EMFF Operational Programme 2014-2020

Marine Biodiversity Scheme

Marine Institute Cetacean Monitoring

Cetacean Distribution and Relative Abundance Survey

During the Blue Whiting Acoustic Survey

20st March – 9th April 2021

Lead Agency: Marine Institute

Lead Partners: National Parks and Wildlife Service,

Authors: Irish Whale and Dolphin Group

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An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

EUROPEAN UNION
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Foras na Mara
Marine Institute

Irish Whale and Dolphin Group

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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 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 relationship between predators such as seabirds and marine mammals is also poorly understood and is required to implement an Ecosystem Approach to Fisheries Management. The Irish Whale and Dolphin Group (IWDG) were contracted by the Marine Institute Ireland to conduct a cetacean survey from RV Celtic Explorer during the annual Blue Whiting Acoustic Survey (BWAS), running from 20 March to 9 April 2021.

A single Marine Mammal Observer (MMO) was aboard the Marine Institute's research vessel RV Celtic Explorer for the three week research cruise. The role of the MMO was to record survey effort, including environmental variables that affect detectability and 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 5-10 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 ≥1km. A total of 13 days of surveying was possible, amounting to a total of 98 hours of survey time. Sea-state was relatively good during survey days (≤3 at 40.4% of effort recordings) and visibility was also favourable (>5km at 86.8% of effort recordings).

A total of 15 separate sightings of cetaceans were recorded. Recorded species were: common dolphins (*Delphinus delphis*); Long-finned pilot whales (*Globicephala melas*); northern bottlenose whales (*Hyperoodon ampullatus*); humpback whales (*Megaptera novaeangliae*); killer whale (*Orcinus orca*); sperm whale (*Physeter macrocephalus*) and bottlenose dolphins (*Tursiops truncatus*).

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 harbour 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/harbour 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 vessels (Celtic Explorer and Voyager) 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 programmes 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; Rogan et al. 2018). 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). Since 2004, Ireland has participated in an international coordinated survey program along with vessels from Norway, Russia, the Netherlands and the Faroes (O'Donnell et al. 2017) targeting blue whiting (*Micromesistius poutassou*) to monitor spawning and post-spawning aggregations in the North East Atlantic. Owing to the highly migratory nature of this species, a large geographical area along the Atlantic margin of Ireland and the UK is surveyed annually, with surveys timed to coincide with peak spawning of the blue whiting stock (O'Donnell et al. 2017).

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

Conducting marine mammal observations onboard the blue whiting acoustic survey presents a highly advantageous opportunity to record cetaceans in several key areas of Irelands EEZ (e.g. the Rockall Plateau and Porcupine Bank), and in neighbouring UK waters. The oceanic waters of Irelands 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).

Methods

During this survey cetacean observations were conducted by a single Marine Mammal Observer (MMO) during daylight hours between 06:30 and 12:00, and from 13:00 to 18:00. On average (average taken over 'full days' available to survey), 10 hours 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.

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, normally observations would continue inside from the ship's Bridge as have done on previous surveys. However, as a result of current Covid-19 protocols access to the ship's Bridge was restricted, thus effort watches were abandoned and casual watches employed (from alternating port and starboard sides) to supplement sightings data.

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. Due to this survey being conducted at a time of year when poor weather is the norm, surveying was conducted in all sea states (when it was safe to do so as outlined above) and in moderate to good visibility. This was justified on the basis that all cetacean distribution data from the poorly surveyed season is of value.

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).

