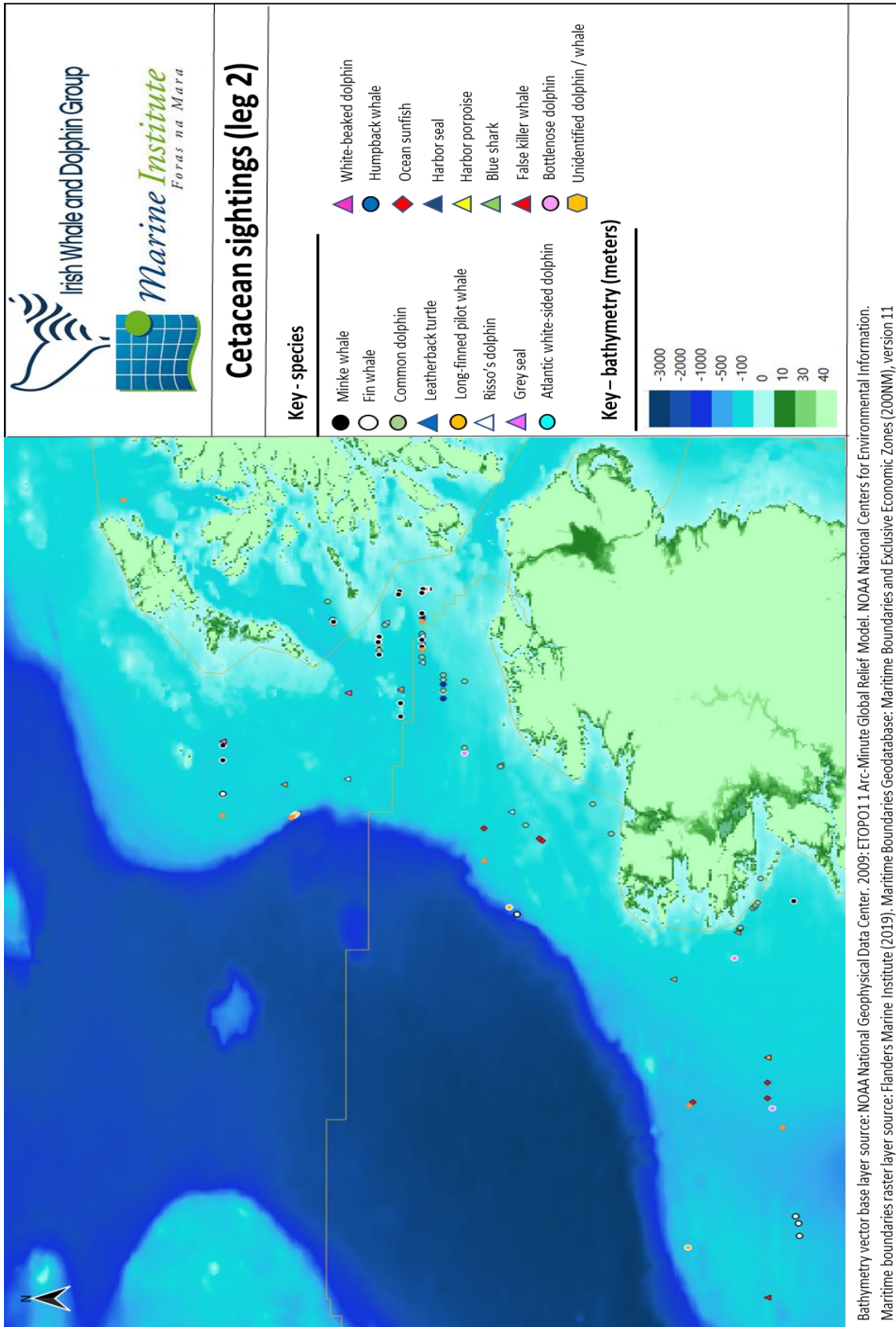


Figure 8. Locations of cetacean sightings during WESPAS survey leg 2.

Common dolphins (*Delphinus delphis*) (Figure 9) and minke whales (*Balaenoptera acutorostrata*) (Figure 10) were the most frequently recorded species accounting for 23.5% of recordings each (27 sightings of each species). Common dolphins were also the most abundant species recorded on the survey (502 animals recorded accounting for 60% of all animals counted across all species). Sightings of both common dolphins and minke whales occurred primarily in coastal water with the furthest record from the coast logged at 60km. The observed group size for common dolphins ranged from 2 to 100 individuals. The observed group size for minke whales ranged from 1 to 5 individuals.



Figure 9. Common dolphins.



Figure 10. Minke whale.

The second most frequently observed species were bottlenose dolphin (*Tursiops truncatus*) (Figure 11), Risso's dolphin (*Grampus griseus*) (Figure 12) and ocean sunfish (*Mola mola*) (Figure 13) accounting for 7% of recordings each (8 recordings of each species). Bottlenose dolphins were the most abundant species recorded of the three (92 animals recorded accounting for 11% of all animals across all species), followed by Risso's dolphins (46 animals, 6% of all animals) and ocean sunfish (8 animals, 1% of all animals). Sightings of bottlenose dolphins occurred primarily in offshore habitats at

various location around Ireland. Sightings of Risso's dolphins occurred primarily offshore of the north and north-west coast of Ireland and west coast of Scotland. Ocean sunfish were recorded in varying areas of the continental shelf, shelf edge and in both Irish and UK waters.



Figure 11. Bottlenose dolphins.



Figure 12. Risso's dolphins.



Figure 13. Ocean sunfish.

