ORCA Looking out for Whales and Dolphins

THE STATE OF CETACEANS 2024

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Foreword

2023 will perhaps be best remembered by ORCA as the year we went truly global. There was always an international dimension to our work, with surveys being undertaken in many different parts of the world. But our data is now increasingly characterised by ongoing and repeated studies of marine areas that we had never previously spent time in, and which have never been surveyed on a regular basis.

Given the extent of our knowledge about the land based environment, it's extraordinary that only a quarter of our marine environment has even been mapped, let alone explored or studied. And while mapping fills out our knowledge, it's a passive, technical exercise. It doesn't provide the answers we need to understand habitat hotspots, population or abundance numbers, migrations and new or emerging threats.

This accessibility is the reason why marine conservation has lagged behind land based work. But it is catching up, and some of these previously out-of-reach zones have become more accessible. Somewhat inevitably, this is partly to do with technological advances that actually pose threats to marine habitats, such as deep-sea mining for mineral extraction, or acoustic pollution.

The map of our global survey effort, with ever-increasing threads of activity around the world, is testament to our extraordinary volunteer Marine Mammal Surveyors and Ocean Conservationists, who are fulfilling the true aspiration of the citizen science concept by expanding our knowledge of the marine environment. Each line on the map is a journey facilitated by our equally loyal partners, be they cruise ships, ferries or commercial shipping. This pairing of citizen scientists with ships traversing our understudied seas means that every year we unravel a little more of the mystery of our marine environment, and build the evidence that will help safeguard it for the future.

Sally Hamilton
ORCA, CEO

Humpback whale - Dougie Wainwright

Key Highlights in 2023

Since 2006, ORCA has conducted effort based cetacean surveys from platforms of opportunities (namely ferry and cruise ships), resulting in 1,341 surveys and 217,426 individual animals recorded. A total of 44 different species of whales, dolphins and porpoises have been identified during this period.

Over recent years the geographical scope of ORCA's work has expanded from the Northeast Atlantic Ocean to cover much of the world's ocean including the Southern Ocean, the Arctic Ocean and Northeast Pacific Ocean, which are now monitored regularly.

In this single year alone, a staggering 35 different species of whales, dolphins and porpoises were recorded during ORCA effort based surveys amounting to 36,448 individual animals.

Protecting Vulnerable Populations

Dedicated distance sampling surveys

- In 2023 ORCA conducted 97 surveys across 14 ferry routes. A total of 20,011 kilometres of survey effort was achieved, the highest level of effort recorded in a single year
- There were 896 sightings* of 4,292 individual animals of which 753 were identified to the species level. Twelve species were recorded in total
- Common dolphins once again were the most frequently encountered species with 439 sightings of 3,209 animals
- Most sightings were recorded on the Plymouth (UK) - Santander (Spain) ferry route with 276 sightings of 1,920 animals. Ten different species were record in total
- Sightings were also high on the Isles of Scilly route; 155 sightings of 624 individuals and the Oban - Castlebay Scottish route, 140 sightings of 581 animals

** a single sighting can consist of a single animal or up to a group of hundreds of individual animals*

Breaching common dolphin - Richard Lovelock

Conserving Critical Habitats

Dedicated effort based surveys

- In 2023 a total of 286,961 kilometres of effort was undertaken which is double the effort in 2022. The sea regions surveyed included the Arctic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, western North Atlantic Ocean, South Atlantic Ocean, Southern Ocean and Pacific Ocean
- There were 10,059 sightings consisting of 42,045 animals with 35 different species of cetacean recorded
- The Arnoux's beaked whale and strap-toothed beaked whale were recorded for the first time

OceanWatchers volunteer surveys (at sea and from land)

- In total OceanWatchers conducted 23,274 kilometres of survey effort at sea with the most surveyed regions concentrated in the Northeast Atlantic which is where the majority of trained OceanWatchers are based. Surveys were also carried out in the Gulf of California, the Indo-Pacific sea regions and in the western Pacific Ocean
- OceanWatchers at sea recorded 714 sightings of 9,267 animals, identifying 31 different cetacean species
- Melon-headed whale and the pygmy sperm whale were recorded for the first time
- On land, OceanWatchers watched for a total of 435 hours. Most effort was in the Southwest of England, but surveys were also conducted in Alaska, France and Germany
- A total of 282 sightings were recorded from land amounting to 1,281 animals. The harbour porpoise was the most frequently recorded species followed by common dolphins and bottlenose dolphins

Saving Large Whales from Collisions

- The Alaskan research project continued in 2023 examining how large whales behave around large vessels. An ORCA Marine Mammal Observer collected behavioural data from a cruise ship with preliminary results showing that vessels of a certain size can take effective avoidance action and reduce the collision risk if the whale is sighted beyond 1000m
- Further ship strike behavioural work continued in the Bay of Biscay on board a ferry with recordings of fine scale behaviours of close encounters with whales. Findings included recordings of multiple near miss events with fin whales and Cuvier's beaked whales. The fin whales observed tended not to react to the ship's presence
- Survey work continued in the Southern Ocean in order to assess the abundance and distribution of recovering large whale populations for ship strike risk. Preliminary findings show that humpback whales recorded near the Antarctic Peninsula were far higher early in the season than anticipated. The waters around Elephant Island are becoming a hotspot for fin whales

Common dolphin - Paul Soulby

Contents

The Report and its Purpose

The State of Cetaceans 2024 is ORCA's seventh annual report summarising the findings of platform of opportunity cetacean surveys around the world in 2023. The report is split into sections based on the objectives of each aspect of ORCA's work: to protect vulnerable populations by monitoring densities and abundance over time, to conserve critical habitats particularly in the high seas and to protect large whales from vessel strikes.

Despite growing awareness of human impacts on the ocean, the pressures continue to pile onto cetaceans and the ecosystems they inhabit. However, scientific progress and management lags behind the fast pace of these growing threats and an up-to-date picture of cetacean distribution and abundance is critical in order to manage these threats and mitigate their impact as much as possible. Citizen science at a large scale is essential to step up monitoring to match management needs and meet conservation goals.

This report builds on the 18 years' worth of cetacean sightings and environmental data collected during the 1,341 dedicated ORCA surveys conducted between 2006-2023 using vessels of opportunity, namely ferries and cruise ships.

Atlantic spotted dolphins - Judith Scott

Sightings and Survey Overview

ORCA has collected effort based cetacean sightings data since 2006, resulting in 1,341 surveys. ORCA's survey work can be broadly divided into two types of data collection. Firstly, line transect distance sampling surveys, which estimate cetacean densities and are conducted from the bridge of ferries around the UK (refer to the Protecting Vulnerable Populations section of this report) and cruise ships in the Southern Ocean. The second type of data collection involves a more flexible survey protocol, ORCA OceanWatchers, whereby data is collected alongside public education on board ferries and cruise ships and is used to understand cetacean distribution and hotspots (refer to the Conserving Critical Habitats section of this report).

Survey areas

Historically, ORCA's data collection has been centred on the Northeast Atlantic and especially the waters surrounding the UK (Figure 1 showing the OSPAR regions used in previous reports). In recent years however, ORCA's scope has expanded to cover much of the world's ocean and now other regions including the Southern Ocean, the Arctic Ocean and Northeast Pacific are also monitored regularly and the area surveyed expands year on year (Table 1 and Table 2).

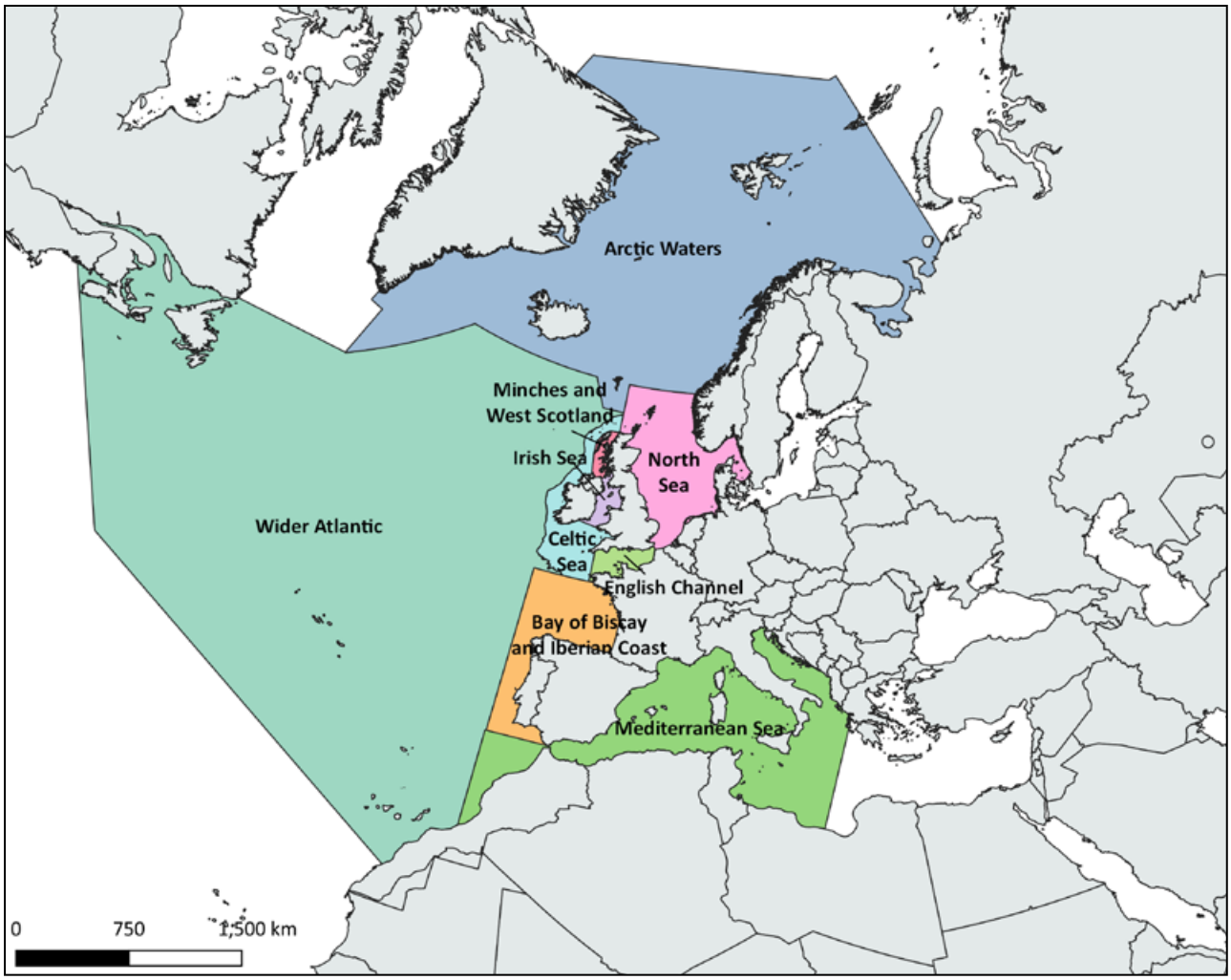


Figure 1: Sea regions regularly surveyed by ORCA

Table 1: Routes and sea regions surveyed by ORCA between 2006 and 2023

Sea Region	Route	Years Active	Company
North Sea	Newcastle-IJmuiden	2009, 2011-2019, 2023	DFDS
	Newcastle-Bergen	2006-2008	DFDS
	Harwich-Esbjerg	2008-2014	DFDS
	Immingham-Gothernburg-Brevik	2015	DFDS
	Aberdeen-Lerwick	2016-2019, 2023	NorthLink Ferries
	Various cruises	2006, 2009-2019, 2021-2023	Ambassador Cruise Line, Cunard, Fred. Olsen Cruise Lines, HX, P&O Cruises, Saga, Silversea
English Channel	Plymouth-Roscoff	2014-2019, 2022-2023	Brittany Ferries
	Plymouth-Roscoff-Cork	2017	Brittany Ferries
	Portsmouth-Caen	2014-2019, 2022-2023	Brittany Ferries
	Poole-Cherbourg	2017-2019, 2022-2023	Brittany Ferries
	Dover-Calais	2016-2020, 2023	DFDS
	Portsmouth-Fishbourne	2015-2019	Wightlink
	Lymington-Yarmouth	2015	Wightlink
	Southampton-Cowes	2016-2019	Red Funnel
	Newhaven-Dieppe	2023	DFDS
	Various cruises	2007, 2010-2019, 2021-2023	Ambassador Cruise Line, Fred. Olsen Cruise Lines, HX, P&O Cruises, Saga, Silversea
Celtic Sea	Penzance-St Mary's	2009-2019, 2022-2023	Isles of Scilly Travel
	Various cruises	2007, 2009-2019, 2021-2023	Ambassador Cruise Line, Fred. Olsen Cruise Lines, HX, P&O Cruises, Saga, Silversea
Irish Sea	Heysham-Douglas	2011-2013, 2015-2016	Isle of Man Steam Packet Company
	Various cruises	2008-2019, 2021-2023	Ambassador Cruise Line, Fred. Olsen Cruise Lines, HX, Saga, Silversea
Minches and West Scotland	Ullapool-Stornoway	2017-2019, 2022-2023	Caledonian MacBrayne
	Oban-Castlebay	2017-2019, 2022-2023	Caledonian MacBrayne
	Oban-Coll-Tiree-Colonsay	2017-2019, 2022-2023	Caledonian MacBrayne
	Uig-Lochmaddy-Tarbert	2019, 2022-2023	Caledonian MacBrayne
	Ardrossan-Campbeltown	2019, 2022-2023	Caledonian MacBrayne
	Various cruises	2009-2019, 2021-2023	Ambassador Cruise Line, Fred. Olsen Cruise Line, HX, P&O Cruises, Saga
Bay of Biscay and Iberian Coast	Plymouth-Santander	2006-2008, 2022-2023	Brittany Ferries
	Plymouth-Santander-Portsmouth	2009-2019	Brittany Ferries
	Various cruises	2007, 2010-2011, 2013, 2015-2019, 2021-2023	Ambassador Cruise Line, Cunard, Fred. Olsen Cruise Lines, HX, Noble Caledonia, Oceanwide Expeditions, P&O Cruises, Saga, Silversea

Table 1: Routes and sea regions surveyed by ORCA between 2006 and 2023

Arctic Waters	Various cruises	2006,2009, 2011-2012,2014-2019, 2021-2023	Ambassador Cruise Line, Cunard, Fred. Olsen Cruise Lines, HX, Noble Caledonia, Oceanwide Expeditions, P&O Cruises, Saga, Silversea
Wider Atlantic Ocean	Various cruises	2008, 2011-2012, 2014-2019, 2021-2023	Ambassador Cruise Line, Explora Journeys, Fred. Olsen Cruise Lines, HX, P&O Cruises, Saga
Mediterranean Sea	Various cruises	2007-2008, 2010-2012, 2015-2019, 2021-2023	Celebrity Cruises, Crystal Cruises, HX, Noble Caledonia, Silversea
North Pacific Ocean	Various cruises	2018-2019, 2022-2023	Celebrity Cruises, Crystal Cruises, HX, Noble Caledonia, Silversea
South Atlantic Ocean	Various cruises	2019, 2022-2023	Celebrity Cruises, HX, Oceanwide Expeditions, Ponant
South Pacific Ocean	Various cruises	2023	Celebrity Cruises
Southern Ocean	Various cruises	2019, 2021-2023	Albatros Expeditions, Atlas Ocean Voyages, Celebrity Cruises, Crystal Cruises, HX

Ocean Conservationist

Table 2: Total number of sightings and number of individuals (shown in brackets) recorded per species since 2006

Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023	Total no. of sightings	Total no. of animals
Dall's porpoise (*Phocoenoides dalli*)													18 (45)	160 (625)	26 (119)		204	789
Harbour porpoise (*Phocoena phocoena*)	75 (155)	61 (121)	60 (116)	76 (146)	83 (170)	175 (362)	199 (349)	271 (498)	681 (1,489)	483 (1,512)	671 (1,405)	541 (867)	702 (1,635)	1,213 (3,044)	849 (2,134)	1,517 (3,091)	7,657	17,094
Atlantic spotted dolphin (*Stenella frontalis*)												17 (730)	12 (71)	8 (107)	30 (525)	34 (489)	101	1,922
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	1 (4)	1 (5)				2 (10)	1 (100)	1 (3)	3 (14)	6 (34)	2 (6)	6 (19)	2 (28)	8 (50)	25 (337)	17 (168)	75	778
Bottlenose dolphin (*Tursiops truncatus*)	8 (77)	9 (122)	18 (118)	18 (147)	8 (74)	33 (150)	12 (127)	24 (143)	81 (550)	75 (907)	92 (563)	115 (664)	118 (708)	163 (829)	111 (663)	197 (1,143)	1,082	6,985
Commerson's dolphin (*Cephalorhynchus commersonii*)													1 (2)	3 (38)	26 (88)	5 (15)	35	143
Common dolphin (*Delphinus delphis*)	26 (424)	64 (709)	59 (459)	55 (1,219)	105 (4,135)	143 (5,581)	100 (3,635)	204 (3,253)	848 (11,787)	1,251 (21,242)	1,310 (13,391)	1,565 (17,355)	1,378 (10,848)	1,503 (15,114)	1,816 (14,664)	3,415 (23,205)	13,842	146,971
Dusky dolphin (*Lagenorhynchus obscurus*)													4 (14)		11 (83)	12 (125)	27	222
False killer whale (*Pseudorca crassidens*)	1 (23)											2 (11)	1 (5)			3 (41)	7	80
Fraser's dolphin (*Lagenorhynchus hosei*)														1 (20)			1	20
Hourglass dolphin (*Lagenorhynchus cruciger*)															8 (105)	1 (3)	9	108
Northern right whale dolphin (*Lissodelphis borealis*)													6 (44)				6	44
Orca (*Orcinus orca*)	1 (1)		1 (1)	1 (1)		2 (18)	4 (10)	2 (5)	11 (100)	9 (54)	13 (64)	4 (22)	13 (15)	27 (91)	42 (236)	42 (243)	172	861
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)													12 (158)	39 (482)	8 (70)		59	710
Long-finned pilot whale (*Globicephala melas*)	2 (8)	13 (207)	7 (53)	9 (169)		6 (39)	20 (175)	2 (2)	28 (207)	34 (728)	16 (166)	25 (259)	7 (36)	37 (381)	28 (196)	84 (777)	318	3,403
Short-finned pilot whale (*Globicephala macrorhynchus*)									2 (14)	3 (18)	2 (20)	3 (16)	3 (8)	1 (11)	3 (14)	25 (150)	42	251
Peale's dolphin (*Lagenorhynchus australis*)													13 (49)	6 (26)	5 (22)	11 (41)	35	138
Pantropical spotted dolphin (*Stenella attenuata*)																2 (119)	2	119
Risso's dolphin (*Grampus griseus*)	1 (1)	2 (17)	1 (3)	2 (9)	1 (5)	5 (12)	4 (23)	6 (3)	13 (33)	10 (47)	15 (94)	28 (116)	21 (82)	15 (61)	23 (86)	58 (246)	205	838
Rough-toothed dolphin (*Steno bredanensis*)												1 (2)			1 (10)		2	12
Spinner dolphin (*Stenella longirostris*)															1 (6)		1	6
Striped dolphin (*Stenella coeruleoalba*)	4 (65)	6 (87)	9 (97)	13 (417)	13 (155)	27 (1035)	16 (515)	23 (206)	88 (942)	138 (2,160)	168 (1,579)	189 (2,285)	131 (1,917)	155 (2,010)	126 (1,523)	239 (2,701)	1,345	17,694
White-beaked dolphin (*Lagenorhynchus albirostris*)	4 (12)	11 (61)	3 (9)	3 (5)	1 (1)	28 (184)	19 (67)	46 (281)	79 (686)	21 (168)	54 (461)	43 (228)	70 (832)	64 (292)	112 (1,259)	186 (1,146)	744	5,692
Arnoux's beaked whale (*Berardius arnuxii*)																1 (3)	1	3
Blainville's beaked whale (*Mesoplodon densirostris*)															1 (4)	1 (3)	2	7
Cuvier's beaked whale (*Ziphius cavirostris*)	2 (2)	2 (4)	3 (6)	8 (17)	3 (14)	10 (20)	12 (28)	6 (14)	64 (140)	75 (164)	53 (101)	51 (103)	65 (121)	72 (147)	23 (46)	61 (105)	510	1,032
Northern bottlenose whale (*Hyperoodon ampullatus*)	10 (17)	2 (4)	3 (6)		2 (6)	1 (2)	1 (2)		5 (12)	8 (38)	1 (7)	7 (34)	3 (20)	10 (20)	8 (36)	18 (56)	79	260
Sowerby's beaked whale (*Mesoplodon bidens*)		1 (3)			1 (3)	1 (9)	2 (5)	1 (2)	2 (10)	2 (4)	2 (7)	3 (10)		9 (29)	5 (11)	7 (18)	36	111
True's beaked whale (*Mesoplodon mirus*)		1 (3)								1 (3)			1 (2)				3	8
Strap-toothed beaked whale (*Mesoplodon layardii*)																1 (7)	1	7
Sperm whale (*Physeter macrocephalus*)	3 (3)	3 (4)	2 (2)	7 (8)	5 (14)	8 (20)	2 (2)	14 (21)	11 (27)	13 (48)	15 (38)	42 (68)	9 (12)	28 (42)	71 (112)	59 (113)	292	534
Beluga (*Delphinapterus leucas*)							6 (33)			3 (1)	2 (6)		9 (21)	46 (200)	12 (226)	10 (122)	88	609
Narwhal (*Monodon monoceros*)															1 (10)		1	10
Antarctic minke whale (*Balaenoptera bonaerensis*)														19 (34)	4 (4)	9 (10)	32	48
Blue whale (*Balaenoptera musculus*)							3 (4)	4 (10)	3 (4)	1 (1)	13 (26)	1 (1)	3 (5)	21 (32)	21 (40)	18 (28)	88	151
Bowhead whale (*Balaena mysticetus*)														1 (1)		4 (5)	5	6
Bryde's whale (*Balaenoptera brydei*)											1 (1)						1	1
Fin whale (*Balaenoptera physalus*)	6 (10)	14 (19)	74 (134)	11 (19)	6 (9)	42 (52)	27 (41)	28 (50)	120 (163)	202 (281)	252 (384)	204 (297)	397 (753)	512 (815)	348 (675)	453 (732)	2,696	4,434
Gray whale (*Eschrichtius robustus*)														2 (2)		1 (3)	3	5
Humpback whale (*Megaptera novaeangliae*)					1 (1)	3 (11)	2 (4)	11 (25)	31 (47)	25 (65)	32 (43)	82 (127)	19 (27)	397 (874)	379 (819)	328 (638)	1,310	2,681
Minke whale (*Balaenoptera acutorostrata*)	6 (6)	9 (8)	9 (10)	14 (15)	16 (19)	36 (40)	44 (70)	39 (44)	143 (162)	86 (92)	95 (113)	119 (132)	153 (171)	251 (364)	218 (330)	647 (773)	1,885	2,349
North Atlantic right whale (*Eubalaena glacialis*)												1 (1)				1 (1)	2	2
Sei whale (*Balaenoptera borealis*)		1 (3)			1 (3)		2 (3)	2 (4)	9 (10)	1 (3)	6 (10)	21 (23)	19 (31)	27 (36)	23 (32)	50 (125)	162	283
Southern right whale (*Eubalaena australis*)															2 (2)	3 (3)	5	5
Total no. of sightings/individuals	150 (808)	200 (1,377)	249 (1,014)	217 (2,172)	246 (4,609)	522 (7,545)	476 (5,193)	684 (4,564)	2,222 (16,347)	2,447 (27,570)	2,815 (18,485)	3,079 (23,370)	3,190 (17,660)	4,798 (25,777)	4,367 (24,487)	7,520 (36,448)	**Total: 33,173**	**(217,426)**
Total no. of species	15	16	14	13	14	16	19	17	18	20	20	24	29	29	35	35	**Total: 44**	

Protecting Vulnerable Populations

A fundamental question in wildlife management is how many animals are there? Are numbers going up, down or staying stable? In most cases, a complete comprehensive count of all individuals in a population is not feasible, so other methods are required to get at least an idea of abundance. Distance sampling uses information about the decreasing probability of detecting animals with increasing distance from the observer to correct for missed animals and is a popular method for estimating cetacean abundance (Kaschner *et al.* 2012).