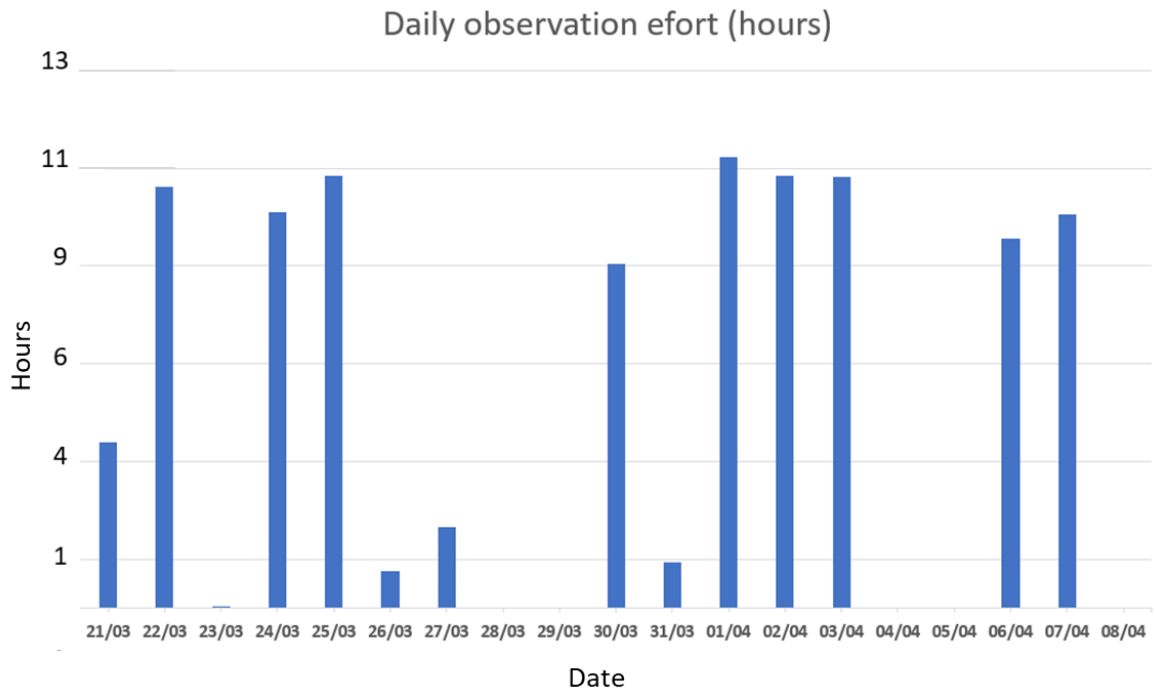

Figure 1. Daily observation effort during survey

Results

Environmental conditions

The 2021 Blue Whiting Survey's proposed survey transects spanned 2,642 nautical miles from the Porcupine Bank to the Faroe Banks (Figure 2). Environmental data was collected at 208 stations. A total of 6 full days (i.e. 23, 28 and 29 March, and 4, 5 and 8 April) and 4 half days (i.e. 21, 26 27 and 31 March) were lost due to bad weather, where surveying was not possible due to unsafe survey conditions or when the vessel had to shelter from storms (at Sheephaven Bay and The Outer Hebrides).

Mean wind speed during survey effort was 18.7 knots. Sea state was ≤3 at 40.4% of environmental stations (59.6% sea state 4-6). Visibility was good (>5km) at 86.8% of stations, moderate (1–5km) at 11.8% of stations and poor (<1km) at 1.4% of stations - discounting periods during which surveying was suspended due to dense fog or heavy rain (visibility <500m). A heavy swell (2m+) was recorded at 33.6% of stations. Rainfall was recorded at 13.6% of stations, snow at 4.1% of stations and fog/mist at 4.8% of stations (Figures 3-5).