Long-finned pilot whales (*Globicephala melas*) (Figure 14), fin whales (*Balaenoptera physalus*) (Figure 15) and grey seals (*Halichoerus grypus*) (Figure 16) were the third most frequently record species accounting for 4.4% of recordings (5 recordings of each species). Long-finned pilot whales were the most abundant species recorded of the three (20 animals recorded accounting for 2.4% of all animals across all species), followed by fin whales (12 animals, 1.4%) and grey seals (5 animals, 0.6%). Sightings of long-finned pilot whales occurred along the shelf edges, consistent with this species preferred habitat. One of the sightings of long-finned pilot whales was of a deceased animal to which the interaction with blue sharks scavenging on it was observed. Sightings of fin whales occurred along shelf edges and adjacent shelf waters to the west of Ireland on the Porcupine Bank and also off the coast of St. Kilda, Scotland. Sightings of grey seals occurred in offshore in continental shelf waters to the west and north-west of Ireland.



Figure 14. Long-finned pilot whales.



Figure 15. Fin whales.



Figure 16. Grey seal.

The fourth most frequently observed species was the humpback whale (*Megaptera novaeangliae*) (Figure 17) accounting for 2.6% of recordings (3 recordings of this species). A total of 10 individual animals were recorded during the survey accounting for 1.2% of all animals across all species. Sightings of humpback whales were recorded in nearshore and offshore waters to the south-west, west and north-west coasts of Ireland.



Figure 17. Humpback whale fluke.

The fifth most frequently observed species was white-beaked dolphin (*Lagenorhynchus albirostris*) (Figure 18) accounting for 1.7% of recordings (2 recordings of this species). A total of 7 animals were recorded accounting for 0.9% of all animals across all species. Sightings of white-beaked dolphins were recorded off the west coast of the Outer Hebrides, Scotland.



Figure 18. White-beaked dolphin.

Single sightings of harbour porpoise (*Phocoena phocoena*) (Figure 19) on the Porcupine Bank, harbour seal (*Phoca vitulina*) and Atlantic white-sided dolphins (*Lagenorhynchus acutus*) (Figure 20) over the Stanton Banks, false killer whales (*Pseudorca crassidens*) over the Porcupine Bank, blue sharks (*Prionace glauca*) (Figure 21) and leatherback turtle (*Dermochelys coriacea*) at the shelf edge – south of Ireland, were also recorded.



Figure 19. Harbour porpoise.



Figure 20. Atlantic white-sided dolphin.



Figure 21. Blue shark.

Discussion

The cetacean distribution survey carried out on board the R.V. Celtic Explorer for the 2021 WESPAS yielded 105 sightings of cetaceans. 824 individual animals of 13 identifiable species were recorded. During days of high sea states and heavy swells of the survey, this may have negatively affected the detection rate of cetaceans by the MMO, particularly those species with inconspicuous surfacing behaviors (Ryan et al. 2012; Cominelli et al. 2016). Periods of high winds and swell also hindered the MMO's ability to identify some animals to species level.

The WESPAS survey differs from other annual acoustic surveys in that it covers a much wider area of the continental shelf and shelf edge regions. As such, it provides a unique opportunity for data collection and surveillance of cetaceans across a large latitudinal gradient, which can be difficult to cover by other means. The majority of species recorded on this survey were done so in areas of upwelling, banks, continental shelf edges and nearshore where migrating fish populations congregate. Therefore, these dynamic areas are likely important habitats for these higher tropic species (Wall et al. 2006).

A single sighting of 2 probable false killer whales occurred over the Porcupine Bank, close to the shelf edge. The animals were seen twice within the same sighting but high winds and sea state meant they could not be positively identified nor was it possible to capture photographs. However, comprehensive analysis of observed morphological characteristics using identification keys led to the conclusion, by process of elimination, that the probability of species identification was such.

One of the humpback whales, sighted approximately 60km north-west of Malin Head, Co, Donegal, was subsequently confirmed as a new individual for Irish waters. This animal has now been catalogued by the Irish Whale and Dolphin Group (IWDG) as animal #HBIRL111 (Figure 22).



Figure 22. New individual humpback whale record.

The WESPAS survey provides an excellent opportunity for the collection of data on the abundance, distribution and behaviour of cetaceans in Irish waters. However, the amount and quality of data collected is confounded by factors such as environmental conditions and cetacean survey design. Poor weather, albeit infrequently, reduced the total number of cetacean survey hours undertaken but also likely affected the detection probability of many species, particularly those with inconspicuous surfacing behaviours (Cominelli et al. 2016). To remedy this issue, the additional use of PAM could have a positive effect on the detection rate and could help over-come some of the issues surrounding the visual detection of some cetaceans in poor sea states (MCR 2011; Ryan et al. 2012).

Acknowledgments

I would like to extend a special thank you to Captains Denis Rowan and Anthony Hobin, and Chief Scientists Michael O'Malley and Ciaran O'Donnell, along with the crew of the Celtic Explorer for their support and professional conduct during the survey.

I would also like to thank the galley crew for their hospitality, and also the marine crew for providing me with access to the crow's nest.

Finally, I wish the ship's crew and the Marine Institute staff all the best for future surveys. Both, the Explorer crew and the Marine Institute staff have been a pleasure to work with I look forward to working with them again.

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Further details available on www.emff.marine.ie

Managing Authority EMFF 2014-2020	Specified Public Beneficiary Body
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This project or operation is part supported by the Irish government and the European Maritime & Fisheries Fund as part of the EMFF Operational Programme for 2014-2020



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Department of Agriculture,
Food and the Marine



EUROPEAN UNION
This measure is part-financed
by the European Maritime
and Fisheries Fund



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