Humpback whale - Terry Carne

Carrying out these types of surveys at sea is expensive and logistically challenging, so purpose-designed surveys are limited in space and time and consequently, the ability to detect trends in abundance is hampered (Taylor *et al.* 2007, Kaschner *et al.* 2012). Using platforms of opportunity such as ferries and cruise ships is a cost effective way to increase temporal coverage of surveys (MacLeod *et al.* 2009). It is also useful to get an idea of trends in abundance through repeated surveys along the same route. Ferry routes, which are relatively fixed, can be used to get an idea of changes over time at a finer resolution than can be achieved with purpose designed surveys (Robbins *et al.* 2020, Tepsich *et al.* 2020).

Dedicated distance sampling surveys

ORCA has conducted distance sampling surveys since 2006, resulting in a long time series of data which provides insight into changes in cetacean densities over time. In this section, the findings from the 2023 ferry-based distance sampling surveys are examined and the emerging trends and patterns observed over the last six years described.

Distance surveyed (effort)

Between March and November in 2023, ORCA conducted 97 surveys across 14 ferry routes (Figure 2). A total of 20,011 km of survey effort was achieved (Table 3). This year, three routes were surveyed for the first time since 2019 (Aberdeen-Lerwick, Dover-Calais, Newcastle-IJmuiden) and an additional two routes were surveyed for the very first time (Mallaig-Lochboisdale, Newhaven-Dieppe) (Table 3).

Table 3: Survey effort in kilometres by distance sampling survey route and year. Solid grey cells indicate years that a route was not surveyed. * indicates new survey routes in 2023

Survey route	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Newcastle-Bergen	8,389	7,522	7,204																23,115
Plymouth-Santander	2,115	3,536	4,453														4,388	5,284	19,776
Harwich-Esbjerg			333	1,770	163	2,544	2,882	2,903	6,168										16,763
Plymouth-Santander-Portsmouth				5,459	4,970	5,692	4,959	4,294	5,270	4,650	3,897	6,430	5,911	3,686					55,218
Newcastle-Umuiden				704		1,855	2,210	4,087	7,532	4,706	4,107	7,282	3,612	3,920				1,243	41,258
Penzance-St Mary's				512	1,622	1,364	1,521	1,686	1,878	2,018	1,820	4,771	2,937	2,027			1,593	1,766	25,515
Heysham-Port Douglas						588	331	257		498	1,219								2,893
Plymouth-Roscoff									1,420	1,123	1,034	2,708	1,184	1,339			1,064	1,321	11,193
Portsmouth-Caen									212	1,462	1,694	2,912	1,767	2,429			2,081	2,460	15,017
Immingham-Gothenburg-Brevik										4,297									4,297
Lymington-Yarmouth										45									45
Portsmouth-Fishbourne										95	110	69	57	57					388
Dover-Calais										95	110	69	57	57				556	944
Aberdeen-Lerwick											916	2,109	2,632	1,971				1,952	9,580
Southampton-Cowes											111	50	67	67					295
Plymouth-Roscoff-Cork												385							385
Poole-Cherbourg												891	983	1,481			1,424	990	5,769
Oban-Castlebay												210	1,171	1,682			734	1,391	5,188
Oban-Coll-Tiree-Colonsay												122	1,003	869			380	1,113	3,487
Ullapool-Stornoway																		525	525
Uig-Lochmaddy-Tarbert														839			337	634	1,810
Ardrossan-Campbeltown														348			321		669
Mallaig-Lochboisdale*																		159	159
Newhaven-Dieppe*																		618	618
Total		11,058	11,990	8,445	6,755	12,043	11,903	13,227	22,480	18,989	15,018	28,008	21,381	20,772	0	0	12,322	20,011	234,402

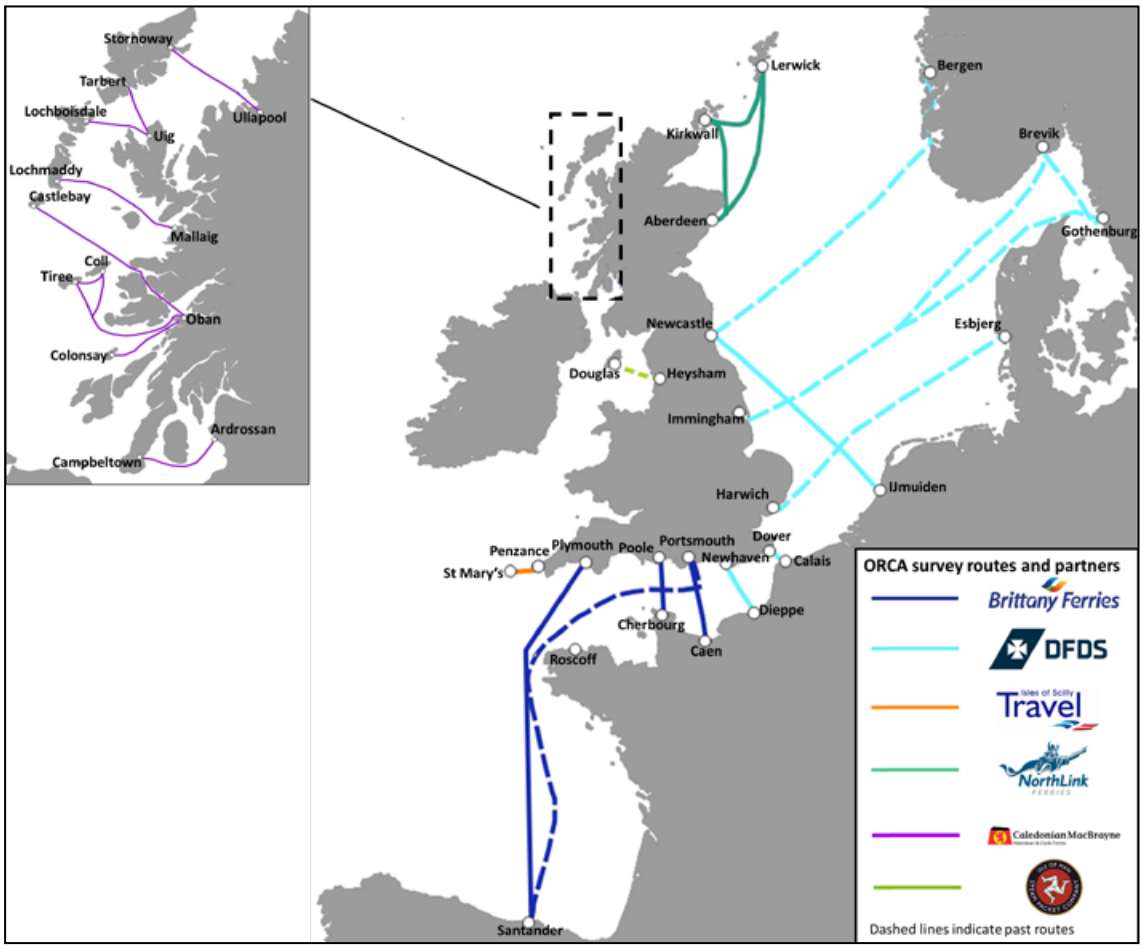


Figure 2: Ferry routes surveyed by ORCA using distance sampling methodologies

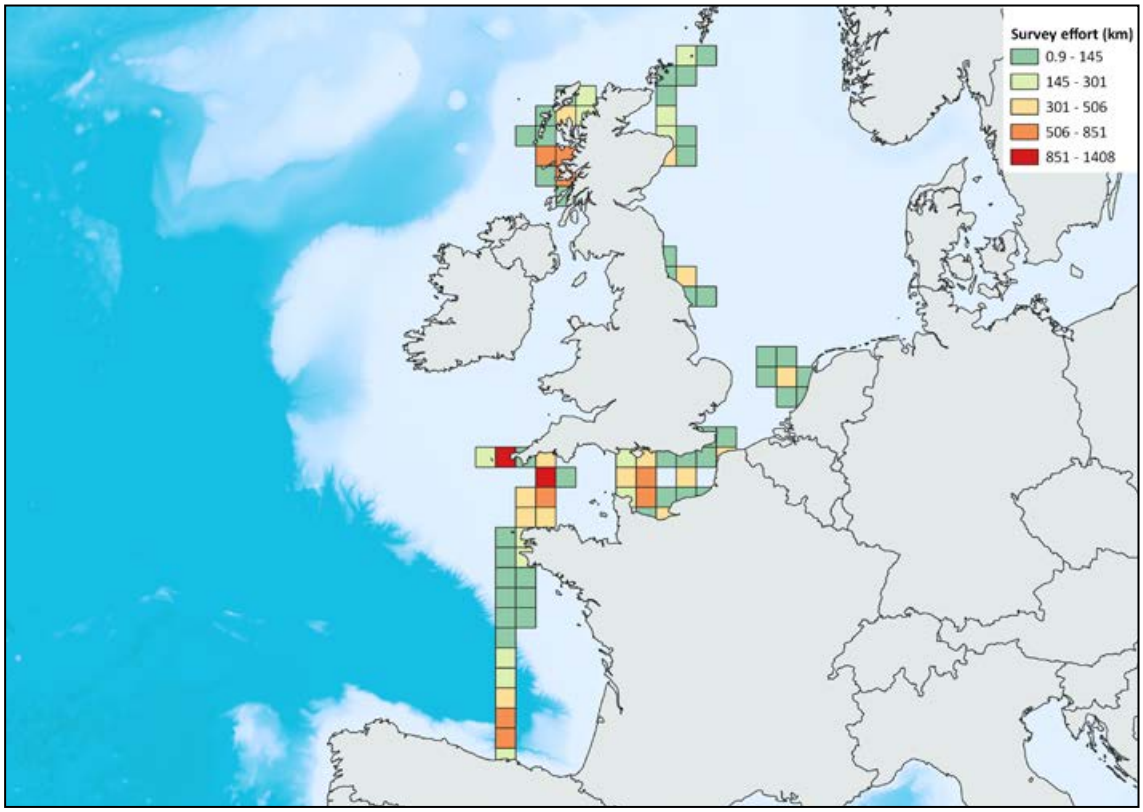


Figure 3: Distance sampling survey effort in kilometres per 50 km^2 grid cell in 2023. Warmer colours indicate higher survey effort

The spatial distribution of survey effort in 2023 is shown in Figure 3. The central portion of the Penzance-St Mary's route and an area just offshore from Plymouth on the Plymouth-Santander and Plymouth-Roscoff routes saw the highest survey effort in 2023. Survey effort was also relatively high in the central English Channel (Poole-Cherbourg and Portsmouth-Caen routes), the southern half of the Plymouth-Roscoff route in the Western Approaches and on the approach to Santander on the Plymouth-Santander route.

Sea state is one of the main environmental factors affecting the detectability of cetaceans (Barlow *et al.* 2001) so it is important to consider how much effort was achieved in 'good' sea states. The impact of sea state varies depending on species, with the detectability being more affected at lower sea states for less conspicuous species such as harbour porpoise and beaked whales. Larger and more noticeable species such as groups of breaching dolphins and large whales are easier to detect at higher sea states (Barlow 2015). The typically higher observation height of the ferries used as observation platforms here could mitigate the effect of sea state to some degree (MacLeod *et al.* 2009). The amount of effort achieved by sea state is shown in Figure 4. Using platforms of opportunity limits the ability to plan survey effort in order to take advantage of good conditions, so little effort was achieved in ideal conditions (sea state 0). However, the majority was achieved in sea states <3 (Figure 4).

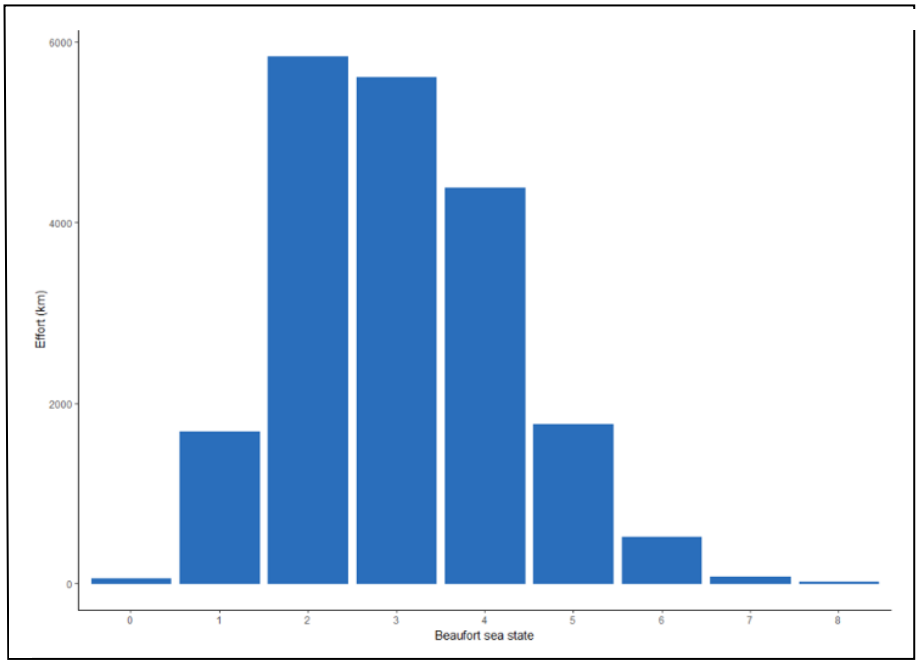


Figure 4: Survey effort in kilometres per Beaufort sea state category in 2023

Sightings

In 2023, 896 sightings of 4,292 individual animals were recorded (Table 4). See Box 1 for details on the distinction between sightings and the number of individual animals. Plymouth-Santander saw the most sightings in 2023, 276 sightings of 1,920 animals. Sightings were also high on the Penzance-St Mary's route, 155 sightings of 624 individuals and the Oban-Castlebay route, 140 sightings of 581 animals. Common dolphin was the most sighted species this year with 439 sightings of 3,209 individuals. This year also saw a marked increase in Risso's dolphin sightings on some routes which is discussed in more detail below. Trends for other regularly sighted species are also discussed below. Other notable sightings included a humpback whale in the Hebrides and two sightings of sei whales in the Bay of Biscay.

Box 1: The distinction between sightings and number of animals

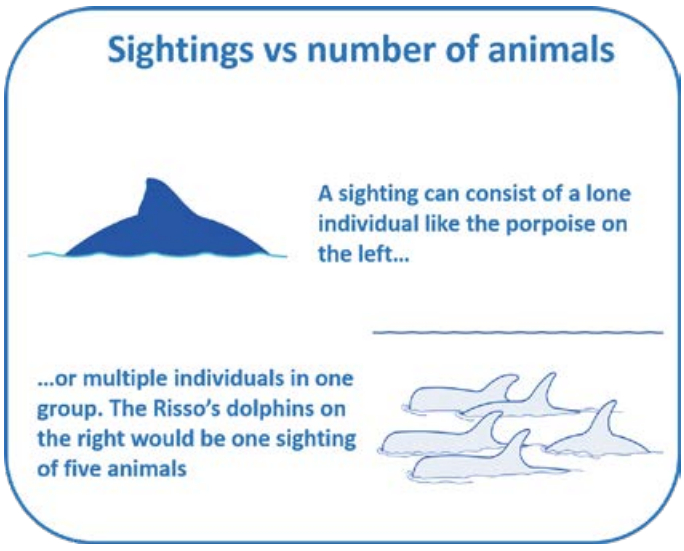


Table 4: Number of sightings and number of individuals (shown in brackets) per species and survey route in 2023

Survey route	Aberdeen-Lerwick	Dover-Calais	Mallaig-Lochboisdale	Newhaven-Dieppe	Newcastle-Ijmuiden	Oban-Castlebay	Oban-Coll-Tiree-Colonsay	Plymouth-Roscoff	Plymouth-Santander	Portsmouth-Caen	Poole-Cherbourg	Penzance-St Mary's	Uig-Lochmaddy-Tarbert	Ullapool-Stornoway	TOTAL
Species															
Harbour porpoise (*Phocoena phocoena*)	23 *(34)*	10 *(16)*	-	-	33 *(60)*	31 *(57)*	18 *(27)*	-	2 *(4)*	-	-	21 *(57)*	3 *(15)*	10 *(25)*	151 *(295)*
Bottlenose dolphin (*Tursiops truncatus*)	7 *(22)*	-	-	1 *(4)*	-	11 *(50)*	1 *(1)*	1 *(2)*	13 *(57)*	2 *(18)*	-	4 *(8)*	-	-	40 *(162)*
Common dolphin (*Delphinus delphis*)	2 *(5)*	-	4 *(86)*	-	-	50 *(405)*	26 *(159)*	53 *(352)*	171 *(1,556)*	3 *(7)*	2 *(3)*	96 *(494)*	9 *(36)*	23 *(106)*	439 *(3,209)*
Long-finned pilot whale (*Globicephala melas*)	-	-	-	-	-	-	-	-	1 *(4)*	-	-	-	-	-	1 *(4)*
Risso's dolphin (*Grampus griseus*)	1 *(7)*	-		-	-	-	-	-	4 *(12)*	-	-	8 *(22)*	1 (3)	3 *(17)*	17 *(61)*
Striped dolphin (*Stenella coeruleoalba*)	-	-	-	-	-	-	-	-	9 *(115)*	-	-	-	-	-	9 *(115)*
White-beaked dolphin (*Lagenorhynchus albirostris*)	3 *(10)*	-	-	-	6 (22)	-	-	-	-	-	-	-	-	-	9 *(32)*
Unidentified dolphin	8 *(11)*	1 *(1)*		-	4 *(8)*	13 *(29)*	3 *(3)*	6 *(24)*	38 *(125)*	3 *(5)*	-	21 *(38)*	3 *(8)*	4 *(17)*	104 *(269)*
Cuvier's beaked whale (*Ziphius cavirostris*)	-	-	-	-	-	-	-	-	1 *(1)*	-	-	-	-	-	1 *(1)*
Unidentified beaked whale	-	-	-	-	-	1 *(2)*	-	-	1 *(1)*	-	-	-	-	-	2 *(3)*
Fin whale (*Balaenoptera physalus*)	-	-	-	-	-	-	-	-	11 *(17)*	-	-	-	-	1 *(1)*	12 *(18)*
Humpback whale (*Megaptera novaengliae*)	-	-	-	-	-	1 *(1)*	-	-	-	-	-	-	-	1 *(1)*	2 *(2)*
Minke whale (*Balaenoptera acutorostrata*)	5 *(5)*	1 *(1)*	-	-	9 *(9)*	25 *(29)*	7 *(7)*	-	3 *(4)*	-	-	5 *(5)*	3 (3)	10 *(12)*	68 *(75)*
Sei whale (*Balaenoptera borealis*)	-	-	-	-	-	-	-	-	2 *(4)*	-	-	-	-	-	2 *(4)*
Unidentified whale	2 *(2)*	-	-	-	-	5 *(5)*		1 *(1)*	15 *(5)*	-	-	-	-	5 *(5)*	28 *(28)*
Unidentified cetacean	-	-	-	-	-	3 *(3)*	-	-	5 *(5)*	1 *(1)*	-	-	-	2 *(5)*	11 *(14)*
Total	51 *(96)*	12 *(18)*	4 *(86)*	1 *(4)*	52 *(99)*	140 *(581)*	55 *(197)*	61 *(379)*	276 *(1,920)*	9 *(31)*	2 *(3)*	155 *(624)*	19 *(65)*	59 *(189)*	896 *(4,292)*

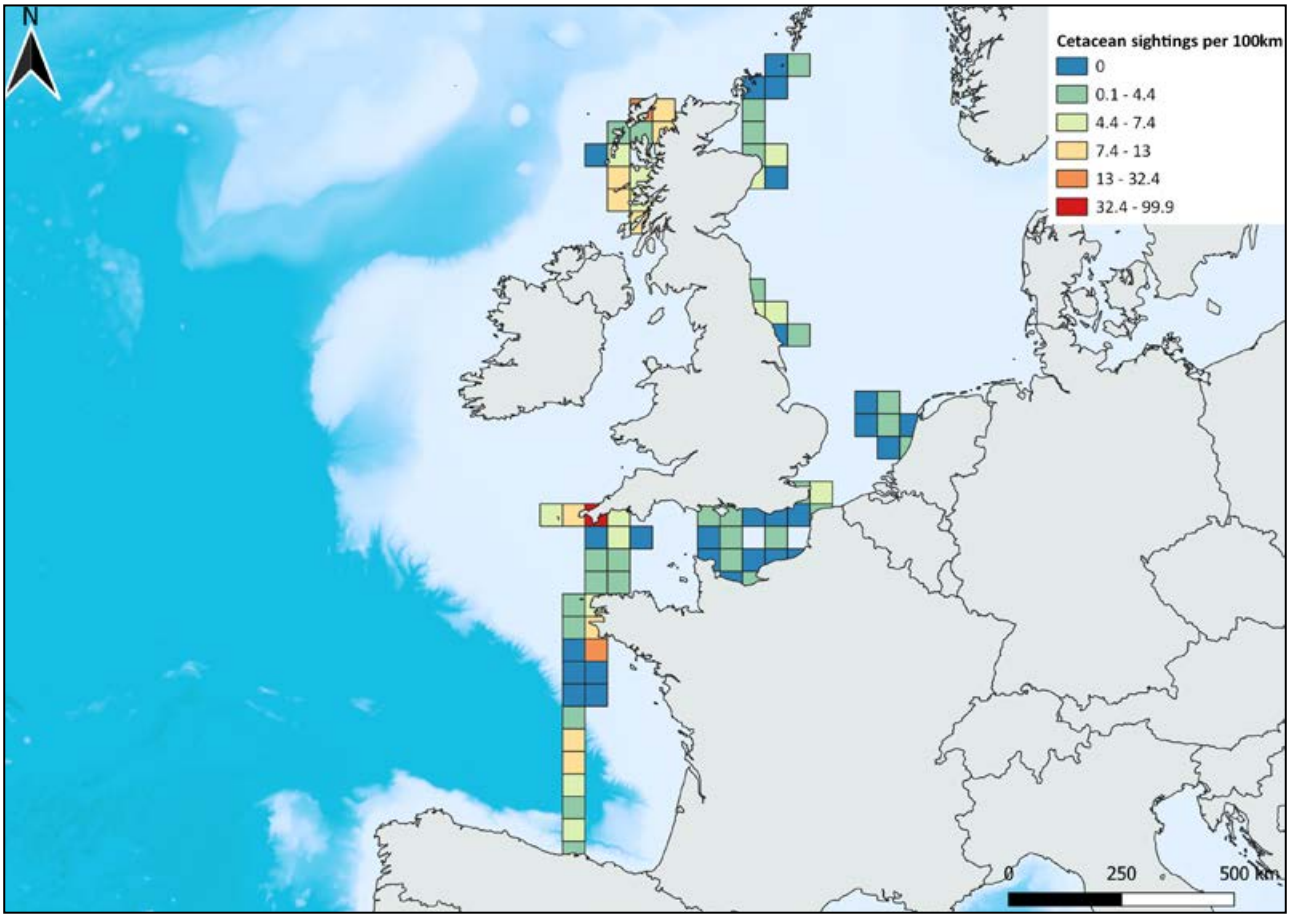


Figure 5: Overall cetacean sightings per 100 kilometres of ferry survey effort in each 50 km² grid cell in 2023. The warmer the colour, the higher the rate of sightings per kilometre

The highest rate of overall sightings per 100 km across species was on the Penzance side of the Penzance-St Mary's route, followed by the northwestern part of the Ullapool-Stornoway route in the Outer Hebrides. Sightings rates were also high off Brittany on the Plymouth-Santander route, the middle portion of the Penzance-St Mary's route and the southeast of the Hebrides (Oban-Castlebay and Oban-Coll-Tiree-Colonsay, Figure 5). In contrast to previous years, sightings were somewhat lower along the northern Spanish continental slope and canyons (ORCA 2023).