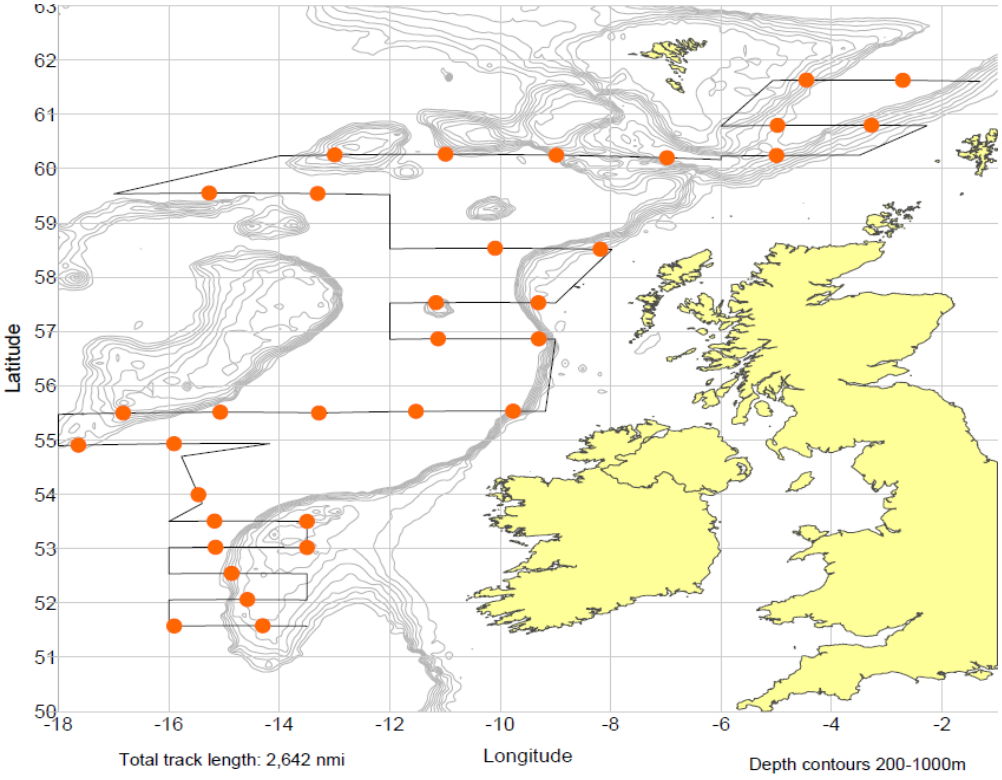

Figure 2. Blue Whiting 2021 proposed survey track with CTD stations

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

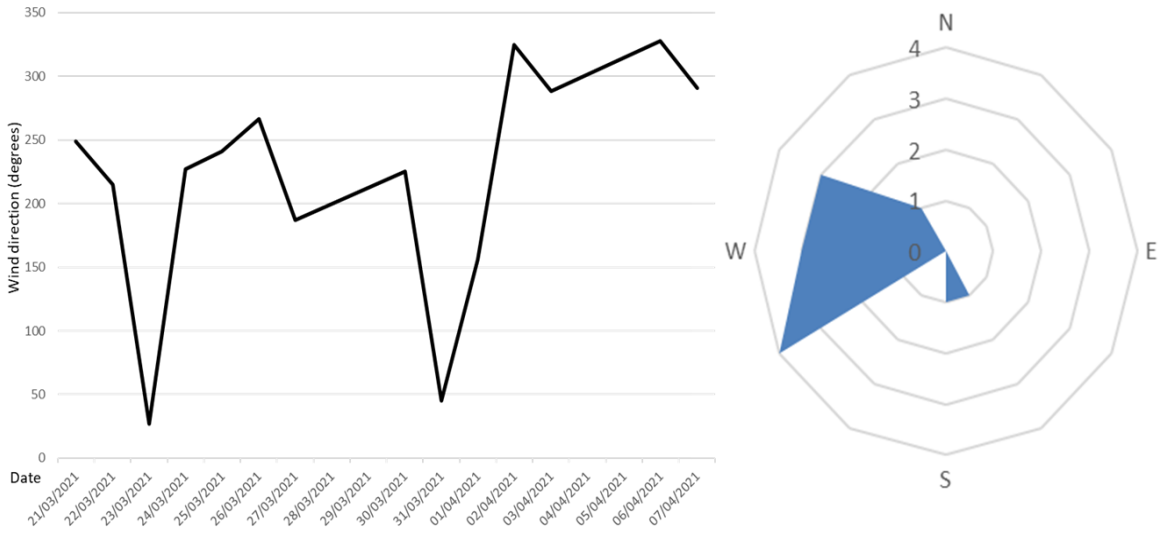

Figure 4. Average daily wind speed direction recorded during survey hours

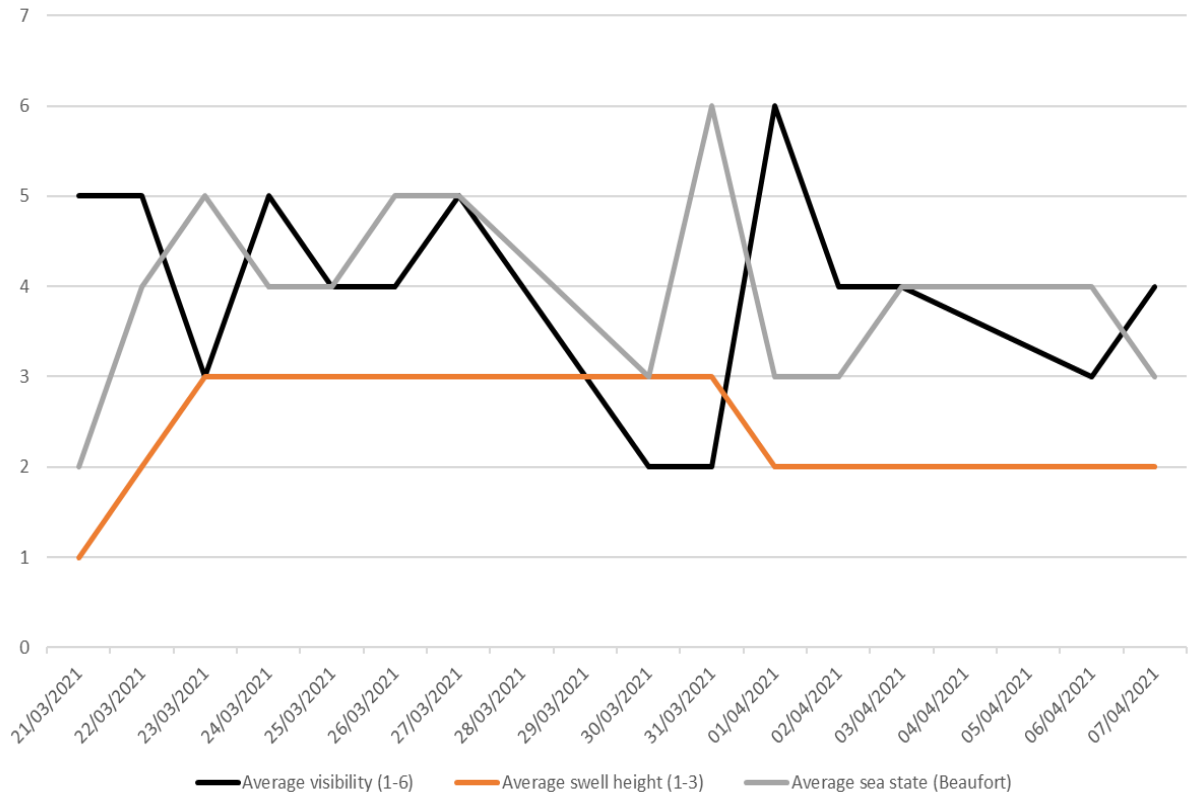

Figure 5. Average daily visibility, swell height and sea state recorded during survey hours

Cetacean Survey Results

In total, 13 days were spent surveying with 98 hours of survey time logged (Figure 6). Sea state varied between 2 and 6 across the survey duration with <5 accounting for 85.2% of surface conditions.

