ORCA Looking out for Whales and Dolphins

THE STATE OF CETACEANS 2023

orca.org.uk

SUMMARY

The State of Cetaceans 2023 report is the latest landmark in ORCA's ongoing mission to use citizen science to improve the monitoring and the protection of cetaceans (whales, dolphins and porpoises) globally. Since 2001, ORCA citizen scientists have boarded ferries and cruise ships around the world and recorded the marine wildlife they observed. This is the sixth in a series of annual reports and builds on existing publications.

With our surveys expanding globally, we are gaining even greater insights about marine mammal populations in more diverse and remote parts of the ocean, our report now reflects this increasing global dimension to our work.

The State of Cetaceans reports continue to demonstrate why ongoing regular monitoring of cetaceans is vital. The compilation and analysis of real-time, long-term data are essential to make effective and informed decisions about the protection of our whales and dolphins which is so urgently needed. Utilising ferry and cruise platforms is a highly effective tool to estimate density, distribution and range of these animals in near real-time so that worrying patterns can be identified early.

This report in particular looks at how citizen science can be used to protect vulnerable cetacean populations, identify critical habitats and understand the behaviour of the large whales around vessels to help reduce the number of animals being hit by ships.

Whilst citizen scientists can provide an army of watchful eyes thanks to the (extra) ordinary people, many of whom volunteer their free time in the name of conservation, we also need commitment from governments and industry to take swift and decisive action when evidence shows the growing threat to these animals and the habitats in which they live.

Pilot whale - Richard Lovelock

KEY HIGHLIGHTS

Since 2006, ORCA has conducted 721 distance sampling surveys from 22 ferry routes in partnership with 11 ferry companies and 396 effort based surveys have been conducted in partnership with three ferry companies and 12 cruise companies across the world's ocean.

Protecting Vulnerable Populations

Distance sampling surveys

- In 2022 a total of 62 surveys across ten ferry routes operated by three companies and resulting in 12,811 km of effort were carried out
- Survey effort in 2022 was still lower than in previous years in the aftermath of the pandemic with the highest survey effort seen around the Isles of Scilly and in the English Channel
- There were 639 sightings* of 4,069 cetaceans, of which 534 were identified to the species level. Thirteen species were recorded in total
- Common dolphins were the most frequently encountered species with 353 encounters
- Most sightings were recorded on the Plymouth-Santander ferry route with 222 sightings which were dominated by common dolphins which accounted for 159 of these

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

Common dolphins - Richard Lovelock

Conserving Critical Habitats

Dedicated effort based surveys

- Sea regions surveyed included the Northeast Atlantic, northwest European shelf, the Mediterranean Sea, the Mid-Atlantic Ridge, Arctic Waters, part of the Western Atlantic Ocean, coastal South Atlantic Ocean, the Eastern Pacific Ocean, the Southern Ocean and for the first time, the Northwest Passage. In total, 141,348 km of effort was conducted
- Thirty-five species were seen in total consisting of 3,857 encounters and 20,997 individuals. Common dolphins were the most recorded species, with 11,662 individuals recorded
- Hourglass dolphins, narwhals and southern right whales were recorded for the first time

The OceanWatchers programme

- In total, 1,623 km of survey effort was conducted at sea with the most surveyed regions being the Northeast Atlantic Ocean, Wider Atlantic Ocean and the Mediterranean Sea, predominantly from cruise ships
- Twenty-one cetacean species were recorded consisting of 275 sightings and 1,707 individuals
- On land over 280 hours was spent watching, resulting in 163 sightings; 149 of which were identified to the species level
- The most watched regions in the UK were Cornwall, Wales, Devon and Northumbria with the harbour porpoise being the most commonly seen species
- Outside the UK, surveys were conducted in the Netherlands, France, Madeira and South Africa which yielded sightings of Heaviside dolphins, an ORCA first