Striped dolphin underwater

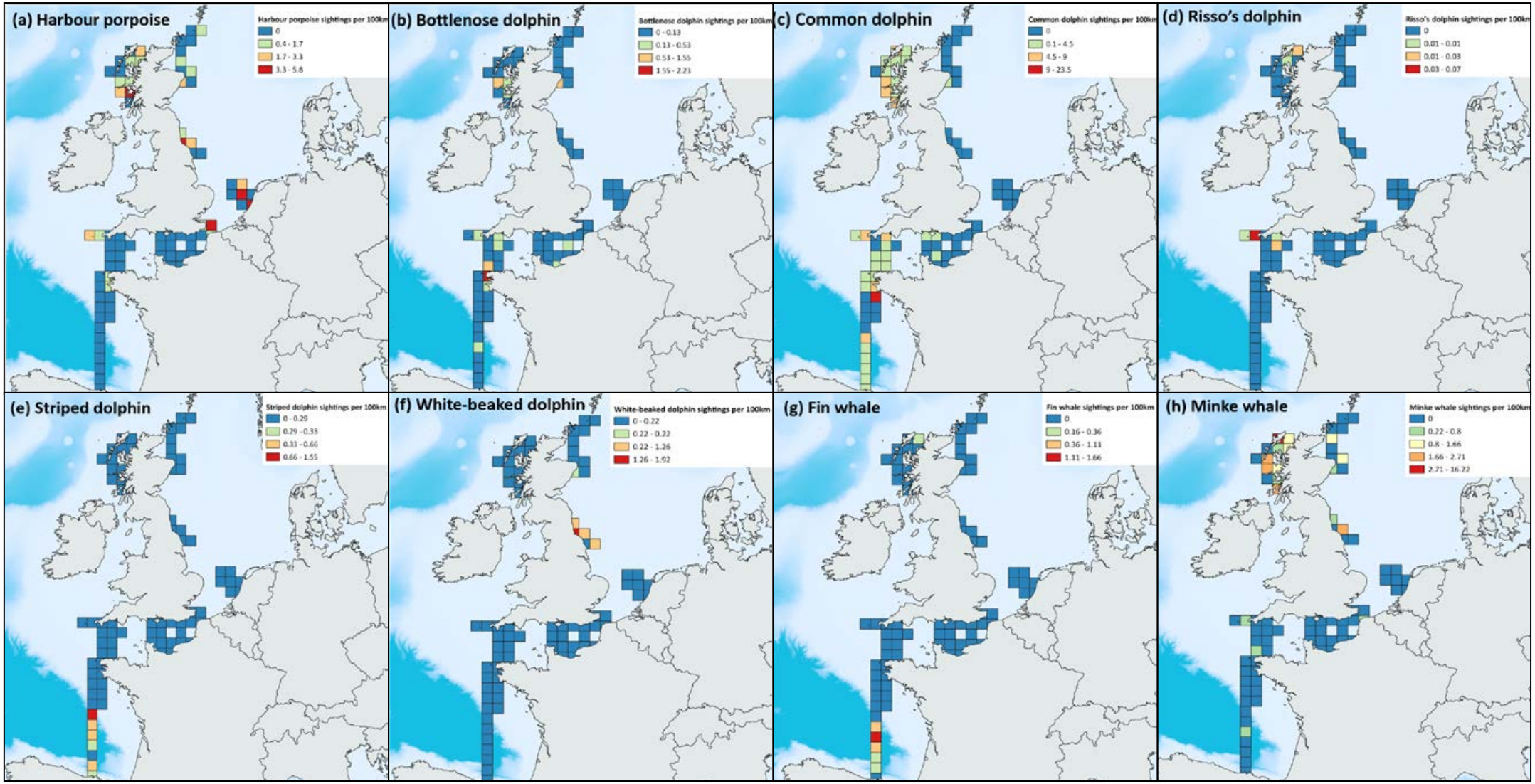


Figure 6: Sightings per 100 kilometres of effort in each 50 km^2 grid cell for commonly seen species during ferry surveys in 2023

Maps of the sightings rate per grid cell for commonly seen species are shown in Figure 6. High rates of harbour porpoise sightings were observed on both sides of the Newcastle-IJmuiden route and on the Dover-Calais route. Bottlenose dolphins were seen in the English Channel, the Hebrides and an especially high sightings rate was observed off Brittany. Common dolphins were widespread to the west of the UK and Europe and were especially prevalent in the southwest of the Hebrides, in the central part of the Penzance-St Mary's route and on the continental slope on the Plymouth-Santander route. The highest rate of Risso's dolphin sightings was observed on the Penzance side of the Penzance-St Mary's route, but sightings rates were also high approaching the Isle of Lewis on the Ullapool-Stornoway route and around Plymouth. Striped dolphin sightings rate was highest at the shelf edge on the Plymouth-Santander route while white-beaked dolphin sightings were concentrated on the northwest side of the Newcastle-IJmuiden route. Minke whales were most frequently seen on the northwestern side of the Newcastle-IJmuiden route and in the Hebrides, consistent with previous years. The northwest tip of Brittany and the Penzance-St Mary's route also saw relatively high sightings of minke whales. As expected, fin whales were mainly seen in the deeper waters of the Bay of Biscay on the Plymouth-Santander route, especially on the outer continental slope, but there was also a sighting in the Outer Hebrides on the Ullapool-Stornoway route.

While a different analysis is required to incorporate the effects of distance on detection (Buckland *et al.* 2001), sightings per unit effort can be used as a coarse measure of relative abundance pending further analysis (e.g. when comparing sightings between years). It is important to standardise the number of sightings by the amount of effort achieved as this can vary, for example if bad weather limits survey effort in one year compared to other years or if effort varies between routes due to differing lengths of the surveys.

Sightings rather than group size were used as the unit of analysis to make the figures more comparable between species with different group sizes, e.g. typically solitary whales and porpoises vs gregarious dolphins. Graphs showing the trend in encounter rate (number of sightings divided by 100 km of survey effort) for selected species since 2017 to facilitate comparison between routes with different starting years are shown below. The values have been scaled so they can be shown in one figure and values compared. This means that they have been transformed so that they are centred on zero and are not absolute values.

Pod of striped dolphins - Paul Soulby

Harbour porpoise

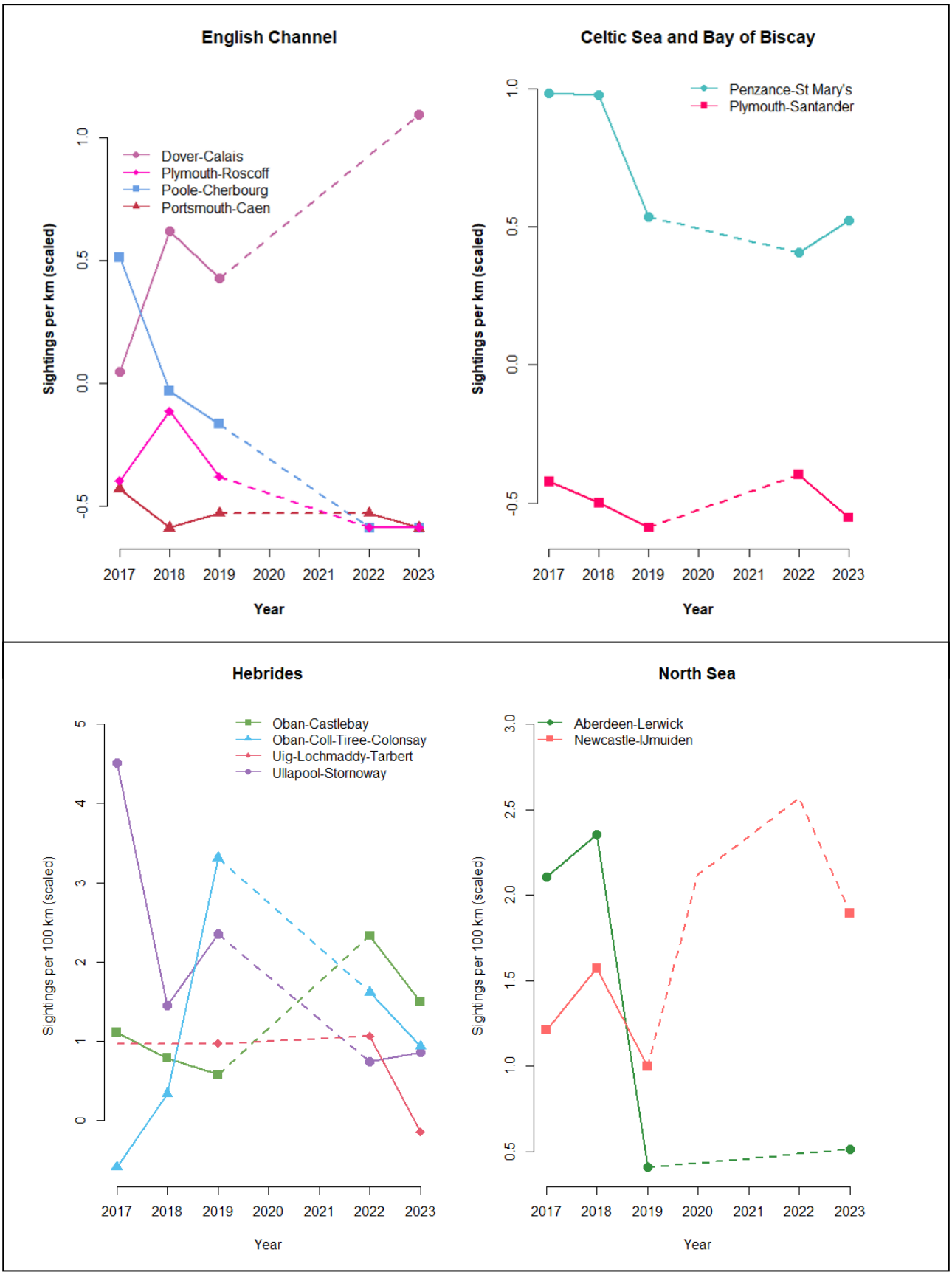


Figure 7: Harbour porpoise sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

Sightings rates of harbour porpoises have declined since 2017 on the Portsmouth-Caen route and since 2018 on the Plymouth-Roscoff route while sightings have remained low on the Poole-Cherbourg route. In contrast, the sightings rate on the Dover-Calais route has increased overall (Figure 7). As well as previous research using ORCA's distance sampling data (Nielsen *et al.* 2021), systematic surveys have also identified the Strait of Dover as being an area of high density for this species (Laran *et al.* 2017) which provides independent confirmation of this. The English Channel is subject to a multitude of threats including high levels of shipping which could affect porpoises and monitoring changes in density over time can help to mitigate their impact. Further monitoring will be required to see whether the decrease on some routes in the English Channel continues.

Overall harbour porpoise sightings were high on the Penzance-St Mary's route in 2023 (Table 3), and once standardised by effort, the sightings rate showed a small increase compared to 2022, albeit not to the same level as in 2017 and 2018 (Figure 7). Previous research using ORCA's distance sampling data has identified this area as having particularly high densities of this species and suggested that this was related to sea surface temperature and seabed slope (Nielsen *et al.* 2021). The rate of sightings may have been lower in 2022 due to weather conditions making porpoises difficult to spot even if present rather than a decline for other reasons.

Although the Plymouth-Santander route crosses the continental shelf before and after crossing deep water where harbour porpoises are less frequently seen, sightings rates have been low overall since 2017 with a small peak in 2022.

Harbour porpoise sightings rates on the routes in the Hebrides have fluctuated markedly since 2017 (Figure 7), but previous research indicates that harbour porpoise abundance in the Hebrides can vary substantially between years (Marubini *et al.* 2009, Booth *et al.* 2013). The sightings rate since 2017 has declined overall on the Ullapool-Stornoway route, but there was a slight increase in 2023 compared to 2022. Although the sighting rate of harbour porpoise decreased from 2022 on the Oban-Castlebay route, it was still relatively high in 2023 compared to pre-2022 levels. This route passess through the Sound of Mull, an area of the Hebrides which may provide good habitat for this species (Booth *et al.* 2013). Tidal processes interacting with the complex topography of the Hebrides may create profitable feeding areas for harbour porpoises which have high energetic requirements (Marubini *et al.* 2009). Conversely, sightings rates have decreased on the Oban-Coll-Tiree-Colonsay route since 2019.

Sighting rates were also high on the Newcastle-IJmuiden route and showed an increase since the last time this route was surveyed in 2019. Previous research using ORCA's data identified an increase in porpoise densities on both the northern and southern sides of this route over time (Nielsen *et al.* 2021) and this appears to have continued since 2017. Further north on the Aberdeen-Lerwick route, the sighting rate has remained low since 2019 when the sightings rate dropped precipitously. This region was identified as a high density area previously (Nielsen *et al.* 2021) and further monitoring will be necessary to see if this decrease continues and to understand why.

Monitoring densities of harbour porpoise is important as their nearshore habitats are disproportionately impacted by a range of threats that could negatively affect them, from vessel disturbance to energy installations to fisheries (Avila *et al.* 2019). Bycatch mortality is the main threat to harbour porpoises in Europe but there is also increasing concern about displacement from foraging habitats due to noise disturbance (Carlen *et al.* 2021).

Harbour porpoise pair - Elfyn Pugh

Bottlenose dolphin

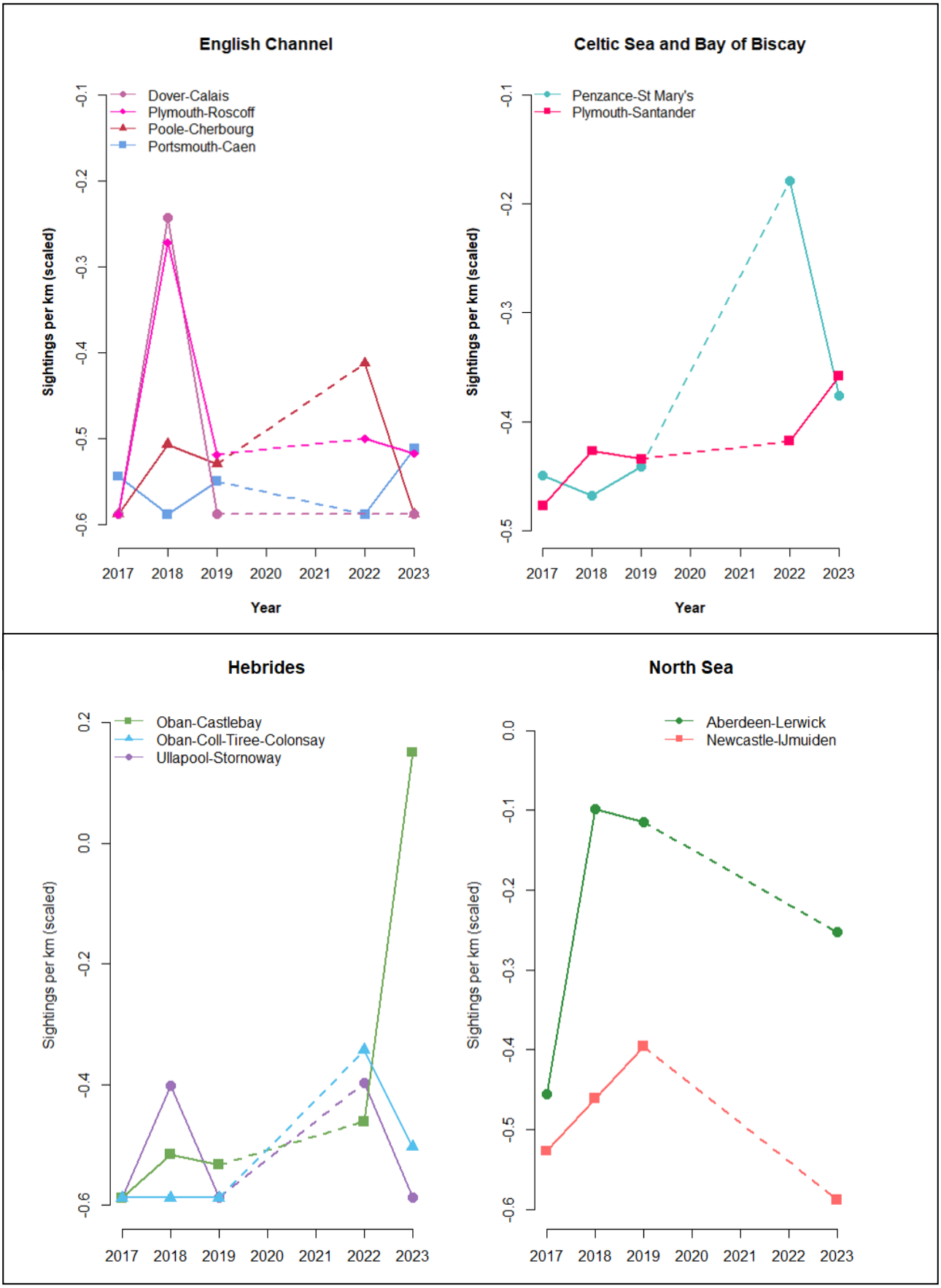
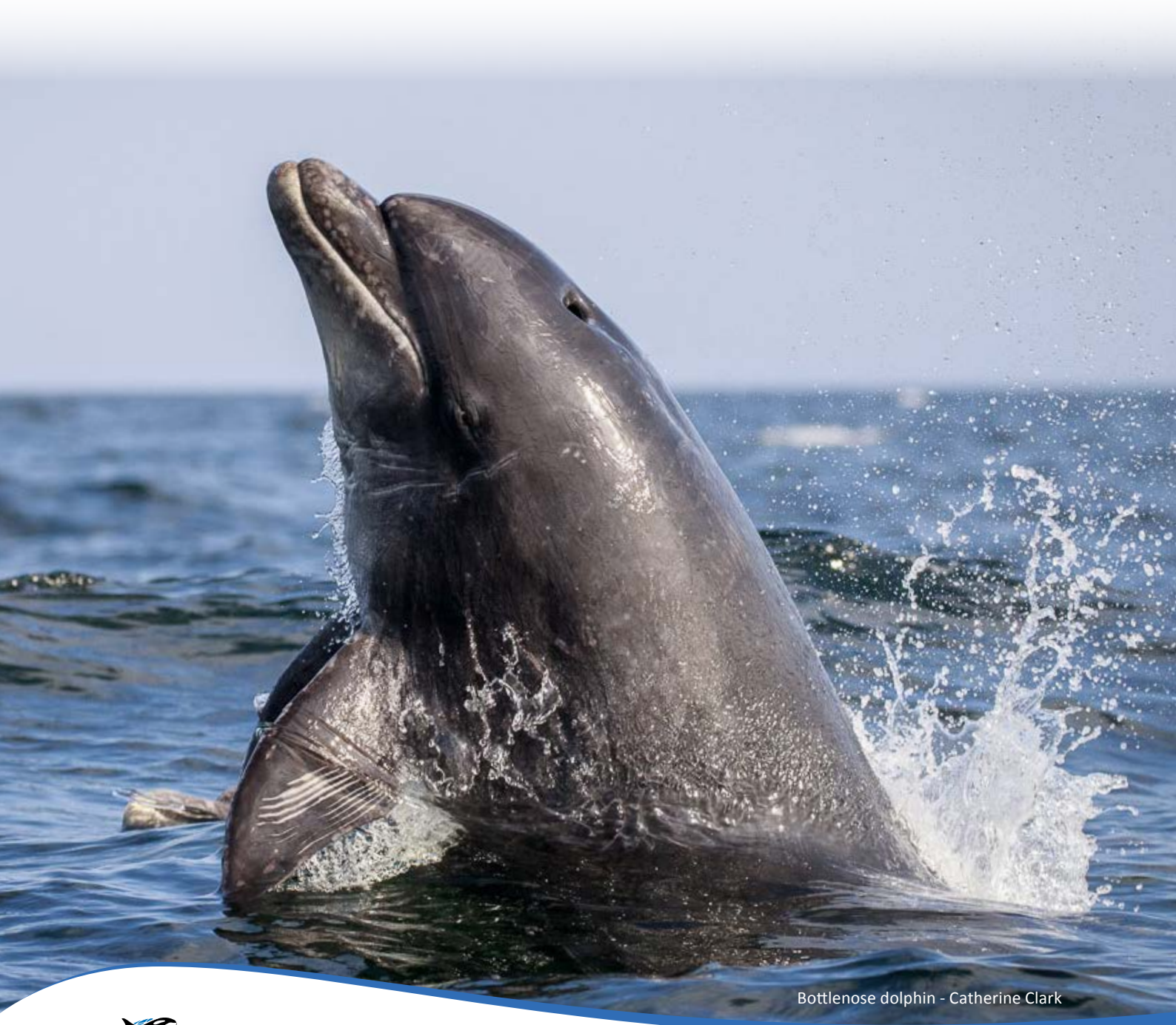


Figure 8: Bottlenose dolphin sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

Sightings rates of bottlenose dolphins declined in 2023 on the Poole-Cherbourg route and increased on the Portsmouth-Caen route (Figure 8). Bottlenose dolphin sightings also decreased on both of the North Sea routes since the last time these routes were surveyed in 2019. Coastal populations of bottlenose dolphins may in fact range widely (Robinson *et al.* 2012, Hoekendijk *et al.* 2021) so changes in the rate of sightings could reflect these movements rather than an actual increase or decline in the population. Sightings of this species have increased year on year since 2017 on the Plymouth-Santander route. In 2023, they were mostly seen in the Iroise Sea off Brittany (Figure 8) which is home to a coastal population (Louis *et al.* 2017).

It is also possible that bottlenose dolphin sightings in some areas reflect variations in the occurrence of more transient and less well understood offshore bottlenose dolphin populations. Dolphins from the offshore ecotype are known to occur in the Bay of Biscay where they aggregate on the outer shelf and continental slope to forage for deep water fish such as hake (Certain *et al.* 2008). It is not possible to definitively distinguish the two ecotypes from the data presented here, but it still provides insight into patterns at the species level.