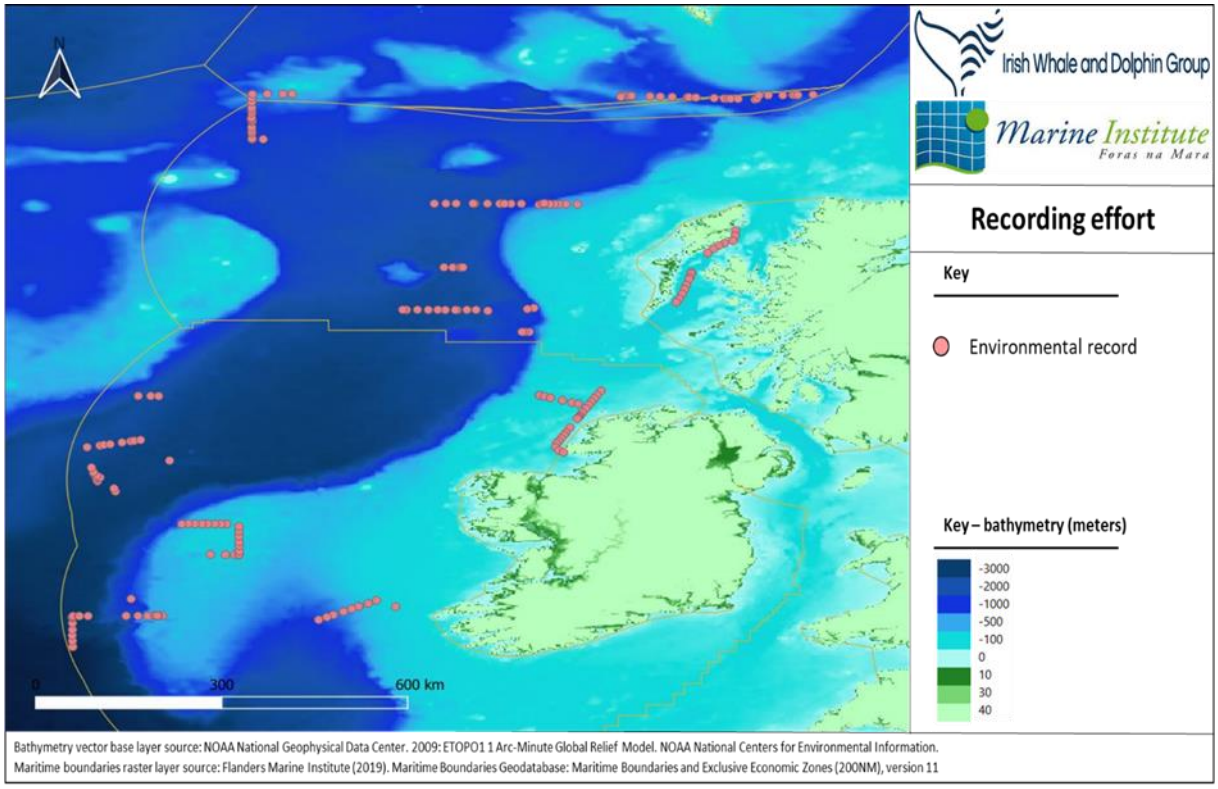

Figure 6. Survey effort from 21 March – 7 April 2021

Seven cetacean species were encountered during the survey i.e. common dolphin (*Delphinus delphis*); Long-finned pilot whale (*Globicephala melas.*); northern bottlenose whale (*Hyperoodon ampullatus*); humpback whale (*Megaptera novaeangliae*); killer whale (*Orcinus orca*); sperm whale (*Physeter macrocephalus*) and bottlenose dolphin (*Tursiops truncatus*) (Table 2).

Additional sightings were made of unidentified dolphins and whales (thought to be bottlenose dolphins, northern bottlenose whales and an unidentified large whale) at various locations both on and off the continental shelf. Sightings of dolphin species occurred both on and off the continental shelf whereas pilot whale sightings occurred over the continental shelf slopes and in adjacent deep waters, which are considered the preferred habitats for this species (Figure 7).

Sightings of larger whale species (i.e. northern bottlenose whales, humpback whales, killer whale and unidentified large whale) all occurred in deep water. The occurrence of the lone male killer whale in very deep water suggests it was a member of the offshore population, but individual identification through photo-id was not possible.

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

Species	Scientific Name	No. of Sightings	No. Of Individuals	Group Size Range
Common dolphin	*Delphinus delphis*	1	7	7
Long-finned Pilot whale	*Globicephala melas*	4	37	4-22
Northern bottlenose whale	*Hyperoodon ampullatus*	1	6	4-6
Humpback whale	*Megaptera novaeangliae*	1	2	2
Killer whale	*Orcinus orca*	1	1	1
Sperm whale	*Physeter macrocephalus*	1	1	1
Bottlenose dolphin	*Tursiops truncatus*	4	4	4
Unidentified dolphin		2	2	1
Unidentified whale		3	3	1
	Totals	**18**	**63**	