Bottlenose dolphin - Catherine Clark

Common dolphin

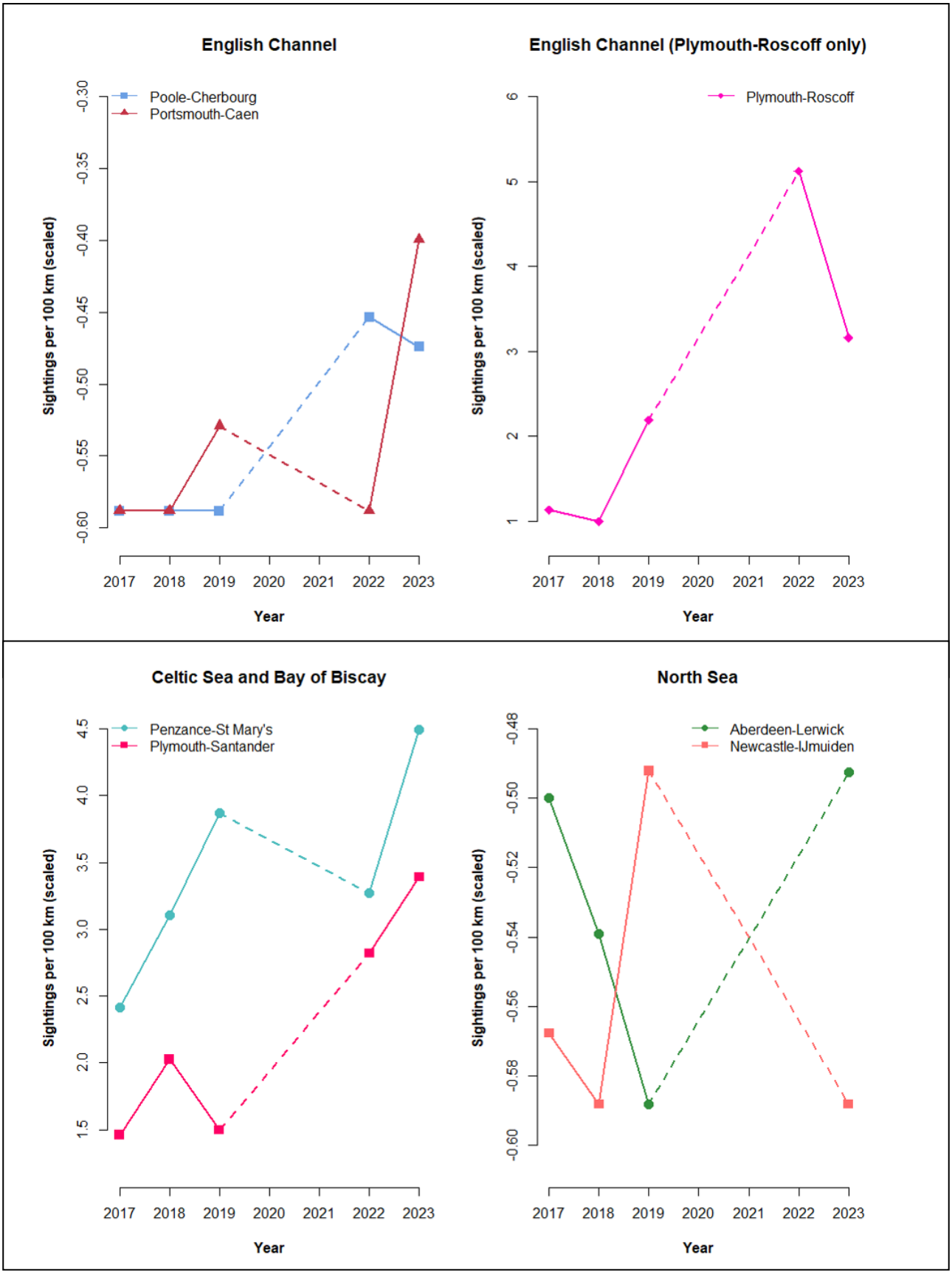


Figure 9: Common dolphin sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was availabl

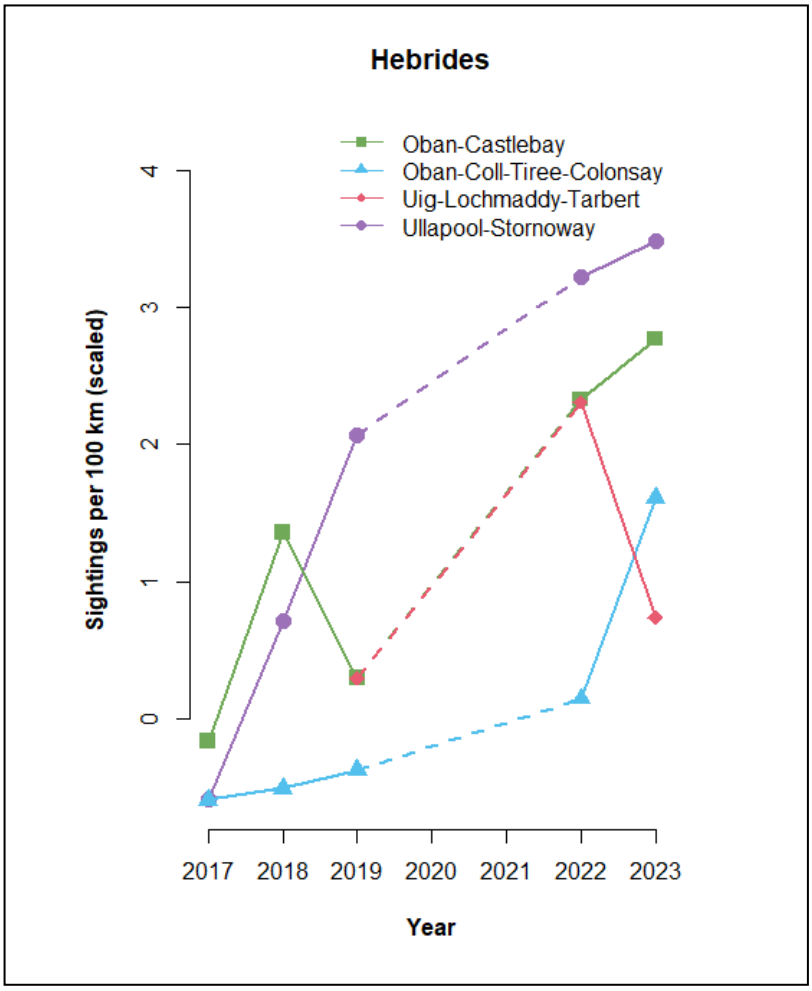


Figure 9: Common dolphin sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

Notably, although common dolphin sightings are infrequent in comparison to other routes, sightings rates have increased on the Portsmouth-Caen route in the English Channel (Figure 9). This is consistent with ORCA's previous research which suggested a small increase in the English Channel since 2006 (Robbins *et al.* 2020). Data from these routes were not included in that analysis which could provide independent evidence of this increase. Sightings of common dolphins increased year on year on the Plymouth-Roscoff route overall and despite a slight dip compared to 2022, the sighting rate remained high in 2023 (Figure 9).

Sighting rates of common dolphin remained high on the Penzance-St Mary's route in 2023 and increased compared to 2022. Previous ORCA research has demonstrated high densities of common dolphins on this route (Robbins *et al.* 2020) and this has continued in 2023. The highest sightings rate of common dolphins since 2017 was observed on the Plymouth-Santander route in 2023 (Figure 9).

As with harbour porpoises, monitoring changes in the density of common dolphins in areas with high fishing effort is vital. In the Celtic Sea and Bay of Biscay, thousands of common dolphins die each year due to being caught in fishing gear (Rouby *et al.* 2022). The Bay of Biscay has been identified as an area of high overlap between common dolphins and fisheries (Peltier *et al.* 2021) and common dolphin bycatch mortality remains high. Modelling suggests that the population of common dolphins in this area is declining faster than it is increasing and could eventually become extinct if bycatch remains high (Mannocci *et al.* 2012).

In January 2024 an emergency measure was adopted by France to ban fishing in the Bay of Biscay in an effort to protect dolphin populations from bycatch. The temporary month-long ban was in place from 22 January to 20 February 2024, covering the entire area of the Atlantic coastline, from Brittany to the Spanish border and applied to commercial fishing vessels longer than eight metres equipped with certain nets (pelagic trawl, bottom pair trawl, trammel net, set gill net) (Conseil d'Etat 2024). Although this is a step in the right direction to reduce dolphin bycatch mortality, in particular common dolphins, with only a four-week pause in high-risk fishing activities and exemptions in place, the timeframe of this ban needs to be extended and made permanent.

This highlights the importance of continuous monitoring in order to document changes in distribution and relative abundance to help inform bycatch mitigation measures. For example, ORCA research demonstrated a decrease in sightings in 2017 both on the Plymouth-Santander route and the Penzance-St Mary's route; a year of high bycatch mortality (Robbins *et al.* 2020, Rouby *et al.* 2022). This demonstrated that citizen science data can help to monitor the impact of bycatch at finer temporal scales.

Sightings of common dolphins also remained high on the Hebrides routes except for Uig-Lochmaddy-Tarbert where a decrease from 2022 was observed. The increase was particularly stark on the Oban-Castlebay route which saw the largest sightings rate since surveys on this route began in 2017 (Figure 9). A particularly large increase was also observed on the Oban-Coll-Tiree-Colonsay route in 2023.

On both of the North Sea routes, common dolphins continued to be recorded at low levels since 2017 (Figure 9). Sightings of this species in the North Sea are sporadic and are thought to be limited to the summer months (Reid *et al.* 2003) and this data is consistent with this. Further monitoring in the coming years could be important to establish if common dolphins expand their range into the North Sea.

Common dolphins - Madison Bowden-Parry

Risso's dolphin

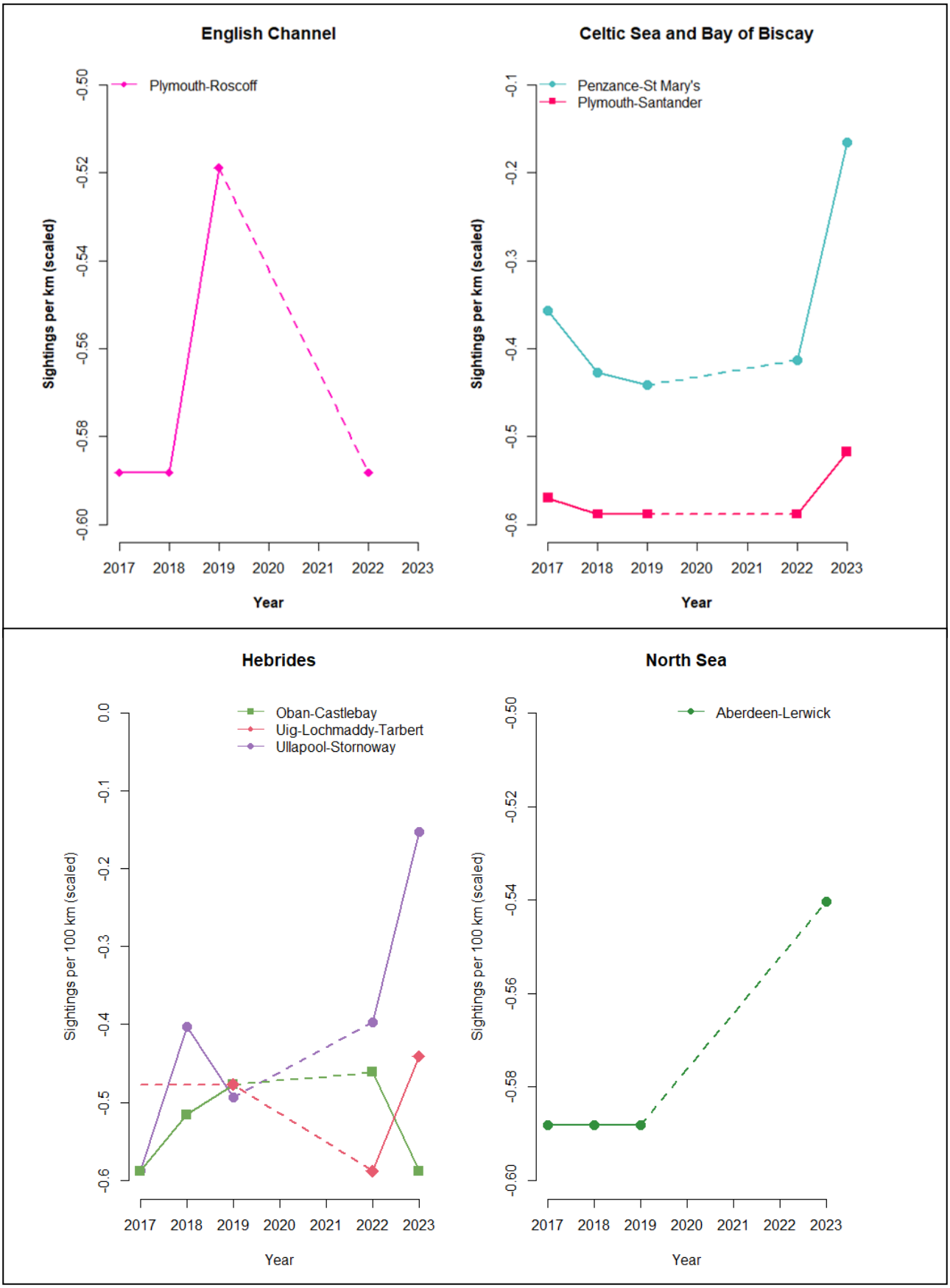


Figure 10: Risso's dolphin sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

Risso's dolphins were not observed on the Oban-Castlebay or Plymouth-Roscoff routes in 2023, but sightings increased on all other routes where this species has been recorded previously (Figure 10). This increase was particularly pronounced in the Western Approaches on the Penzance-St Mary's route and on the Ullapool-Stornoway route in the Minch, a known important site for this species (Weir *et al.* 2019). Evidence from photo identification suggests that Risso's dolphins range widely around the UK (de Boer *et al.* 2018, Weir *et al.* 2019), so changes could reflect movements in and out of different areas. Little is known about Risso's dolphins outside of a few studies on specific populations (Bearzi *et al.* 2011). This highlights the value of ORCA's ferry surveys for monitoring infrequently seen species such as Risso's dolphin. It is important to note that ORCA's current ferry survey coverage does not capture the Irish Sea where this species also occurs (Jefferson *et al.* 2014).


Risso's dolphin

Risso's dolphins mainly feed on cephalopods (MacLeod *et al.* 2014). The life history strategy of cephalopods combined with their sensitivity to environmental conditions means that their abundance can be extremely variable (Rodhouse *et al.* 2014). Therefore changes in the abundance of Risso's dolphins could reflect this. Cephalopod abundance is thought to be increasing (Doubleday *et al.* 2016) and in some areas such as in the North Sea this has been the case (Oesterwind *et al.* 2022). Therefore it will affect the occurrence and distribution of their predators. Further surveying will be necessary to see if the abundance of Risso's dolphins around northwest Europe increases as well. Changes in their distribution could alter the nature and intensity of threats they face and monitoring will help to inform management of these.

Striped dolphin

Striped dolphins were seen exclusively in the Bay of Biscay on the Plymouth-Santander route in 2023 (Figure 11). This is consistent with the known distribution of this species which is thought to prefer warmer, deeper water (Jefferson *et al.* 2015). However, sightings rates decreased from 2022 which saw the highest rate since 2017 (Figure 11). In the Bay of Biscay, striped dolphins are thought to target the deep scattering layer - deep water prey that migrate to the surface from the deep ocean at night (Ringlestein *et al.* 2006), although feeding in coastal areas has also been reported (Spitz *et al.* 2006).

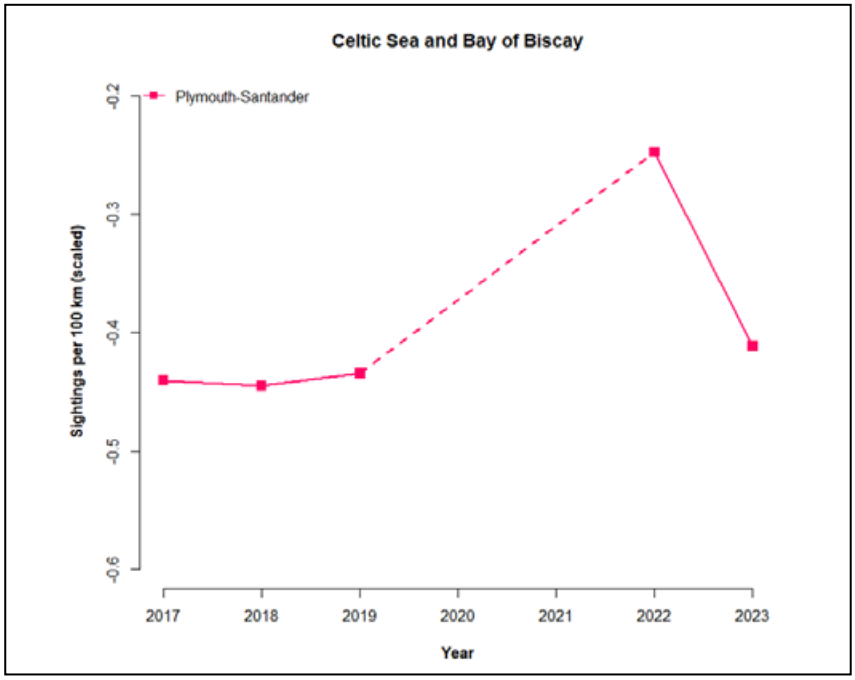


Figure 11: Striped dolphin sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

White-beaked dolphin

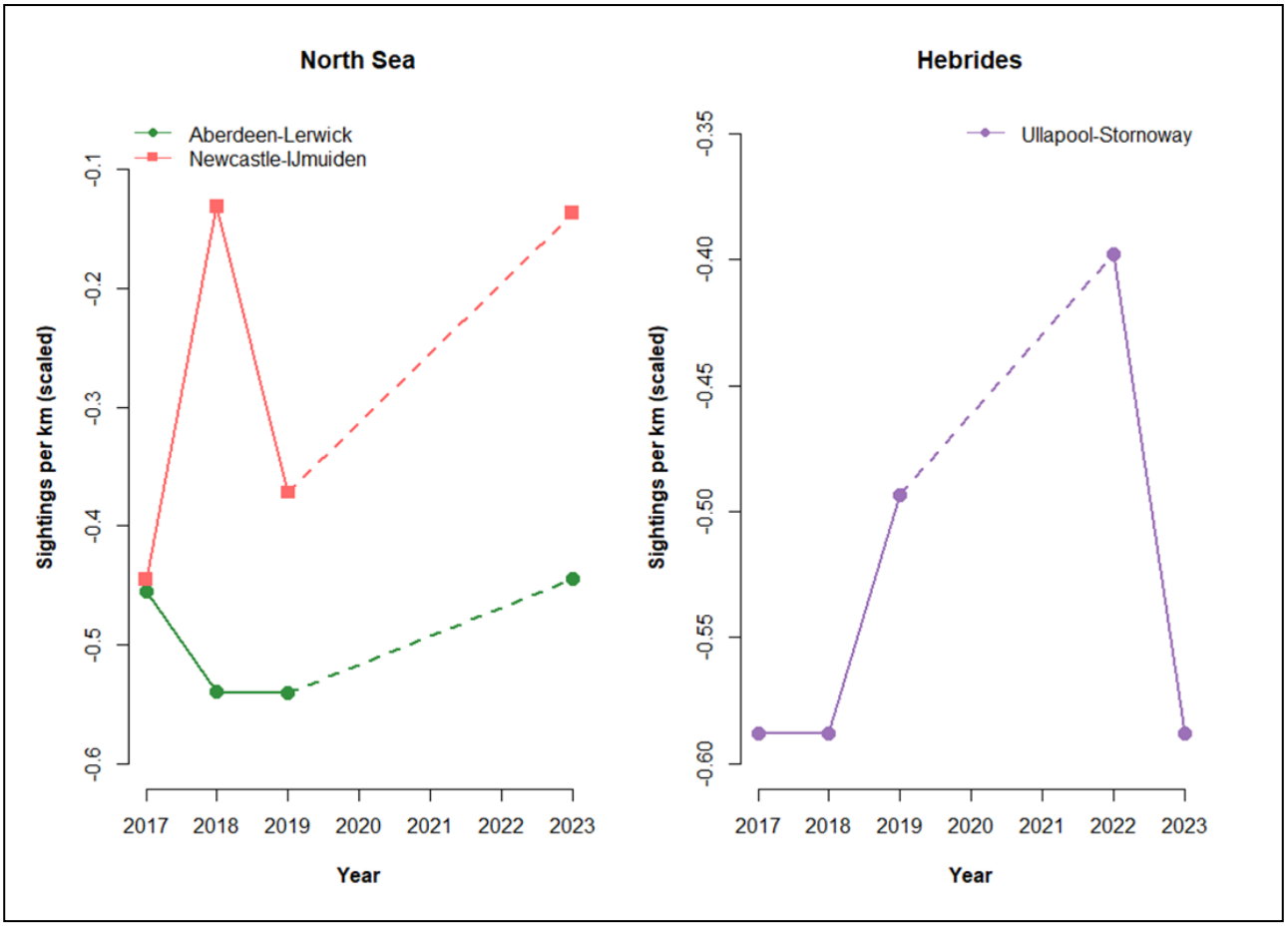


Figure 12: White-beaked dolphin sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

White-beaked dolphins were seen exclusively on the Aberdeen-Lerwick and Newcastle-IJmuiden routes in 2023, with a large increase in sightings rate since 2019 (Figure 12). The northwestern half of the Newcastle-IJmuiden route has been identified as a hotspot for this species in previous ORCA reports (ORCA 2016). The northwestern North Sea may support important life cycle activities such as calving and feeding based on evidence from strandings and sightings (Weir *et al.* 2007).

As a typically cold water species, changes in abundance of white-beaked dolphins over time are of particular interest as the ocean warms. No white-beaked dolphins were seen on any of the routes in the Hebrides in 2023 (Figure 12). It has been speculated that common dolphins which remained abundant overall in this area in 2023 may outcompete white-beaked dolphins which occupy a similar ecological niche as they expand north in warming waters (MacLeod *et al.* 2008). Long term monitoring is critical to test these hypotheses and monitor change.


White-beaked dolphins - Charlotte Kirchner

Minke Whale

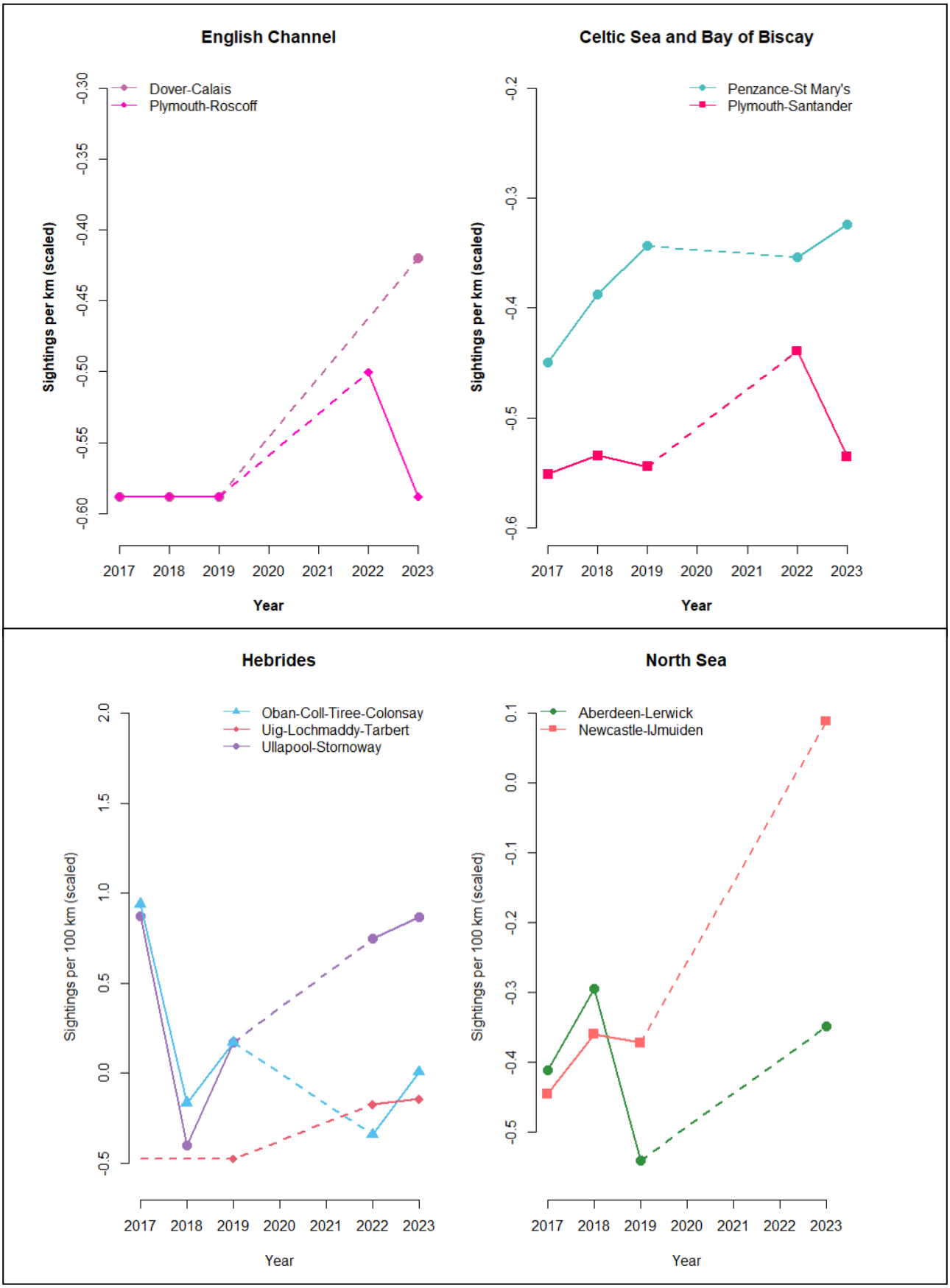


Figure 13: Minke whale sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

Sighting rates of minke whales on the North Sea routes increased in 2023 compared to previous years. There was a steadier increase on the Newcastle-IJmuiden route compared to the Aberdeen-Lerwick route where the sightings rate has fluctuated more over time (Figure 13). In the Hebrides, the sightings rate has increased over time since 2018 on the Ullapool-Stornoway route, while the sightings rate has been more variable on the Oban-Coll-Tiree-Colonsay route (Figure 13). Sightings remained relatively low on the Uig-Lochmaddy-Tarbert route, but have shown an increase in 2022 and 2023 compared to the first time this route was surveyed in 2019 (Figure 13). Sightings on the Penzance-St Mary's route have gradually increased over time, while no minke whales were recorded on the Plymouth-Roscoff route in 2023 (Figure 13). One sighting was recorded on the Dover-Calais route in 2023, a first for this route.

Both the North Sea and Hebrides are known to be home to high densities of minke whale (Gilles *et al.* 2023) and sightings rates from the ferry surveys are higher in these areas compared to the other sea regions (Figure 13). Previous studies have related minke whale density in the North Sea and the Hebrides directly to prey distribution (Macleod *et al.* 2004, Anderwald *et al.* 2012), so changes in occurrence between years could relate to the availability of prey.

In the Northeast Atlantic minke whales are subjected to commercial whaling by Norway, with 507 individuals slaughtered in 2023, falling short of the 1,000 quota set (AWI, 2023). This whaling practice takes place within the Norwegian Exclusive Economic Zone, but the minke whales sighted on ORCA surveys are at risk. Evidence suggests that minke whales undergo seasonal migrations between summer feeding grounds in higher latitudes and winter breeding grounds in lower latitudes, similar to the life cycle of other baleen whales (Risch *et al.* 2019). Although sightings in the UK occur year-round, there is a peak in sightings between May to September, suggesting seasonal movements (Weir *et al.* 2007). It is therefore important to continue long-term monitoring of this species to understand, in real-time, the impact of whaling, especially as many of the minke whales hunted are pregnant females, so the removal of these individuals from the population will have significant impacts.

Minke Whale

Fin Whale

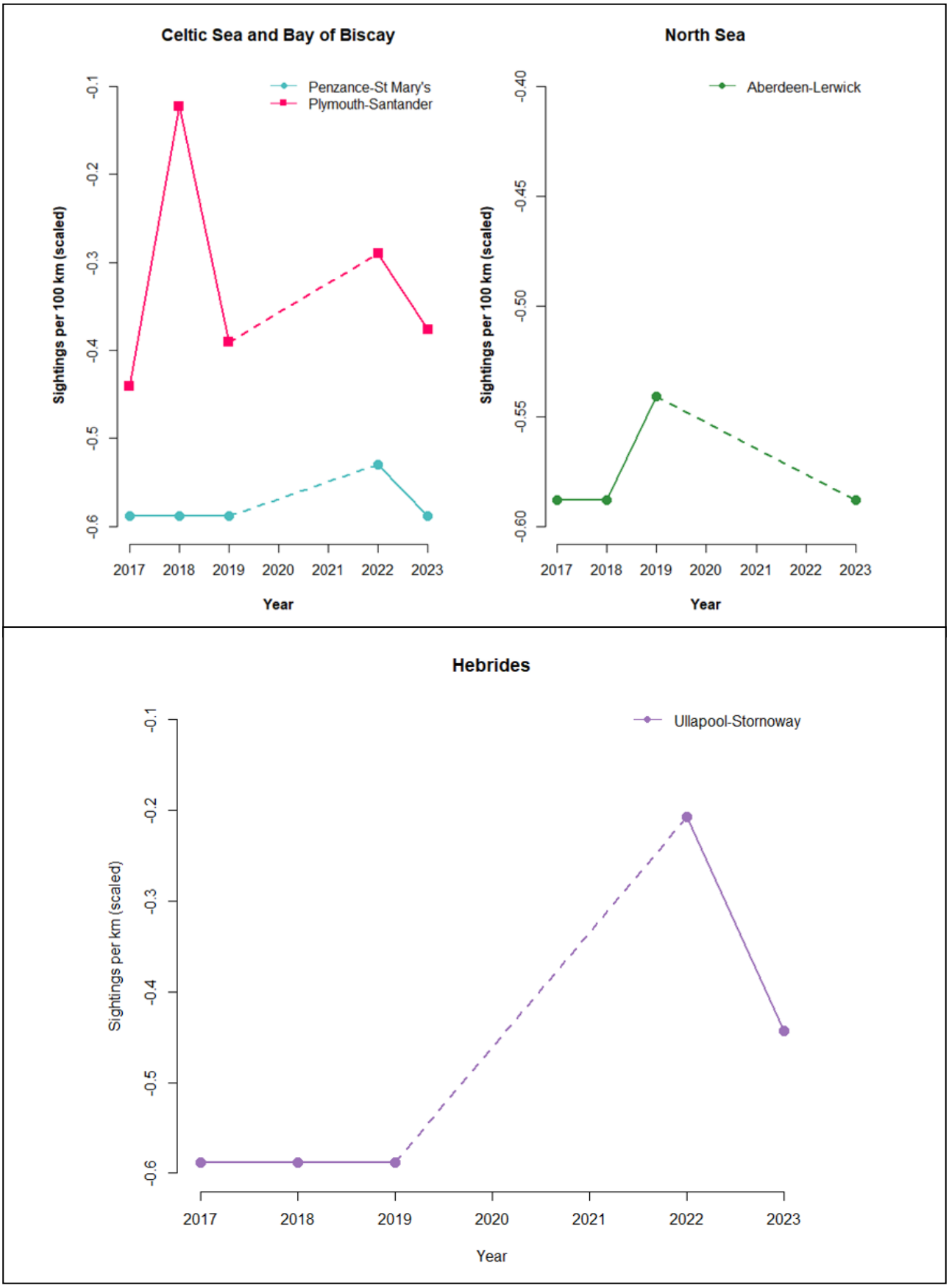


Figure 14: Fin whale sightings rates by route since 2017. The routes have been split into sea regions and the values scaled for ease of comparison. Dashed lines between points indicate years that no surveys were conducted on that route and no data was available

Fin whale sighting rates have fluctuated markedly on the Plymouth-Santander route since 2017, with the highest rates observed in 2018 and 2022 (Figure 14). Further research is needed to understand what drives changes in fin whale density in this region, especially given their susceptibility to ship strike in this busy area for shipping traffic (Peltier *et al.* 2019). Some evidence indicates that changes in fin whale abundance in the Bay of Biscay between years could be related to sea surface temperature, with higher abundance predicted in years when warm water areas covered more of the bay (Garcia-Baron *et al.* 2019).

On the Penzance-St Mary's route fin whales have only been recorded in 2022 (Figure 14). Fin whales are known to occur around the west of Cornwall and the Isles of Scilly in the winter months (Pikesley *et al.* 2012) with some sightings in the late summer months. ORCA surveys do not take place in the winter months in this region due to the ferry not operating during this period.

Fin whales have only been recorded on the Ullapool-Stornoway route in 2022 and in 2019 on the Aberdeen-Lerwick route (Figure 14). Analysis of historical whaling records suggests that fin whales were once regularly found in the waters surrounding Scotland, especially around Shetland (Ryan *et al.* 2022). Continued monitoring is necessary to assess if their populations are recovering from commercial whaling and to inform management of new and emerging threats.

In conclusion, these graphs and analyses demonstrate that there is much variability in the sightings rates for all species as well as individual species across years and within routes. Once again these findings highlight the dynamic nature of their habitat and the need for long-term data collection in order to separate this variability from real changes in populations.

Fin whale - Stephen Marsh

Conserving Critical Habitats

A major barrier to cetacean conservation is lack of data in offshore areas which are expensive and logistically difficult to survey. As a result our understanding of cetacean population status and distribution is very limited in these regions. Collecting data from vessels that are going offshore anyway, i.e. platforms of opportunity is a more cost effective way to monitor these areas. This is crucial as the high seas, areas beyond the jurisdiction of any particular country, are the new frontier for activities such as deep-sea mining, energy extraction and deep sea fisheries which all have the potential to be detrimental to cetacean populations and habitats we know little about. ORCA's effort based data collection in these areas via the OceanWatchers protocol helps to address these knowledge gaps.

Dedicated effort based surveys

The dedicated effort based surveys involve ORCA placing trained Ocean Conservationists and Marine Mammal Surveyors on board ferry and cruise ships around the world. The OceanWatchers app is used for data collection and both our Ocean Conservationists and Marine Mammal Surveyors undergo in-depth online training to access the survey app to ensure data collection remains at a high consistent standard.

**Please note, these cruise and ferry surveys involve a different survey protocol to our distance sampling surveys by Marine Mammal Surveyors on the UK ferry network.*

Distance surveyed

A total of 286,961 kilometres of effort collected using the OceanWatchers protocol was achieved in 2023. The southwest and central regions of the Pacific Ocean were surveyed for the first time. Effort continued to be concentrated in the Northeast Atlantic Ocean and Mediterranean Sea, but effort has also remained high in the western North Atlantic Ocean around Canada and Greenland, in the Southern Ocean and in the eastern North Pacific Ocean (Figure 15).

Citizen scientist at sea

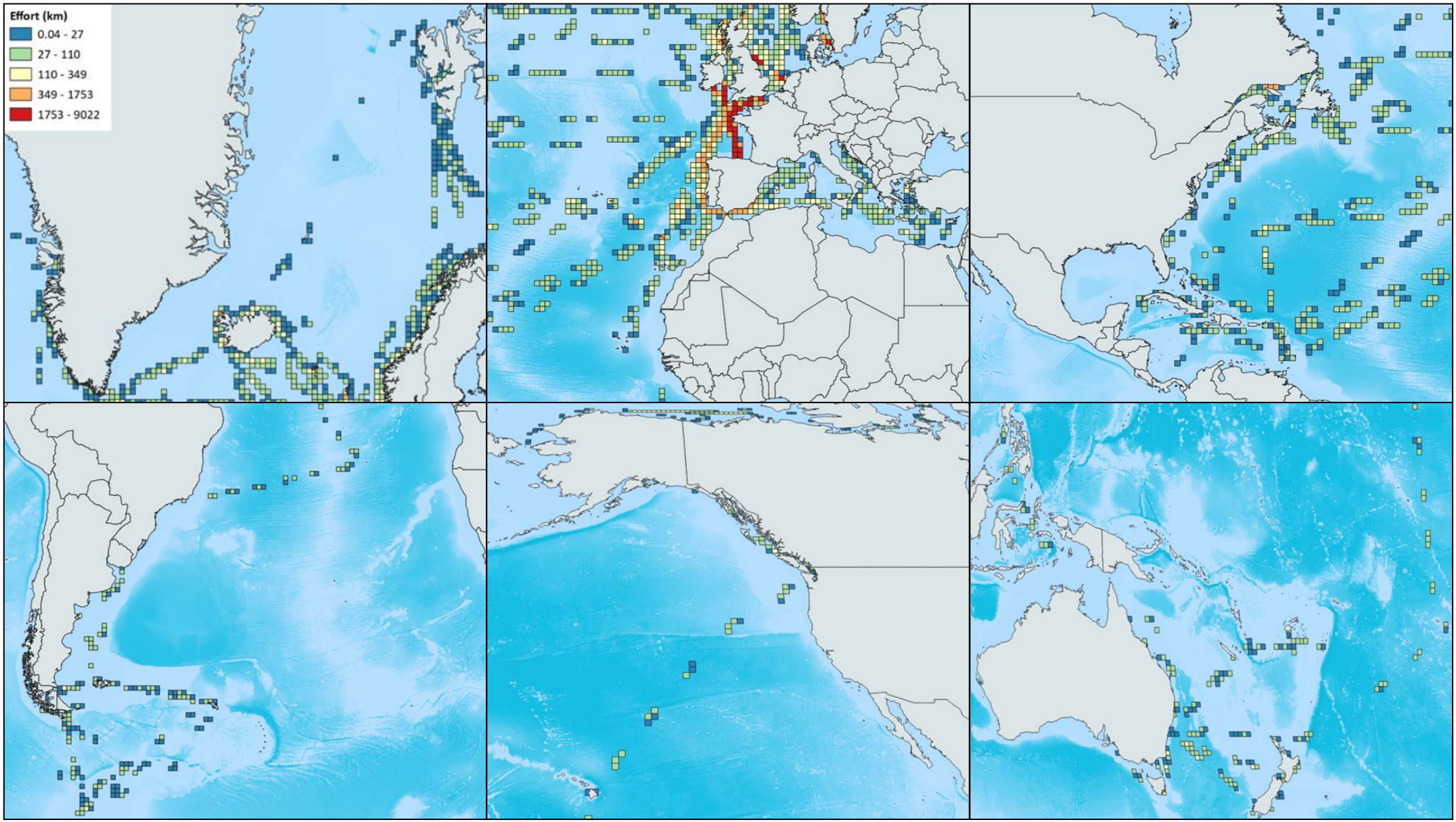


Figure 15: Survey effort in kilometres per 100 km^2 grid cell in 2023 in the Arctic Ocean (top left), Northeast Atlantic Ocean and Mediterranean Sea (top centre), western North Atlantic Ocean (top right), South Atlantic Ocean and Southern Ocean (bottom left), North Pacific Ocean (bottom centre), and South Pacific Ocean (bottom right)

Marine environments at temperate and polar latitudes where the bulk of survey effort was concentrated in 2023, can be highly seasonal due to annual cycles in the availability of sunlight. This in turn influences the seasonal distribution of cetaceans (Becker *et al.* 2017). Shortening day length and poorer weather conditions in the autumn and winter months will influence survey effort so it is important to bear the distribution of effort in mind when interpreting sightings. The amount of effort in kilometres per month is shown in Figure 16. Unlike the distance sampling surveys described in the Protecting Vulnerable Populations section, effort from cruise ships continues year round, albeit at a lower level in the late autumn and winter months. This is important as winter distribution and habitat is not well understood for many cetacean species (Becker *et al.* 2017). In 2023, effort peaked in the summer months when both daily data collection by Ocean Conservationists from passenger ferries and the number of Ocean Conservationists on cruise ships was highest while effort was lowest at the beginning and end of the year (Figure 16).

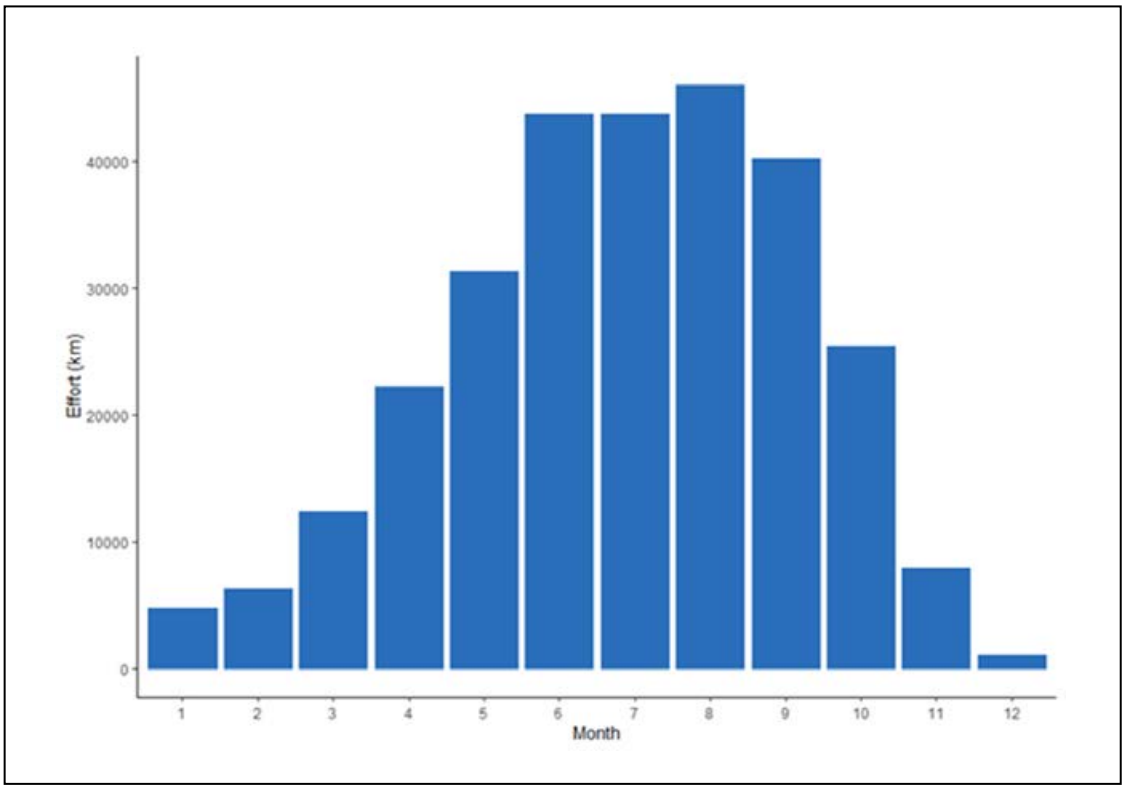


Figure 16: Distribution of dedicated survey effort in kilometres using the ORCA OceanWatchers protocol per month in 2023

Sightings

A total of 10,059 sightings consisting of 42,045 individuals from 35 species were recorded in 2023 (Table 5). Common dolphin was the most sighted species (2,976 sightings, 19,996 individuals) with harbour porpoise a distant second (1,366 sightings, 2,796 individuals), reflecting high levels of effort around northwest Europe. Notable sightings this year included the first records of Arnoux's beaked whales and strap-toothed beaked whales in ORCA's dataset.


Arnoux's beaked whales - Jenna Silk

Table 5: Number of sightings and number of individual animals per species recorded during dedicated ORCA OceanWatchers surveys in 2023. Bold indicates that this species was an ORCA first

	Species	Number of sightings	Number of individuals
Dolphins and porpoises	Harbour porpoise (*Phocoena phocoena*)	1,366	2,796
	Atlantic spotted dolphin (*Stenella frontalis*)	34	489
	Atlantic white-sided dolphin (*Laegnorhynchus acutus*)	17	168
	Bottlenose dolphin (*Tursiops truncatus*)	157	981
	Commerson's dolphin (*Cephalorhynchus commersonii*)	5	15
	Common dolphin (*Delphinus delphis*)	2,976	19,996
	Dusky dolphin (*Lagenorhynchus obscurus*)	12	125
	False killer whale (*Pseudorca crassidens*)	3	41
	Hourglass dolphin (*Lagenorhynchus cruciger*)	1	3
	Orca (*Orcinus orca*)	42	243
	Long-finned pilot whale (*Globicephala melas*)	83	773
	Short-finned pilot whale (*Globicephala macrorhynchus*)	25	150
	Unidentified pilot whale (*Globicephala* sp)	39	245
	Peale's dolphin (*Lagenorhynchus australis*)	11	41
	Pantropical spotted dolphin (*Stenella attenuata*)	2	119
	Risso's dolphin (*Grampus griseus*)	41	185
	Striped dolphin (*Stenella coeruleoalba*)	230	2,586
	White-beaked dolphin (*Lagenorhynchus albirostris*)	177	1,114
	Unidentified dolphin	1,515	6,505
Beaked and toothed whales	**Arnoux's beaked whale (*Berardius arnuxii*)**	**1**	**3**
	Blaineville's beaked whale (*Mesoplodon densirostris*)	1	3
	Cuvier's beaked whale (*Ziphius cavirostris*)	60	104
	Northern bottlenose whale (*Hyperoodon ampullatus*)	18	56
	Sowerby's beaked whale (*Mesoplodon bidens*)	7	18
	Strap-toothed beaked whale (*Mesoplodon layardii*)	**3**	**7**
	Unidentified beaked whale	58	105
	Sperm whale (*Physeter macrocephalus*)	59	113
	Beluga (*Delphinapterus leucas*)	10	122
Baleen whales	Antarctic minke whale (*Balaenoptera bonarensis*)	9	10
	Blue whale (*Balaenoptera musculus*)	18	28
	Bowhead whale (*Balaena mysticetus*)	4	5
	Fin whale (*Balaenoptera physalus*)	441	714
	Gray whale (*Eschrichtius robustus*	1	3
	Humpback whale (*Megaptera novaengliae*)	326	636
	Minke whale (*Balaenoptera acutorostrata*)	579	698
	North Atlantic right whale (*Eubalaena glacialis*)	1	1
	Sei whale (*Balaenoptera borealis*)	48	121
	Southern right whale (*Eubalaena australis*)	3	3
	Unidentified whale	1,316	2,026
	Unidentified cetacean	360	694
	Total	**10,059**	**42,045**

Surfacing fin whale

The OceanWatchers programme

In addition to ORCA's dedicated effort based surveys used to identify critical whale and dolphin habitats, the work carried out by our volunteer network of OceanWatchers has enabled us to expand our spatial coverage of data collection significantly. These trained OceanWatchers conduct surveys in their own time from land or at sea using the OceanWatchers survey protocol.

Distance surveyed (effort) at sea

In 2023, ORCA OceanWatchers conducted 23,274 kilometres of survey effort at sea (Figure 17). Effort was particularly concentrated in the Northeast Atlantic where the majority of trained OceanWatchers are based, but surveys were also carried out in the Gulf of California, in the Indo-Pacific sea regions and in the western Pacific Ocean.

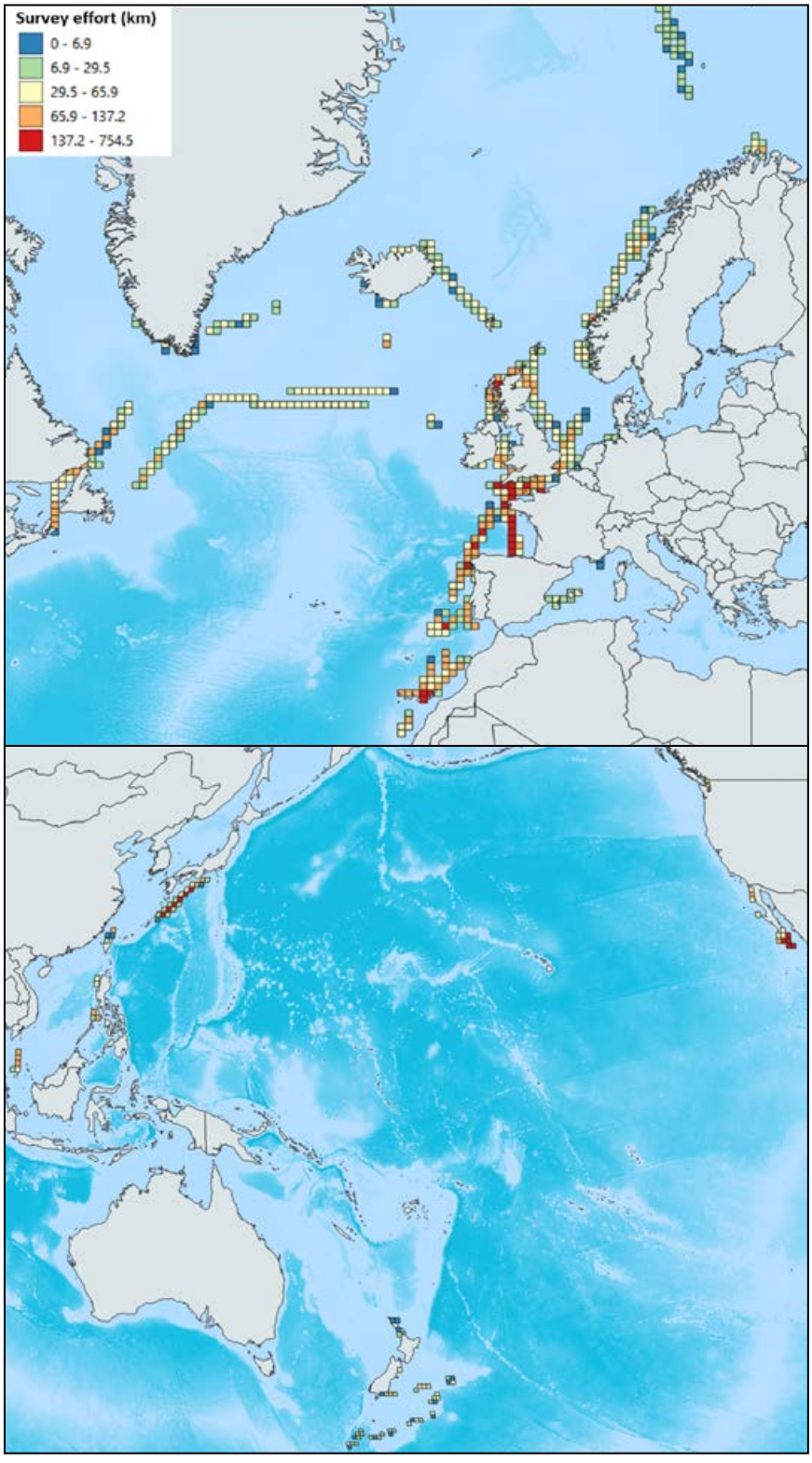


Figure 17: OceanWatchers at sea survey effort in kilometres per 100 km² grid cell in 2023 in the North Atlantic Ocean (top) and Pacific Ocean (bottom)

ORCA OceanWatchers recorded 714 sightings of 9,267 animals in 2023 (Table 6). Sightings of particular interest, and a first for the ORCA database, include melon-headed whales and a pygmy sperm whale; a rarely seen and little understood species. This highlights the value of increased spatial and temporal coverage in survey effort conducted by the network of volunteer ORCA OceanWatchers. Sightings are summarised in Table 6.