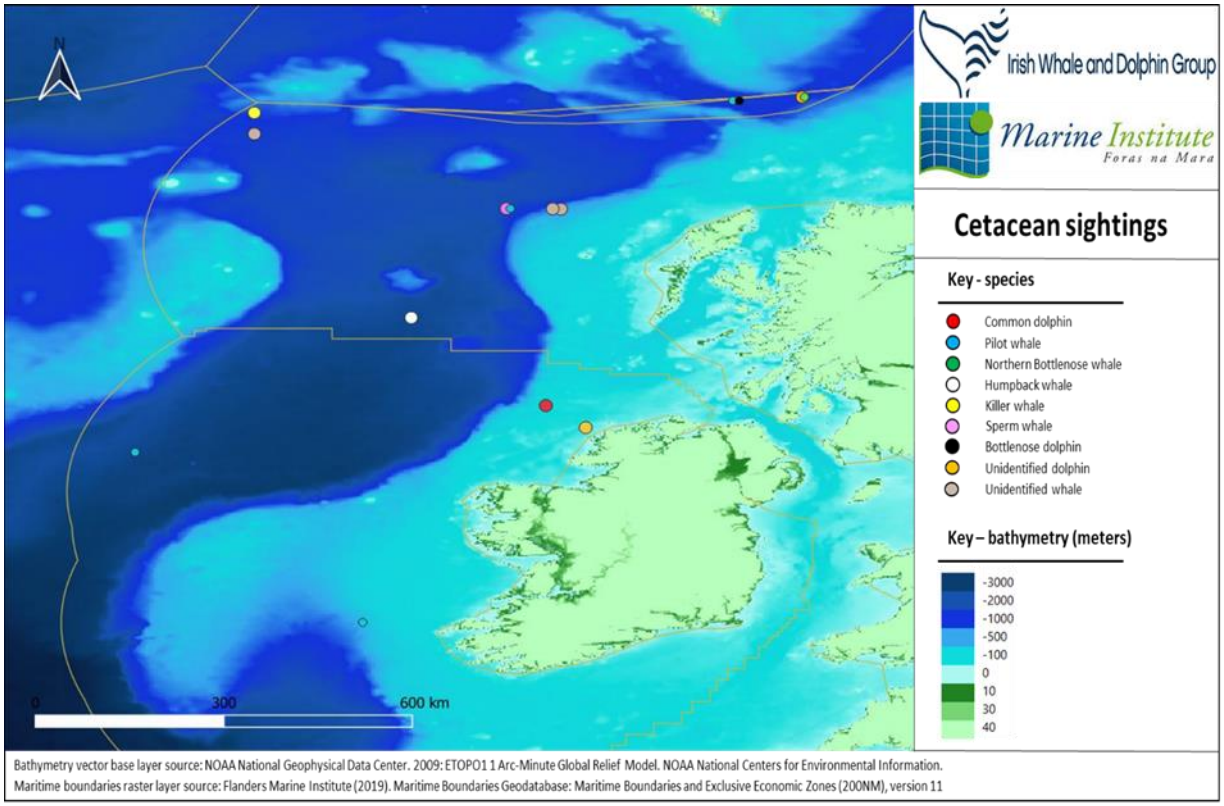

Figure 7. Locations of cetacean sightings during survey.

Long-finned pilot whales (*Globicephala melas*) were the most frequently encountered and abundant species accounting for 4 sightings (27%) and comprising 37 individuals (64% of all individuals counted across all species). Sightings of long-finned pilot whales occurred primarily near continental shelf waters in water depths of less than 500 meters, however a number of sightings were also recorded in deeper waters west of the Porcupine Bank and also in the Rockall Trough. The observed group size for pilot whales ranged from 4 to 22 individuals.

Common dolphins (*Delphinus delphis*) were the second most frequently observed species in terms of number of individuals, accounting for 12% of all cetaceans recorded. One sighting was recorded, consisting of a pod of 7 individuals that were encountered on continental shelf, northwest of Ireland.

Northern bottlenose whales (*Hyperoodon ampullatus*) were the third most frequently observed species in terms of individual numbers, accounting for 10% of all cetaceans recorded. One sighting was recorded, consisting of a pod of 6 individuals that were encountered off the northwest coast of Scotland in water deeper than 1000 meters.

Bottlenose dolphins (*Tursiops truncatus*) were the fourth most frequently observed species in terms of individual numbers, accounting for 7% of all cetaceans recorded. One sighting was recorded, consisting of a pod of 4 individuals that were encountered in waters deeper than 1000 meters off the northwest coast of Scotland.

A single sighting of two humpback whales (*Megaptera novaeangliae*) was recorded in the middle of the Rockall Trough. Single sightings of a lone sperm whale (*Physeter macrocephalus*) and killer whale (*Orcinus orca*) were recorded at locations also in the northern most section of the Rockall Trough.