Table 6: Number of sightings and number of animals per species recorded during OceanWatchers at sea surveys in 2023. Bold indicates that this species was an ORCA first

	Species	Number of sightings	Number of animals
Dolphins and porpoises	Dall's porpoise (*Phocoenoides dalli*)	4	20
	Harbour porpoise (*Phocoena phocoena*)	61	126
	Unidentified porpoise	5	11
	Atlantic spotted dolphin (*Stenella frontalis*)	11	188
	Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	1	7
	Bottlenose dolphin (*Tursiops truncatus*)	26	322
	Common dolphin (*Delphinus delphis*)	183	6,920
	Dusky dolphin (*Lagenorhynchus obscurus*)	3	15
	Fraser's dolphin (*Lagenodelphis hosei*)	1	10
	Hourglass dolphin (*Lagenorhynchus cruciger*)	1	1
	Melon-headed whale (*Peponocephala electra*)	**1**	**12**
	Orca (*Orcinus orca*)	12	59
	Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	1	2
	Long-finned pilot whale (*Globicephala melas*)	3	21
	Short-finned pilot whale (*Globicephala macrorhynchus*)	2	13
	Unidentified pilot whale (*Globicephala* sp)	5	53
	Risso's dolphin (*Grampus griseus*)	12	29
	Striped dolphin (*Stenella coeruleoalba*)	24	262
	White-beaked dolphin (*Lagenorhynchus albirostris*)	11	101
	Unidentified dolphin	79	697
Beaked and toothed whales	Cuvier's beaked whale (*Ziphius cavirostris*)	1	3
	Northern bottlenose whale (*Hyperoodon ampullatus*)	3	5
	Unidentified beaked whale	5	9
	Beluga (*Delphinapterus leucas*)	3	6
	Pygmy sperm whale (*Kogia breviceps*)	**1**	**1**
	Sperm whale (*Physeter macrocephalus*)	5	7
Baleen whales	Blue whale (*Balaenoptera musculus*)	11	17
	Bowhead whale (*Balaena mysticetus*)	1	2
	Bryde's whale (*Balaenoptera brydei*)	1	1
	Fin whale (*Balaenoptera physalus*)	31	43
	Gray whale (*Eschrichtius robustus*)	1	3
	Humpback whale (*Megaptera novaengliae*)	57	115
	Minke whale (*Balaenoptera acutorostrata*)	36	39
	Sei whale (*Balaenoptera borealis*)	2	4
	Southern right whale (*Eubalaena australis*)	1	1
	Unidentified whale	90	107
	Unidentified cetacean	19	35
	Total	**714**	**9,267**

Time surveyed (effort) from land

Land based surveys have the advantage of being less intrusive than boat based surveys and have been used to monitor the occurrence of cetaceans in coastal areas which are more impacted by human activities (Embling *et al.* 2015).

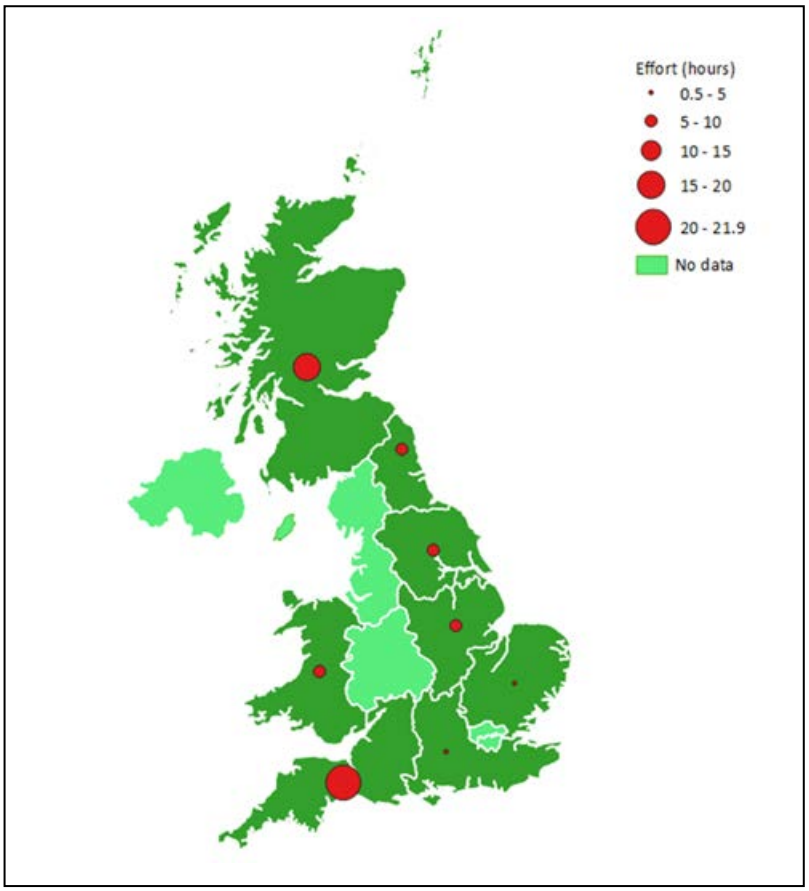


Figure 18: Hours of effort per UK region during OceanWatchers land based surveys in 2023

ORCA OceanWatchers spent a total of 435 hours conducting land based surveys in 2023. Most effort was carried out around the UK, especially in southwest England followed closely by Wales (Figure 18). Outside the UK, surveys were conducted in Alaska, France and Germany. This resulted in 282 sightings of 1,281 animals. Harbour porpoises were recorded most frequently, to be expected as this is a coastal species, but common dolphins, bottlenose dolphins and Risso's dolphins were also regularly observed. Notable sightings included humpback whales off southwest England in the winter, a fin whale seen off southwest England in the summer and pilot whales seen in Scotland (Table 7).

Table 7: Number of sightings and number of individual animals per species during OceanWatchers land based surveys in 2023

	Species	Number of sightings	Number of animals
Dolphins and porpoises	Harbour porpoise (*Phocoena phoecoena)*	146	300
	Bottlenose dolphin (*Tursiops truncatus*)	23	115
	Common dolphin (*Delphinus delphis*)	54	672
	Unidentified pilot whale (*Globicephala* sp)	2	12
	Risso's dolphin (*Grampus griseus*)	13	73
	Unidentified dolphin	14	64
Baleen whales	Fin whale (*Balaenoptera physalus*)	2	4
	Humpback whale (*Megaptera novaengliae*)	4	5
	Minke whale (*Balaenoptera acutorostrata*)	5	6
	Unidentified whale	4	7
	Unidentified cetacean	15	23
	Total	**282**	**1,281**

Identifying hotspots in 2023

Identifying important areas at sea poses logistical and financial challenges, but there is an urgent need to identify these 'hotspots' to bring management measures, such as protected areas, into force. The definition and quantification of hotspots varies depending on the context (Sussman *et al.* 2019). In this report a hotspot is an area with particularly high densities of a single or multiple cetacean species.

In marine environments and especially in pelagic (offshore) areas, the location of cetacean hotspots can vary substantially due to the dynamic physical processes operating in the ocean (Hyrenbach *et al.* 2000, Briscoe *et al.* 2016) so up-to-date data is needed to help inform management.

ORCA's dedicated effort based OceanWatchers data collection can help define these hotspots, so with this in mind, the spatial distribution of effort corrected sightings (sightings per 100 km of effort) for species regularly sighted in 2023 is described below. To avoid skewed results in areas with low levels of effort, only the sightings rates in cells where >50 km of effort was achieved are shown.

Fin whale

High rates of fin whale sightings were observed southeast of Greenland, south of Iceland and to the northwest of the Iberian Peninsula. Additionally, a clear hotspot emerged in the deep waters of the Bay of Biscay during the summer months (Figure 19); this is in agreement with previous studies (Laran *et al.* 2017, Garcia-Baron *et al.* 2019). It is estimated that more than 10,000 fin whales aggregate over the abyssal plain of the Bay of Biscay during the summer (Hammond *et al.* 2021), with most individuals migrating out of the area during the winter months (Laran *et al.* 2022).

Fin whales are considered Vulnerable on the IUCN Red List of Threatened Species (Cooke, 2018) and on a global scale is the most commonly recorded species to collide with ships (Laist *et al.* 2001, David *et al.* 2011). The Bay of Biscay is an area with increasingly heavy shipping traffic (Peltier *et al.* 2019, Robbins *et al.* 2022a), therefore this fin whale hotspot is of particular interest for ship strike mitigation measures.

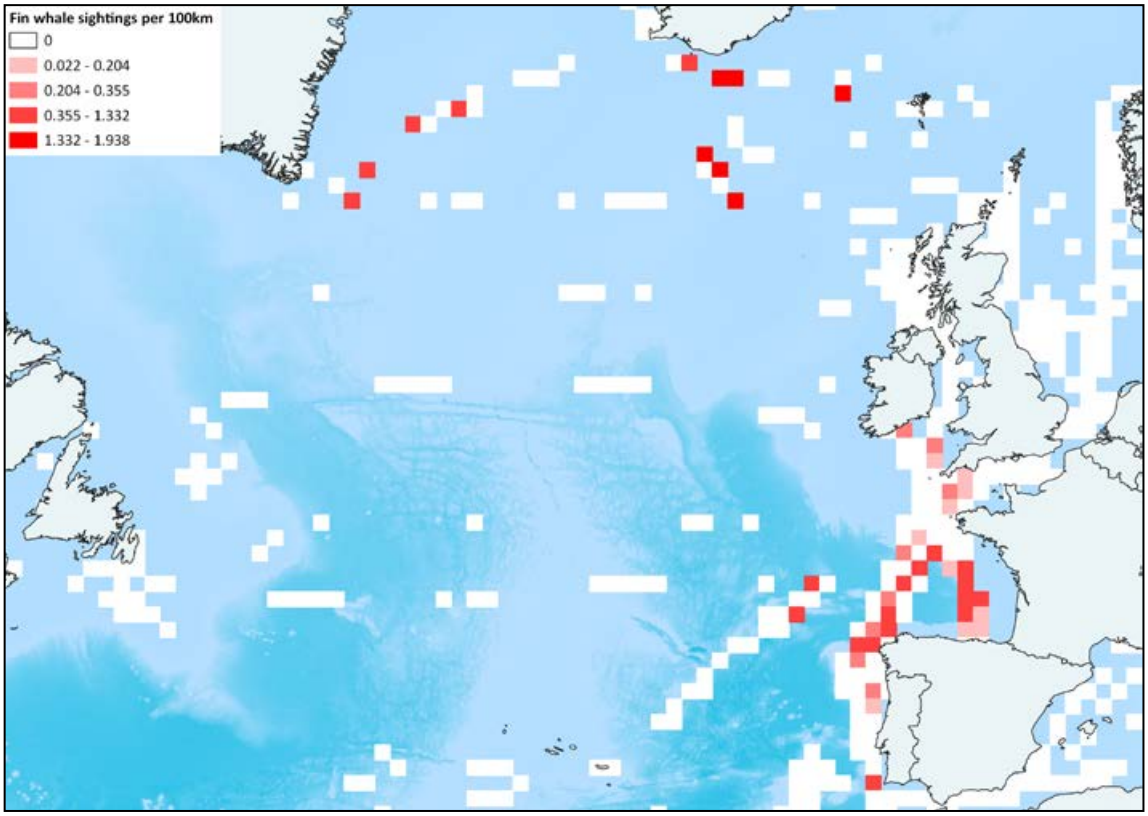


Figure 19: Fin whale sightings rates per 100 kilometres in each 100 km² grid cell in the Northeast Atlantic Ocean

Minke whale

Minke whale sightings were concentrated in shallower, coastal waters in the Celtic Sea, western English Channel and around Iceland, Norway and Greenland (Figure 20). The highest sightings rates however were in the northwestern North Sea and the Hebrides. The waters between the coast of west Scotland and the Outer Hebrides are some of the richest in terms of cetacean diversity in the UK (IUCN-MMPATF 2024). The minke whale is often a solitary species with aggregations in the UK rarely exceeding ten individuals. However, in the Hebrides aggregations of up to 20 animals have been often observed feeding during the late summer months (Anderwald *et al.* 2012).

Stomach contents analysis has shown that minke whales commonly feed on sandeel, sprat and herring in Scottish waters (Pierce *et al.* 2004), with their distribution closely linked with sandeel availability (Macleod *et al.* 2004, Anderwald *et al.* 2012). The announcement of the ban on industrial sand eel fishing in Scottish waters by the Scottish Government in February 2024 (Scottish Government 2024) was therefore greatly welcomed by the conservation community. However, minke whales remain under threat in this hotspot.

Entanglement in static fishing gear (pots or creels) is the single largest cause of death for minke whales in Scottish waters (Northridge *et al.* 2010). In the Hebrides recent research has estimated the annual fatal entanglement rate of minke whales is 2.3% of the latest population estimate, indicating a risk of localised depletion (Leaper *et al.* 2022). Collaboration with the fishing industry and policy makers to trial alternative gear types, such as lines that sink to the seabed rather than floating in the water column and entangling baleen whales, is key to reducing this threat and efforts should be focussed in these identified hotspots. Vital work carried out by the Scottish Entanglement Alliance, launched in June 2018, is doing exactly this.

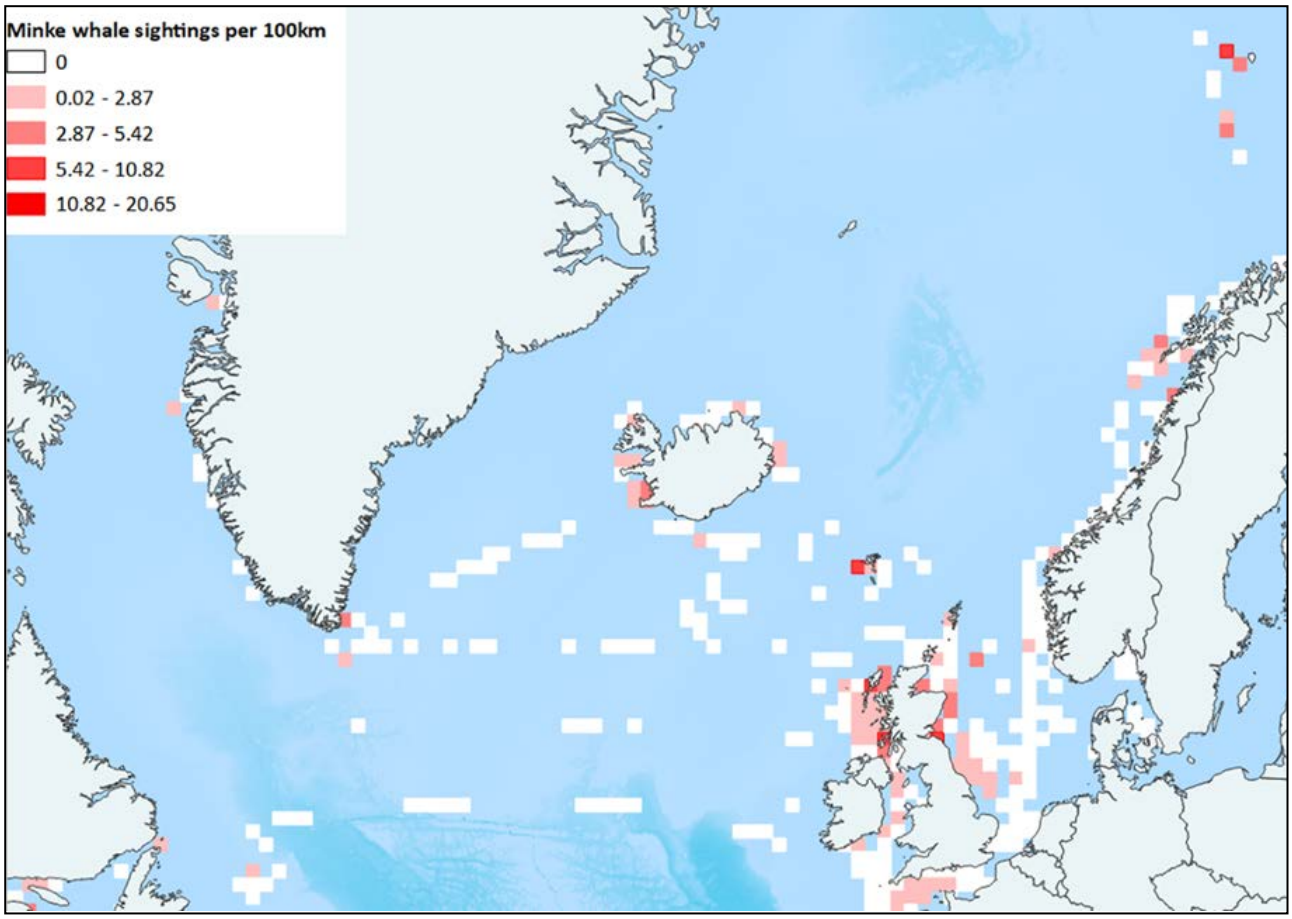


Figure 20: Minke whale sightings rates per 100 kilometres in each 100 km^2 grid cell on the northwest European continental shelf and around Norway, Iceland and Greenland

Beaked whales

Beaked whales are species rich with 24 species currently described (Committee on Taxonomy 2023), but their offshore distribution, cryptic behaviour at the surface, long dive durations and difficulty in identifying some species at sea makes studies of their distribution difficult (Barlow *et al.* 2006). ORCA's data collection in these offshore areas is therefore particularly valuable in order to understand the distribution of these elusive species and to identify important beaked whale habitats.

From ORCA's 2023 dataset, unidentified beaked whale sightings rates were high in the canyons of the Canadian continental slope, off the northwest corner of the Iberian Peninsula and around Eastern Atlantic islands of the Azores, Madeira and the Canary Islands and in the submarine canyons of the southern Bay of Biscay (Figure 21). This is consistent with previously identified important beaked whale habitat (MacLeod and Mitchell 2006, Virgili *et al.* 2022). Submarine canyons, such as the Santander, Torrelavega and Cap Breton canyons located in the southern Bay of Biscay, provide important habitats for deep diving beaked whales where steeply descending slopes drives oceanographic processes and productivity, promoting feeding opportunities (Moors-Murphy 2014). Studies have shown that these deep diving species are affected by disturbance from the use of sonar with impacts ranging from displacement from foraging habitats (Miller *et al.* 2015) to mass mortalities (Cox *et al.* 2006). Understanding their distribution is key to minimising overlap between beaked whales and these activities.

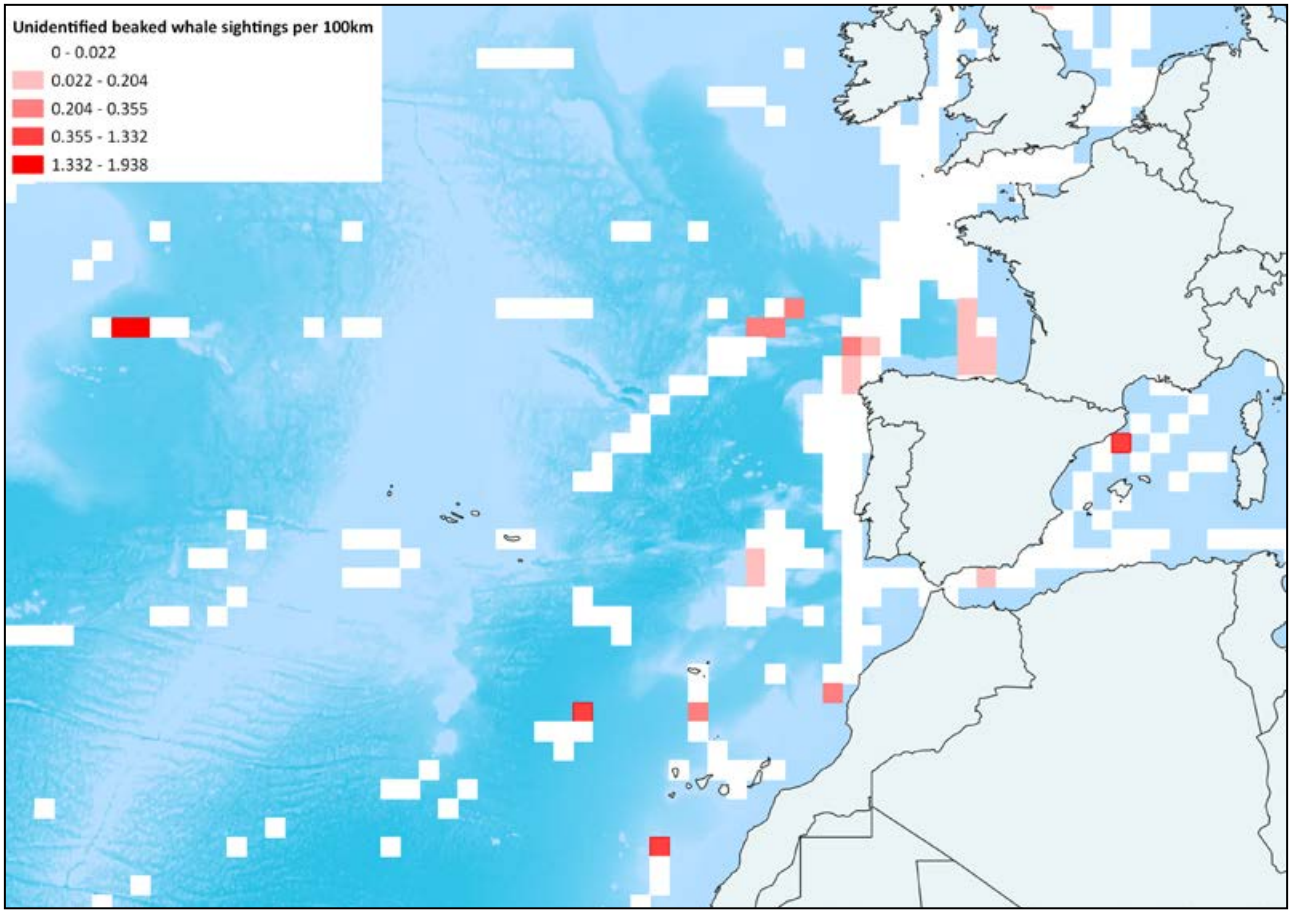


Figure 21: Unidentified beaked whale sightings rates per 100 kilometres in each 100 km^2 grid cell in the Northeast Atlantic Ocean and Mediterranean Sea

Previous ORCA research has demonstrated that beaked whales, particularly the Cuvier's beaked whale, are consistently sighted throughout the canyons in the southern Bay of Biscay, with possible year-round presence (Robbins *et al.* 2022b). ORCA's 2023 data continues to demonstrate this trend with high Cuvier's beaked whale sightings rates observed in this area despite intense survey effort which would down-weight sightings (Figure 22). This highlights these canyons as a hotspot for Cuvier's beaked whales.

Hotspots for Cuvier's beaked whale sightings rates were also observed on the shelf edge of the Armorican shelf and in the Alboran Sea in the Mediterranean Sea (Figure 22). This coincides with the Alboran Deep Important Marine Mammal Area (IMMA) which was designated in part as an important habitat for Cuvier's beaked whales which are present in this area in high densities in every season (IUCN-MMPATF 2017).

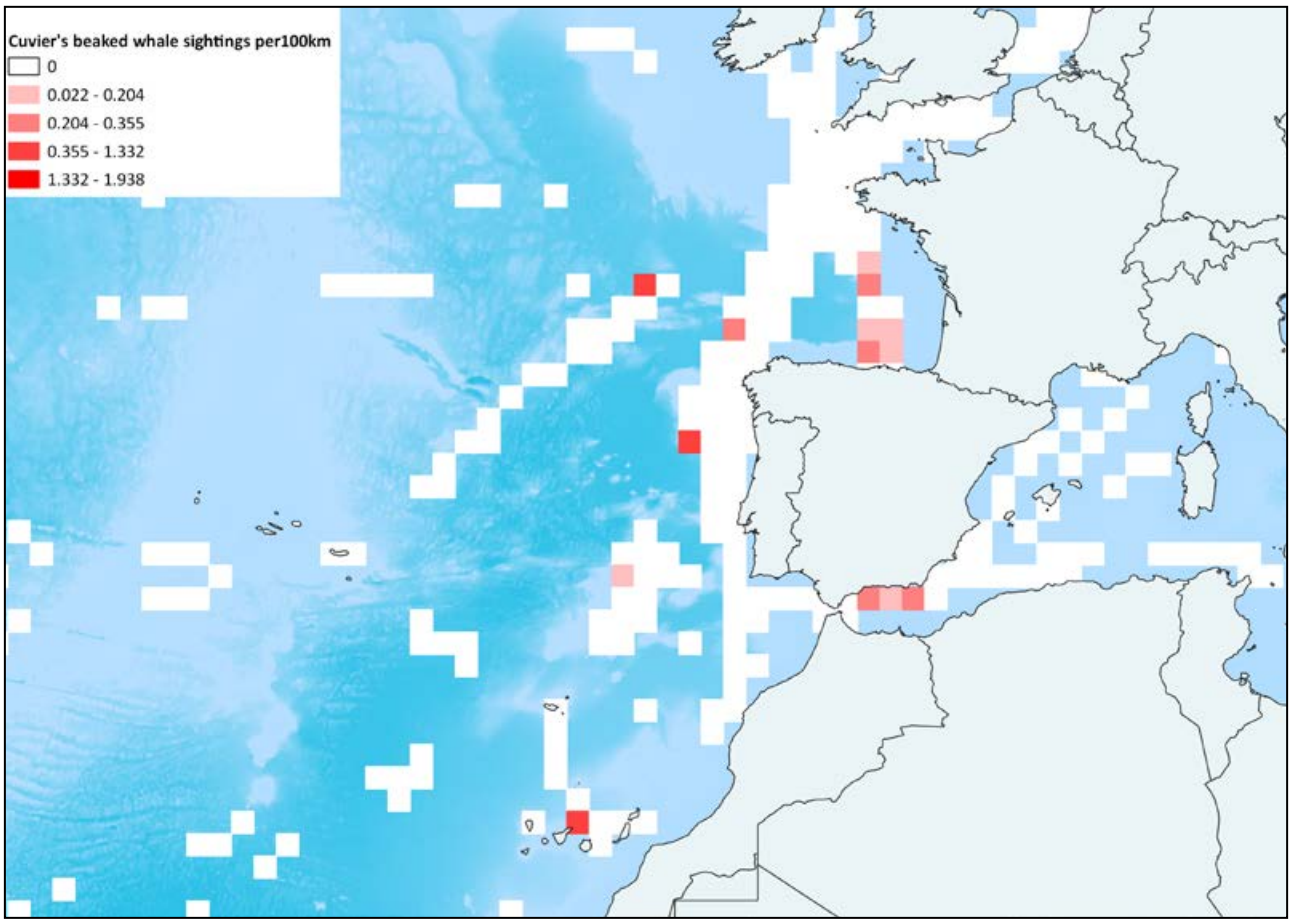


Figure 22: Cuvier's beaked whale sightings rates per 100 kilometres in each 100 km² grid cell in the Northeast Atlantic Ocean and Mediterranean Sea

Cuvier's beaked whales - Paul Soulby

Harbour porpoise

Harbour porpoise sightings rates were high in the coastal regions of the UK, Iceland, northern Spain and the Norwegian fjords (Figure 23a). The highest densities were observed in the Hebrides, off the east coast of Scotland, in the western North Sea, and in the Kattegat, especially in the Oresund (stretch of water between Sweden and Denmark) (Figure 23b).

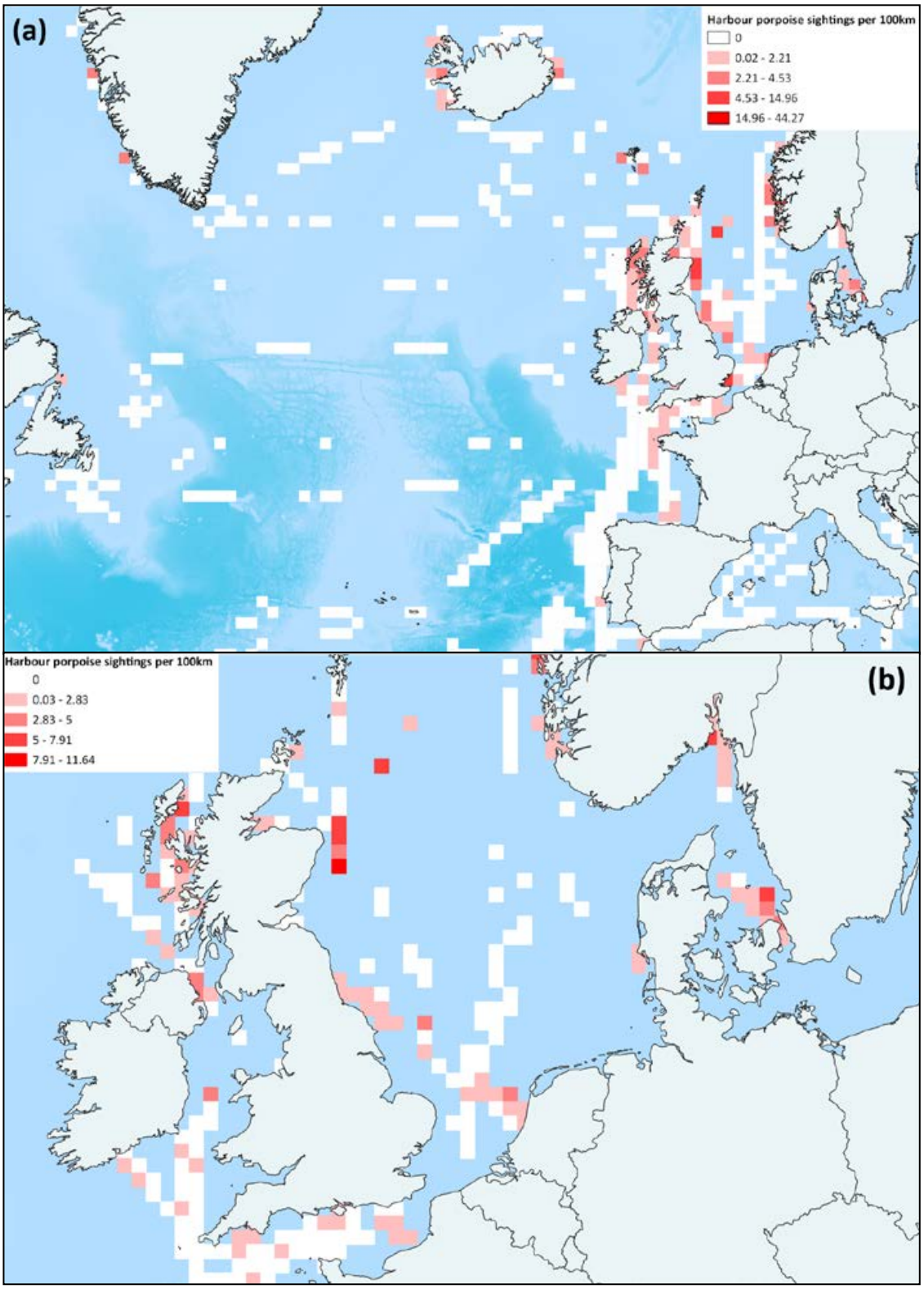


Figure 23: Harbour porpoise sightings rates per 100 kilometres in (a) each 100 km² grid cell in the Northeast Atlantic Ocean, and (b) in 50 km² grid cells to show hotspots on the northwest European shelf in more detail

The narrow straits in the Kattegat create strong fronts, eddies and upwelling with food-rich areas providing high abundance of important prey species for harbour porpoise (Sveegaard *et al.* 2012). This area also includes the distinct Belt Sea population of harbour porpoise, which are genetically and morphologically different from the neighbouring North Sea and Baltic Proper populations (Wiemann *et al.* 2010, Lah *et al.* 2016). Research suggests the Belt Sea harbour porpoise population has decreased by more than 30% over the last three generations, categorising the population as vulnerable according to the HELCOM RED LIST Category (HELCOM 2022). Harbour porpoises are threatened by a variety of anthropogenic impacts, such as bycatch, pollution, overfishing and noise (Carlen *et al.* 2021) and these threats can have catastrophic impacts on already small and declining populations.

Harbour porpoises were almost absent in the English Channel two decades ago (Reid *et al.* 2003), but are now sighted regularly in this area (Hammond *et al.* 2021, Blanchard *et al.* 2023) and hotspots are shown in Figure 23b. In the North Sea, a southward shift in distribution since the 1990s is well documented (Hammond *et al.* 2013) and may be related to changes in the distribution and abundance of prey species such as sandeel, herring and sole (Peschko *et al.* 2016). Dogger Bank, a large shallow bank in the central North Sea, has unique bathymetry and prevailing currents making it a highly productive area, especially for sandeels, and harbour porpoise occur in the area at high densities in all seasons (Gilles *et al.* 2016, Hammond *et al.* 2021). The permanent closure of the sandeel fisheries in English waters of the North Sea that came into effect in April 2024 will help support harbour porpoise populations in this region, particularly as research has linked a reduction in sandeel consumption with harbour porpoise starvation (MacLeod *et al.* 2007). But as harbour porpoise hotspots are located around the UK coast it is important that this ban is extended beyond the North Sea.

Harbour porpoise - Andy Gilbert

Common dolphin

Common dolphins were nearly ubiquitous along the western seaboard of northwest Europe in 2023, consistent with ORCA's previous years of data (Figure 24). Large aggregations of common dolphins are found in the Bay of Biscay (Hammond *et al.* 2017, Gilles *et al.* 2023), with a seasonal movement from oceanic areas in the summer months to the continental shelf and into the English Channel in the winter months (Blanchard *et al.* 2021, Laran *et al.* 2022). Interestingly, in recent years, including 2023 common dolphins have been recorded on ORCA surveys in the English Channel and on the shelf edge throughout the year, suggesting this to be an important area for the species.

The biggest threat facing common dolphins is bycatch. Thousands of animals die each year in the Northeast Atlantic due to being caught in fishing gear and at an unsustainable rate for the population; as described in the Protecting Vulnerable Populations section. Policy makers need to prioritise these hotspot areas, developing and actioning robust bycatch mitigation plans to safeguard common dolphin populations.

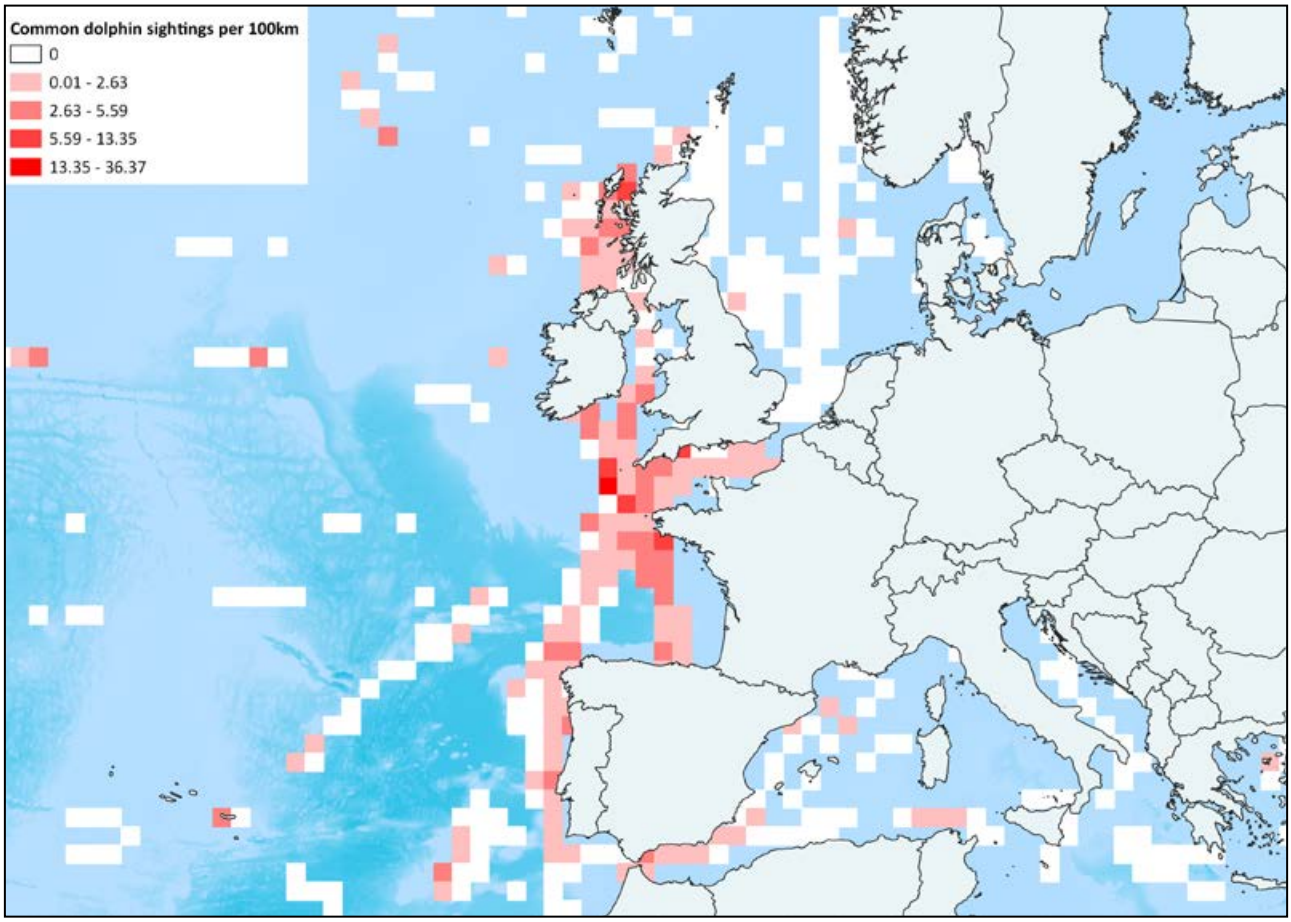


Figure 24: Common dolphin sightings rates per 100 kilometres in each 100 km² grid cell in the Northeast Atlantic Ocean

As described above, many cetacean species are affected by anthropogenic activities and almost one quarter are at risk of extinction (Davidson *et al.* 2012). Conserving cetaceans is difficult due to their high mobility and the large areas of ocean that they occupy and identifying these hotspots and then protecting them is one approach to conserving cetacean species. However, getting enough information to decide which areas are critical habitat is no easy feat and requires the pooling of data and expertise across different organisations. In 2013, led by the IUCN Marine Mammal Protected Areas Task Force, the Important Marine Mammal Areas (IMMAs) programme was established to bring together experts from across the world to identify these critical habitats.

Important Marine Mammal Areas in the Northeast Atlantic

An IMMA is defined as an area with ecological properties that are necessary to improve or maintain the conservation status of marine mammal species, i.e. areas where important life cycle activities take place and areas where diversity and abundance are concentrated (Tetley *et al.* 2022). Since the initiative began, 74.3% of the world's ocean has been assessed and 280 IMMAs have been designated (IUCN-MMPTAF 2024).

In 2023, the Northeast Atlantic Ocean and Baltic Sea were the focus and experts including ORCA convened in Hamburg, Germany to assess the available evidence and determine which areas could be designated as IMMAs. ORCA has been collecting effort based data on cetacean distribution and abundance in the Northeast Atlantic since 2006; a long running dataset which is rare for cetaceans and invaluable for identifying potential important areas, especially in offshore areas where survey effort is typically low. This workshop resulted in 33 new IMMAs being designated across the Northeast Atlantic Ocean and Baltic Sea (Figure 25).

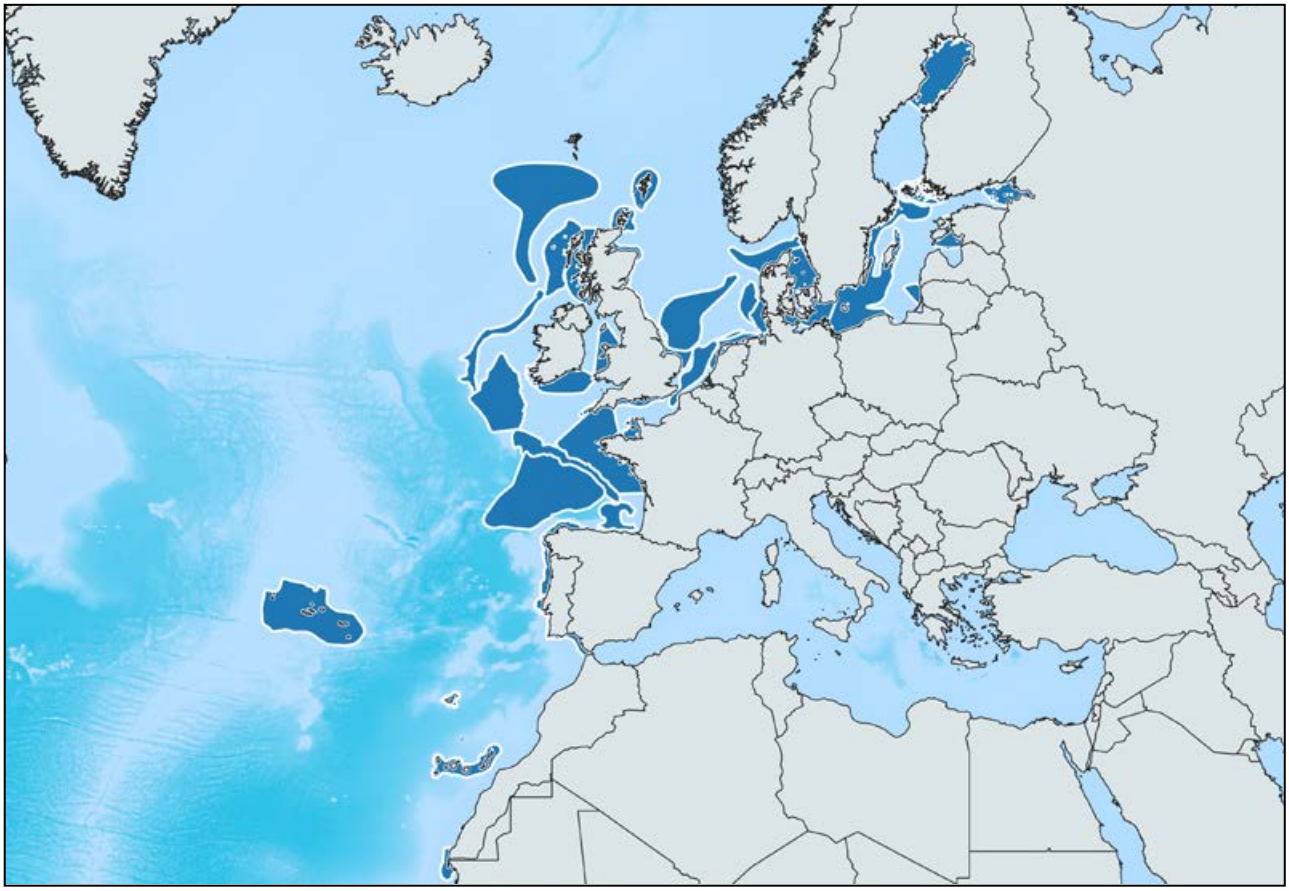


Figure 25: Northeast Atlantic Ocean and Baltic Sea IMMAs (highlighted in dark blue)

Co-chair of the IUCN Marine Mammal Protected Areas Task Force Erich Hoyt said: "ORCA's work to map cetacean habitats in the Bay of Biscay and throughout the eastern Atlantic has been extremely valuable in helping to identify Important Marine Mammal Areas, or IMMAs, in the Northeast Atlantic Ocean and Baltic Sea…… As we now develop a second programme to monitor and implement IMMAs, we look forward to further collaborations across our growing network in areas where ORCA is planning to work. In fact, we are already pleased to note ORCA's pioneer efforts with shipping companies in several Indian Ocean IMMAs to address the problem of shipstrikes."

But what do these designations mean in effect? IMMAs provide a check to establish if marine habitats are included under existing national or international measures, and ensure that new areas requiring protection are highlighted. If an authoritative IMMA designation, backed up with expert scientific data and evidence, isn't matched with national marine protection measures, then conservationists have a hugely valuable point of leverage to exert to ensure critical cetacean habitats are protected.

Saving Large Whales from Large Vessel Collisions

Ship strikes are considered one of the top two human induced threats to large whales (the other being entanglement in fishing gear) (Clapham *et al.* 1999, Peel *et al.* 2018, Schoeman *et al.* 2020). However, the true number of ship strikes that occur annually is not known due to strikes often going unreported or undetected (Van Waerebeek *et al.* 2007).

A ship strike is defined as: "a forceful impact between any part of a watercraft, most commonly the bow or propeller, and a live cetacean, often resulting in death, major injuries or physical trauma" (Cates *et al.* 2017). Increasing encounters between marine traffic and whales are inevitable where shipping is increasing at such a rapid rate: global maritime traffic is projected to increase by 240 - 1,209% by 2050 (Sardain *et al.* 2019). Shipping lanes across the world intersect critical habitats for whales such as feeding grounds, breeding grounds, nursing grounds and migration routes, putting animals at constant risk throughout critical life stages.

Fin whales, North Atlantic and southern right whales, humpback whales, sperm whales and gray whales are among the species most reported in ship strike events, due to their size and behaviours, such as resting, feeding or nursing close to the water's surface (Laist *et al.* 2001). There are several other factors that increase an individual's vulnerability to ship strike including age (juveniles are most at risk due to their lack of experience around large ships, more time spent at the water's surface and reduced spatial awareness) and ambient noise (high levels of background noise may mask the sound of an approaching vessel) (Laist *et al.* 2001, Gerstein *et al.* 2005, Erbe *et al.* 2019).

Any species of cetacean and any type of vessel can be involved in a ship strike event. However, the most lethal and serious injuries to whales are caused by large vessels of 80m or longer and when vessels are travelling at 14 knots or faster (Laist *et al.* 2006). Injury or death is caused to the whale through blunt force trauma from being impacted by an object weighing tens of thousands of tonnes, often travelling more than 20 miles per hour, as well as the impact of sharp propeller blades (Jensen and Silber 2003). This can cause impacts at the individual, population and species level with some species nearing extinction due to ship strikes (Tort *et al.* 2022). The most poignant example is the endangered North Atlantic right whale (see Box 2).

Humpback whale and cruise ship in Antarctica

North Atlantic right whales are dying faster than they can reproduce, largely due to vessel strikes and entanglement. NOAA Fisheries estimates that 346 to 363 endangered North Atlantic right whales were alive at the beginning of 2022.

There are fewer than 70 reproductively active female North Atlantic right whales. Their calving season runs from mid-November to mid-April. Both females and calves are particularly vulnerable to ship strikes from vessels of all sizes, due to the large amount of time spent at the surface for breathing and nursing.

So far, researchers have identified 17 calves this 2023-2024 calving season (correct as of 16/04/2024). Every single female North Atlantic right whale and calf are vital to this endangered species' recovery.

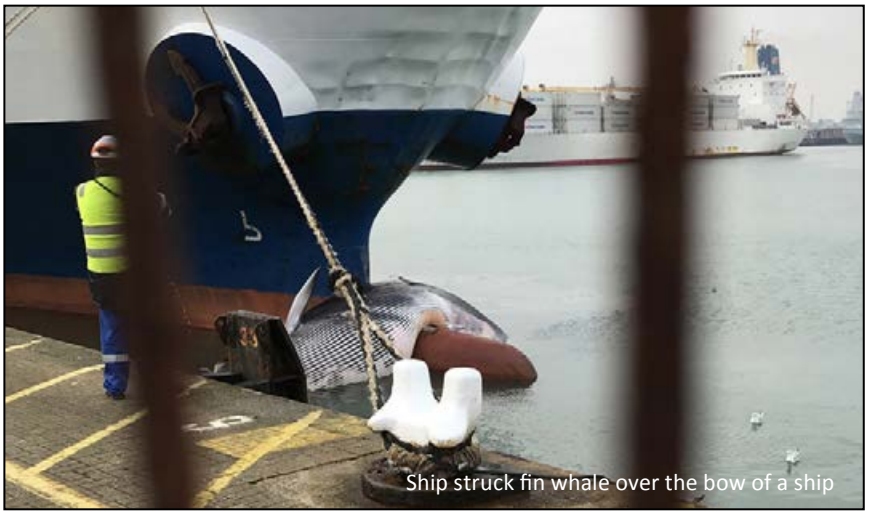
An ORCA Marine Mammal Surveyor team on board the Saga Spirit of Discovery encountered a female North Atlantic right whale in waters off Maine in October 2023. This sighting of one female (possibly of breeding age) caused great interest within the conservation community and was identified as 12 year old female whale #4191. This highlights how ORCA's growing sightings database increasingly contributes to local, national, regional and international conservation efforts and insights.

The most successful mitigation measure to reduce ship strike injury and mortality is to separate at-risk animals and ships so that collisions cannot occur. Where this is not possible, measures like Traffic Separation Schemes and the designation of Areas to be Avoided are also effective to reduce encounters between marine traffic and whales, and have been successful at lowering whale deaths (van der Hoop *et al.* 2013).