Discussion

The cetacean distribution survey carried out on board the R.V. Celtic Explorer for the 2021 Blue Whiting Acoustic Survey (BWAS) yielded 18 sightings. This was comparable to previous years (Table 3) and was despite the hours of potential survey time lost (80 hours) due to unfavorable environmental conditions. A total of 63 individual animals of at least 7 identifiable species were recorded. High sea states and heavy swells during sections of the survey may have also 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 blue whiting survey differs from other annual acoustic surveys in that it is primarily focused on areas west of the continental shelf. As such, it provides a unique opportunity for data collection and surveillance of cetaceans in these deep-water environments, which can be difficult to reach by other means. Long-finned pilot whales were the most frequently encountered and most abundant species occurring in or near the continental shelf slope, areas of upwelling and in deeper water. Continental shelf slopes are known to be highly productive, owing to the upwelling of nutrient rich oceanic waters, and support large and diverse species' assemblages (Mackey et al. 2004). These dynamic areas are likely an important habitat for pilot whales (Wall et al. 2006). Common dolphins and pilot whales have been frequently recorded on previous blue whiting surveys and have dominated the sightings tally in all previous reports available. The results of this survey concur with previous reports.

In keeping with previous surveys (Table 3), a sperm whale was recorded on the 2021 survey. Previous surveys have mostly recorded two or more sperm whales during observational hours, however on the 2021 survey only one adult individual was recorded, and this sighting was associated with the continental shelf slope. As the animal was observed logging, it can be assumed it was resting after a period of feeding. Sperm whales in the North East Atlantic have been recorded to prey heavily on a range of teleost species such as blue whiting (Kawakami 1980), the target species of this survey. Sperm whales in the latitudes surveyed during this survey have been shown to display plasticity in feeding behaviours, indicating they can adapt to food resources, allowing them to exploit wide and variable trophic niches (Teloni et al. 2004).

Six northern bottlenose whales (a beaked whale species) were encountered on one occasion on this survey. Beaked whales have been recorded in low numbers on previous blue whiting surveys. Their detection, however, is severely impacted by adverse sea states (MCR, 2011) thus these species' are

likely under recorded. At-sea identification to species level of beaked whales is also difficult (Ryan et al. 2012) resulting in them often being recorded at higher taxonomic levels.

The blue whiting survey provides an excellent opportunity for the collection of data on the abundance, distribution and behaviour of cetaceans in Irish waters, particularly the less frequently encountered deep diving species (e.g. beaked whales). However, the amount and quality of data collected is confounded by factors such as environmental conditions and cetacean survey design. Poor weather 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 beaked whales in poor sea states (MCR 2011; Ryan et al. 2012).

Table 3: Cetacean sighting records from Blue Whiting Acoustic Survey from 2004-2018 (O'Donnell et al. 2017, 2015; Oudejans 2014) (species in yellow were recorded during 2021)

Year	2018	2017	2015	2014	2013	2011	2009	2008	2006	2005
Species										
Common dolphin	18 (150)	6 (37)	6 (215)	3 (10)	7 (103)	23 (78)	5 (46)	2 (151)		1 (150)
Long-finned pilot whale	6 (62)	2 (9)	6 (35)	16 (97)	9 (67)	3 (20)	1 (15)	16 (132)	5 (53)	4 (40)
Bottlenose dolphin		1 (8)	2 (14)	1 (10)	3 (26)			1 (7)		
Sperm whale	9 (11)	2 (5)		6 (7)	3 (17)		7 (14)	3 (5)		1 (1)
Fin whale		2 (3)			1 (1)					
Killer whale					1 (6)					
Minke whale	3 (3)	1 (1)								
Sowerby's beaked whale					1 (3)			1 (3)		
Cuvier's beaked whale	1 (1)				1 (5)		1 (1)			
Northern bottlenose whale										1 (2)
Risso's dolphin	1 (1)					1 (5)				
White-beaked dolphin										2 (-)
White-sided dolphin		1 (1)						3 (18)		
Harbour porpoise	1 (1)				1 (4)	1 (1)	2 (5)			
Unidentified large baleen whale	1 (1)	1 (1)			7 (8)	1 (1)		1 (1)		
Unidentified whale								1 (2)		
Unidentified beaked whale	1 (2)	1 (1)		1 (1)						1 (1)
Unidentified dolphin	5 (14)		1 (1)	2 (11)	2 (11)	2 (8)		3 (18)		
Unidentified small whale				1 (1)	2 (2)			2 (2)		
Unidentified cetacean	2 (2)				1 (3)					2 (-)
Total	48 (248)	20 (70)	15 (265)	31 (138)	39 (256)	32 (114)	16 (81)	33 (339)	5 (53)	12 (193)

Acknowledgments

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I would also like to thank the galley crew, Jimmy and Morris, 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

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