Studies have found that the probability of a fatal ship strike increases with vessel speed (Vanderlaan and Taggart 2007, David *et al.* 2011, Conn and Silber 2013). Therefore, speed restrictions have been shown to be vital in reducing ship strikes. Seasonal or dynamic speed restrictions of 10 knots in areas that are deemed critical whale habitats can reduce the risk of lethal ship strikes by between 80-90% (Conn and Silber 2013).

As large whales are highly mobile, migratory species these measures are only effective if they are designated in the right places, at the right time of year. Therefore, in order to protect whales we need to know precisely where critical whale habitats are to ensure conservation measures are effective. This is where ORCA's work comes into its own. As well as established effort based data collection programmes ORCA is conducting a number of innovative whale behaviour research projects on board ferry and cruise ships to better understand ship strike risk in the following regions; Alaska, Bay of Biscay and Southern Ocean.

Working closely with shipping partners, ORCA has developed and delivered training courses for seafarers and itinerary planners to help raise awareness and mitigate the impacts of shipping on cetaceans at a global scale.



Ship struck fin whale over the bow of a ship

Understanding whale behaviour around large vessels along the Pacific Seaboard

Alaska citizen science project

The Northeast Pacific Ocean, particularly the coastal waters of Alaska, are identified as a high risk area for ship strike (Nicol *et al.* 2017, Silber *et al.* 2021). This area is a popular cruise destination (Harris *et al.* 2012) whilst also providing habitat that supports high densities of large whales, particularly during the summer months where whales congregate here to feed. This makes it an important area to monitor close encounters between vessels and whales.

After a successful project in 2022, an ORCA Marine Mammal Observer (MMO) was placed on board the Cunard Queen Elizabeth cruise ship during the 2023 Alaska cruise season (May-August). Along with acting as an additional watch keeper on the bridge, the MMO delivered extensive formal and informal ship strike mitigation training to all members of the bridge crew.

Data was also collected through visual observations of whales from the bridge during daylight hours using the ORCA OceanWatchers survey protocol. Additional data were collected on the whale's behaviour in response to the vessel (with a particular focus on humpback whales), as well as any response that the ship needed to make to decrease the likelihood of a ship strike event or near miss. This data was analysed and some interesting conclusions were made.

Key findings

The results show that a vessel of similar size to the Queen Elizabeth can take avoiding action (albeit modest but still valuable) in response to sightings of whales which would be expected to reduce the collision risk. However, there are a number of considerations that need to be taken into account.

For ships of similar size travelling at normal operational speed between 11 and 18 knots if a whale was sighted less than a 1000m, an effective avoidance manoeuvre would not be possible. There are limited options for avoiding whale strikes within the 1000m zone unless the speed is reduced. These results are similar to predictive modelling studies (Baille and Zitterbart 2022) that demonstrate that whales need to be detected several kilometres ahead of a vessel to allow for an effective response.

Also these study results will be species specific whereby avoidance measures at certain distances may work for humpback whales which are a more flamboyant species and are easy to identify at the surface, compared to other whales such as fin whales and sperm whales which spend more time just under or resting at the water surface.

These findings reinforce that slowing down prior to entering an area of high whale presence allows for more scope for effective avoidance. This project will continue in 2024 with ongoing refinement to the protocol in the aim of providing best possible advice to the bridge officers in avoidance manoeuvres in response to sightings of whales.

ORCA Marine Mammal Observer in Glacier Bay National Park, Alaska

Analysing whale behaviours and ship strike risk in the Bay of Biscay

Bay of Biscay citizen science project

High densities of large whales occur in the Bay of Biscay, alongside an increasing density of maritime traffic (Robbins *et al.* 2022a). Fin whales, reported to be one of the species most at risk of ship strike worldwide (Jensen and Silber 2003), occur in large numbers in the deep oceanic waters of the Bay of Biscay, particularly during summer months (Laran *et al.* 2017).

Preliminary evidence from the Northeast Atlantic Ocean indicates a major concern for baleen whales with 15–20% recorded as dying from ship strike (Evans *et al.* 2011). It was also found to be the leading cause of death for large whales stranded on French shores at increasing frequency (Peltier *et al.* 2019), which makes it clear that ship strike in the Northeast Atlantic Ocean is a significant conservation concern.

Understanding how large whales respond in close proximity to large vessels could give us important new insights into the way that these animals perceive shipping traffic. This understanding is crucial to reduce ship strike risk, as it can impact the advice given by conservation bodies to seafarers.

Anecdotal evidence collected by ORCA Marine Mammal Surveyors in the Bay of Biscay has shown that near miss events of fin whales coming extremely close to large ferries in the Bay of Biscay are a common occurrence. It has been noted that whales turn and shield calves within just a few metres of the ship to avoid a collision event, but these behaviours have never officially been recorded.

From April to September 2023, Brittany Ferries hosted an ORCA Research Scientist on board the Galicia, a ferry which crosses the Bay of Biscay numerous times a week. The Research Scientist conducted visual observations for large whales from the bridge during transits across the Bay of Biscay, using a bespoke camera and binocular set up. The camera set up allowed recordings of coarse scale whale movements along with fine-scale footage of closer animals and their behaviours. In addition to collecting effort and environmental data, behavioural data were collected on video for any large whales sighted (predominantly fin whales).

Video was analysed to identify times when a whale is seen above the water's surface, along with the angle and distance from the vessel. Collecting footage of the whale's surfacing movements, including any change in heading and behaviour, are crucial to understand the point at which the whale might change its behaviour, direction of travel and/or respiratory rate (or not) in relation to the oncoming vessel.

Preliminary findings

- Throughout the season, large whale sightings remained fairly consistent with up to 30 whale sightings on any given crossing.
- A total of ten near miss events occurred involving fin whales. Interestingly, numerous near miss events were also captured and recorded of Cuvier's beaked whales.
- The fin whales observed tended not to react to the ship's presence. Animals involved in close encounters seemed to continue with the behaviours and in the direction of travel at the closest distance from the ship as they were when first sighted. Aniceto *et al.* (2016) research showed that fin whales travelling in groups in the Bay of Biscay displayed lowered attentiveness rates in proximity to ferries, which may increase the risk of ship strike.

This research project will be repeated in the summer of 2024, providing a larger and more comprehensive dataset for analyses.

Identifying critical hotspots for large whales in the Southern Ocean

Southern Ocean citizen science project

Understanding the distribution of whales, particularly high density hotspots, can eventually lead to speed reductions or the movement of shipping lanes - both which have been shown to be effective in reducing ship strike risk (Rockwood *et al.* 2020). As described in the State of Cetaceans 2023 report, ORCA are working in collaboration with the British Antarctic Survey, HX and the Government of South Georgia and the South Sandwich Islands to better understand the abundance and distribution of large whale populations in the Southern Ocean, with a particular focus on South Georgia and the Antarctic Peninsula. These large whale populations are recovering from being severely depleted by whaling. It is estimated that whalers hunted 99% of the blue whale population in this region, so much that it is thought blue whales lost their cultural memory of the waters around South Georgia being productive feeding areas (BAS 2020).

When increased shipping traffic (mainly tourism vessels in the Southern Ocean) and densities of large whales overlap, this puts an increasing amount of pressure on whales when they are visiting these areas for feeding. Large whales such as fin whales, humpback whales, blue whales, sei whales and southern right whales are recorded in these areas, with some travelling thousands of miles to reach these rich feeding grounds. However, the exact number of whales and the areas of high densities (hotspots) are not known.

To determine the density and abundance of populations, ORCA uses line transect distance sampling survey methods from platforms of opportunity. Following a successful 2022-23 surveying season, ORCA Marine Mammal Surveyor Teams headed south to continue this vital data collection from on board HX's MS Fram, for the 2023-24 Antarctic season. The aim of this research project is to identify whale hotspots particularly around South Georgia and the Antarctica Peninsula, so that effective mitigation measures can be put in place to protect the large whales that are returning to this critical habitat.

Fin whales sighted in South Georgia

Preliminary findings

- Humpback whale numbers recorded in proximity to the Antarctic Peninsula were far higher early in the season than has previously been anecdotally reported. This does, however, mean that further monitoring is critical to assess whether there are changes in whale density during the Antarctic season and whether areas not covered by the newly defined geofenced time-areas (Figure 26) need to be included in the future.
- The waters around Elephant Island are becoming a hotspot for fin whales, for example in recent years pods of over 100 fin whales have been sighted here. This has implications for vessels visiting the area and understanding the way that whales are using this area is important to ensure sustainable management of activities in this region moving forward.
- Further monitoring is essential to understand whether areas where high densities of whales were recorded on individual itineraries may, in fact, be important hotspots.
- Hotspots for a variety of large whale species were recorded throughout the waters of South Georgia and the South Sandwich Islands.

In response to data collected by the ORCA Teams (Figure 27), and other citizen scientists and researchers on other vessels in 2022-23, the International Association for Antarctic Tour Operators (IAATO) expanded their geofenced (speed restricted) areas around the Antarctic Peninsula both temporarily and spatially (Figure 26). One of the two pre-existing geofenced areas, the Gerlache Strait (and adjacent waters) has been expanded temporally to cover these critical whale habitats for earlier in the season, from the 1st November to the 30th May; covering the majority of the tourist season. The following two geofenced areas have been added on a voluntary trial basis for the 2023-24 and 2024-25 seasons before becoming mandatory in the 2025-26 season; South Shetland Islands and the area surrounding Elephant Island. This provides further much needed protection to whales that spend the austral summer feeding here.

Fin whale sighted in South Georgia by ORCA Marine Mammal Surveyors

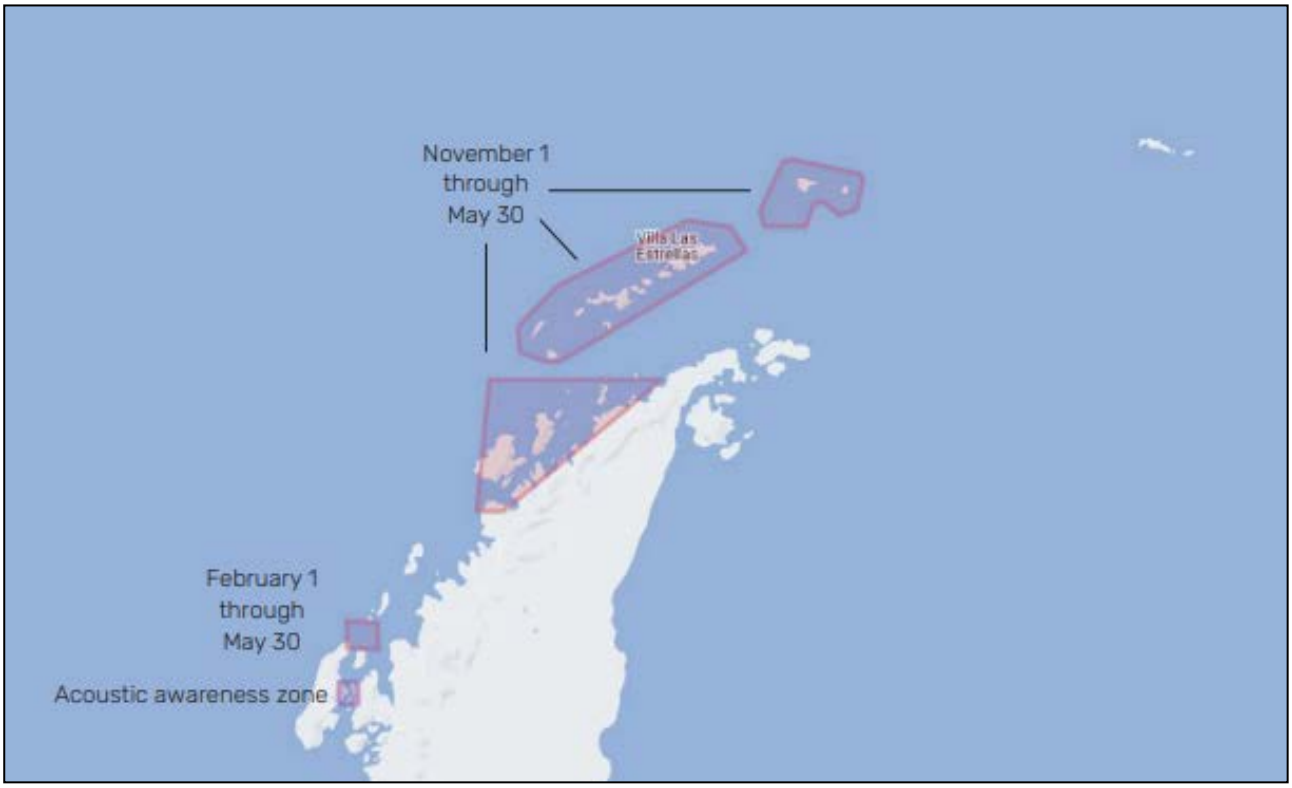


Figure 26: IAATO geofenced time-areas around the Antarctic Peninsula (IAATO 2023). Geofenced time-areas (from North to South) are the area surrounding Elephant Island, the South Shetland Islands, Gerlache Strait and adjacent waters and the Marta Passage

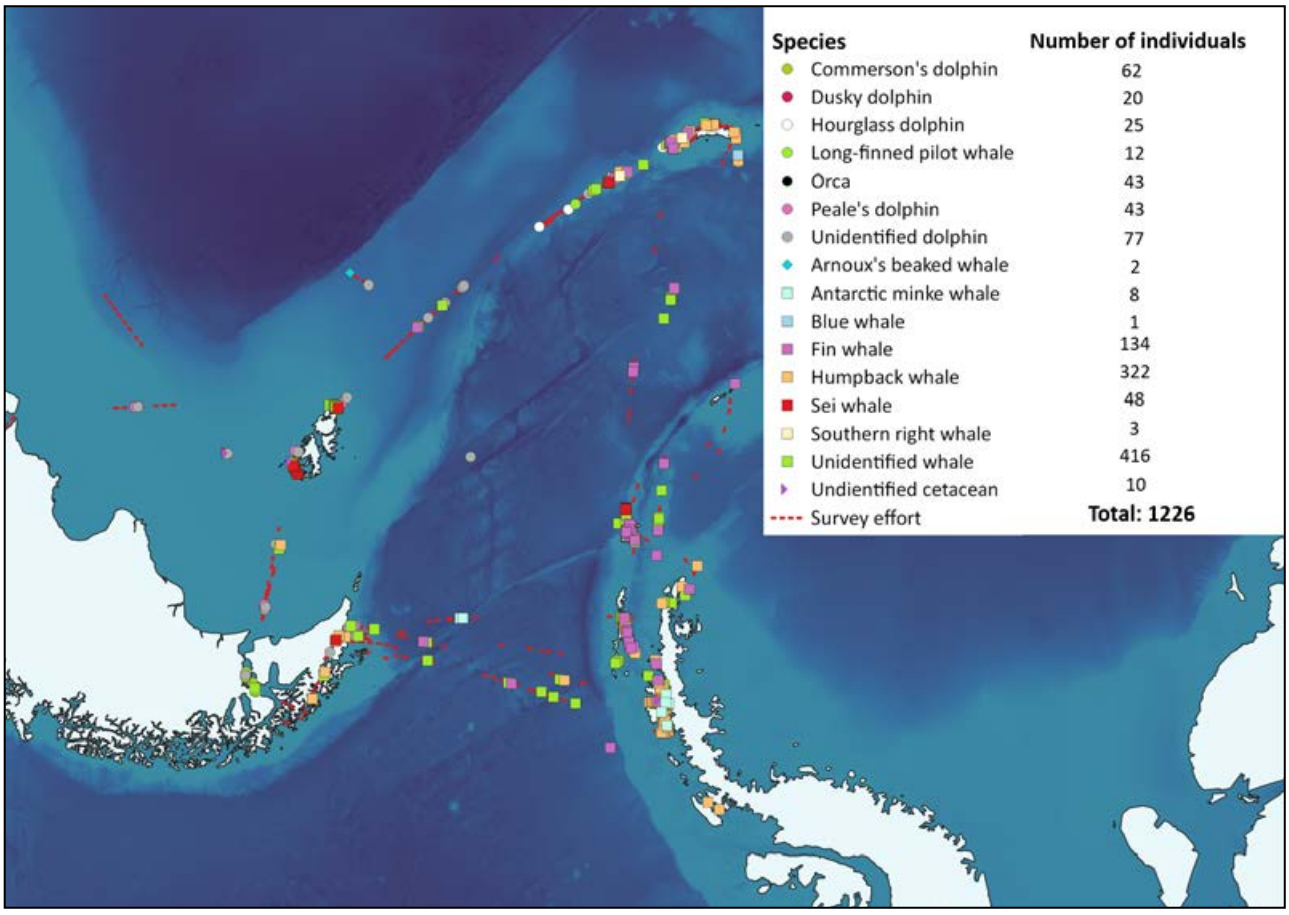


Figure 27: Cetacean sightings from MS Fram during the 2022-23 Antarctic season

Seafarer training

If conservation information is presented as a collaborative endeavour between the shipping industry and conservation bodies, seafarers may be more likely to comply with ship strike mitigation measures (Reimer *et al.* 2016), particularly in areas where there are voluntary measures (Ebdon *et al.* 2020). The recently designated northwestern Mediterranean Sea Particularly Sensitive Sea Area is testament to this (Box 3).

Box 3: Northwestern Mediterranean Sea designated as Particularly Sensitive Sea Area (PSSA) by the International Maritime Organisation (IMO)

The huge impact of ship strikes on large whale populations is now recognised globally. In July 2023, a Particularly Sensitive Sea Area (PSSA) was designated in the northwestern Mediterranean Sea (NW Med PSSA) due to the explicit recognition by the IMO that ship strikes are the main cause of human-induced death for fin and sperm whales in this region. The PSSA encompasses the waters between Valencia and Genoa and includes the following areas which are critical fin and sperm whale habitats;

- The Pelagos Sanctuary in the Ligurian Sea.
- The Mediterranean Cetacean Migration Corridor (Marine Protected Area and Specially Protected Area of Mediterranean Importance).
- Two Important Marine Mammal Areas (IMMAs) - “Gulf of Lions Shelf” and “Slopes and Canyons System of the North-Western Mediterranean Sea”.

Overlapping with these critical whale habitat hotspots are areas of very high vessel movement with 220,000 ships per year transiting through at speeds of between 14 and 35 knots.

Due to the unpredictability of where whales will be at any given time in this area, the option for the re-routing of shipping lanes is not feasible. Therefore, it is proposed that: “Mariners should navigate with particular caution within the NW Med PSSA in areas where large and medium cetaceans are detected or reported, and reduce their speed to between 10 and 13 knots as voluntary speed reduction. However, a safe speed should be kept, so that proper and effective action could be taken to avoid collision and any possible negative impacts on ship’s manoeuvrability”.

This is the first PSSA designated based on ship strike risk and is a key milestone in highlighting the devastating impact of ship strike on sperm whales and fin whales found in this region.

Sperm whale - Richard Lovelock

Education and engagement with seafarers, particularly bridge officers and itinerary planners, is therefore key to boost compliance. ORCA have, with the help of seafaring partners, developed a successful ship strike mitigation training programme. This training provides information for seafarers about the risk of ship strike, how to identify the species most at risk, the critical habitats for these species (bespoke to each company and their itineraries), and practical best practice measures (proactive and reactive) for what to do when whales are sighted.

This training is currently being delivered and utilised by ferry, freight and cruise ship crews globally.

ORCA staff conducting training with Virgin Voyages Officers on board the Valient Lady in the Mediterranean

"As a company committed to protecting the environment, we are pleased to be working with ORCA to reduce the risks of whale collisions in the sea-regions we visit.

ORCA's training has equipped our bridge team with invaluable knowledge about the marine habitats and the marine mammal species around them, instilling a fascination and interest in their protection. The training has provided best practice measures for safely navigating around whales and how to record marine mammal sightings. We are pleased to be able to actively contribute to ORCA's dataset so that we can better protect these incredible creatures.

We are looking forward to our continued work with ORCA to train our entire fleet, both via face-to-face training and through e-learning platforms"

- Jill Stoneberg, Senior Director - Social Impact and Sustainability, Virgin Voyages

Conservation Campaigning and Impact

ORCA achieves nothing if its survey efforts do not result in impact and change. We bring to bear the power of citizen science through participation and innovation, but we have to ensure that this dedication and commitment leads to greater protection for whales and dolphins. It is never about ORCA - it is always what we can achieve and the impact that we can have for our precious marine environment and the animals that live there.

More than anywhere else in the world, ORCA has an unparalleled expertise and dataset about the Bay of Biscay. Repeat surveys over 25 years have enabled us to make a compelling and successful case for the establishment of Important Marine Mammal Areas (IMMAs) in this area and specifically the Northern Continental Shelf of the Bay of Biscay IMMA, the Southern Biscay Canyon System IMMA, Biscay Shelf Edge and Slope IMMA and Biscay Abyssal Plain IMMA.

We are one of the principal data providers to the Joint Cetacean Data Programme (JCDP) led by the Joint Nature Conservation Committee (JNCC) and hosted by the International Council for the Exploration of the Sea (ICES). This is a truly collaborative international initiative with the aim of standardising effort based cetacean data from multiple sources across the Northeast Atlantic, increasing the scientific understanding and ultimately the conservation of these species.

Humpback whale pair - Louise Fox

Our ongoing work in the Antarctic in conjunction with British Antarctic Survey, HX and the Government of South Georgia and the South Sandwich Islands has shown that humpback whales recorded near the Antarctic Peninsula were present in far higher numbers early in the season than was anticipated. The waters around Elephant Island in particular appear to have become a hotspot for fin whales.

Continuing in 2023, ORCA provided expert evidence to the UK government's Environment, Food and Rural Affairs (EFRA) committee, alongside members of the Wildlife and Countryside Link Marine Mammals Group. This agenda-setting body grilled us on the threats facing cetaceans in UK waters and our proposed solutions. Their resulting report was a strong set of recommendations for action, the majority of which have regrettably not been taken up by the government. Current UK legislation protecting marine mammals is not fit for purpose and inadequate for addressing the multiple threats being faced. We shall continue to make this argument through our representation on expert panels. We continue to provide training, advice and ongoing study on the means by which ship strike mitigation can be increased. This is a growing issue of concern and a key focus of our ongoing work. We are looking at a number of innovative means by which ship strike numbers can be reduced and working with partners to develop practical mitigation measures.

We were invited by the Department for Environment, Food and Rural Affairs (DEFRA) to join the official UK delegation to the annual International Whaling Commission Scientific Committee meeting, providing expert, evidence-based recommendations to the Commission. We have accepted an invitation to join the IWC's expert ship-strike Committee, which is developing practical measures to reduce this growing threat.

For ORCA, impact is everything. From the profound and awe-inspiring impact that a first whale or dolphin sighting has on a cruise or ferry passenger, through to the creation of better habitat protections for marine mammals as a result of our citizen science work. This is what underpins our work, continues to always drive us forward and is why we shall always want to achieve more for whales and dolphins.

Fin whale victim of ship strike

Thank You

An overwhelming gratitude of thanks goes to every one of our members and supporters for all their time, support and joy they have given us over many years.

The Ocean Conservationists, the office support, without whose enthusiasm and dedication to the cause, ORCA could not function. The IT wizardry of the app and the data portal team: John Van Breda of Biodiverse IT, Karolis Kazlauskis and Villius Stankaitis of Flumens seeing sightings records magically appearing in the Portsmouth office from the bottom of the world still blows our mind. Cloud Orca for all the Salesforce expertise and donated time to help us place people on ships at a touch of a button.

Russell Leaper and Dr Jonathan Gordon for all their scientific expertise and guidance, gently nudging us in the right direction on how to study whale behaviour from large vessels.

However the biggest shoutout goes to our incredible 800 plus network of volunteer Marine Mammal Surveyors, who practically run the UK offshore monitoring programme. Each one of you has played a role in this vital monitoring work, which can only take place thanks to your contribution - whether in the past, present or future.

We must also not forget one of our most treasured and longstanding ferry partnerships - Brittany Ferries who not only allow us on board across their fleet of ships but provide us with invaluable donated office space - Thank you.

Lastly we would also like to extend our thanks to the ORCA patrons Mark Carwardine, Chris Packham, Nigel Marvin and Lizzie Daly for all their continued support.

Common dolphin - Paul Soulby

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ORCA patron, zoologist, conservationist and author

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