Saving Large Whales from Ship Strike

- ORCA distance sampling surveys were conducted from platforms of opportunity for the first time in the Southern Ocean in order to assess the abundance and distribution of recovering large whale populations
- Marine Mammal Surveyors conducted a total of five distance sampling surveys across the 2022-2023 Antarctic season on board Hurtigruten Expeditions MS Fram
- A pilot surveying protocol to understand humpback whale ship strike ‘near miss events’ was delivered from a cruise ship in Alaska in early summer 2022. Preliminary analysis shows the chances of near miss events were heightened when the humpback whales were feeding or resting
- A bespoke camera and surveying methodology is currently being trialled in the Bay of Biscay to understand how fin whales react to large ferry vessels
- ORCA has worked with over 300 seafarers in our ship strike mitigation training and education programmes, which will increase compliance in voluntary and mandatory ship strike mitigation measures worldwide and will lead to active engagement across the shipping industry of the best practice measures for reducing the ship strike threat

Atlantic spotted dolphins - Lina Verma

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Acknowledgements

Shipping partners

We would like to extend our overwhelming gratitude to our shipping partners* without whom the survey data collection could not be possible.

*active in 2022 and 2023

Corporate members

Supporters and contributors

We would like to thank our amazing networks of Marine Marine Surveyors and Ocean Conservationists who dedicate so much of their time to help protect cetaceans. In particular Andy Gilbert is who has been such a stalwart of ORCA for so many years and will always be a part of the ORCA team. Russell Leaper and Dr Jonathan Gordon for all their patience and endless guidance, particularly around ship strike. Karolis Kazlauskis and Vilius Stankaitis for all their expertise and dedication in building such a fabulous survey app for us. John van Breda for his biodiversity survey knowledge and technical wizardry in creating our data portal.

ORCA volunteers

ORCA's distance sampling monitoring programme is entirely reliant on our network of volunteer Marine Mammal Surveyors. Each one plays a role in this vital monitoring work - whether in the past, present or future. The ORCA OceanWatchers programme complements our distance sampling data collection and the work carried out by our volunteer network of OceanWatchers has enabled us to expand our survey effort significantly.

These annual reports are a testament to their skill, time, effort and dedication. Thank you.

Blue whales - Terry Carne

About ORCA

ORCA is a UK whale and dolphin conservation charity dedicated to the long-term protection of whales, dolphins and porpoises (collectively known as cetaceans) and their habitats across the world's ocean. Founded in 2001, ORCA works to monitor vulnerable cetacean populations and helps to protect threatened marine habitats. Working with governments, industry, research institutions and other conservation charities, ORCA's aim is to create safer places for cetaceans, ultimately promoting the health and well-being of the wider marine ecosystem.

Alongside its dedication to cetaceans, ORCA is passionate about people; the charity's work is as much about people as it is about whales and dolphins. What makes ORCA unique is the way we combine accessible marine education with our conservation activities, allowing us to give people from all walks of life the opportunity to take an active role in marine science and conservation activities. We are making science less exclusive and more accessible and tangible. We train volunteers to join our Marine Mammal Surveyor teams and recruit Ocean Conservationists to support our educational programmes. ORCA's projects reach over 3.5 million people of all ages each year, providing memorable educational activities and remarkable wildlife experiences both on and offshore. By doing so, we are empowering local communities to become stewards of whales and dolphins and the marine environment in which they live.

Marine Mammal Surveyor and guests

The Report and its Purpose

With our surveys expanding globally, we are gaining an even greater insight about marine mammal populations in more diverse and remote parts of the ocean. The 2022 data is presented through the lens of the two main goals of ORCA's data collection: to protect vulnerable populations and to identify critical habitats.

This edition is also a ship strike special, a key focus of ORCA's conservation work. Our work on ship strike as well as wider threats to cetaceans and their habitats has moved onto an international stage, and so our refreshed report 'State of Cetaceans' now reflects this increasing global dimension to our work.

With ever-increasing commercial pressures impacting our ocean, justifiable concern is building about the health of our marine ecosystems. ORCA's cetacean monitoring programmes help to provide the year-round supporting evidence necessary to assess the health of our whale and dolphin populations in the face of these threats. ORCA's research highlights areas within our seas that are consistently utilised by a range of cetacean species. It is these hotspots that must be given more protection as a matter of urgency.

This report builds on the 17 years' worth of sightings and environmental data collected during the 1,117 dedicated ORCA surveys conducted between 2006-2022 using vessels of opportunity (namely ferries and cruise ships). This includes 721 distance sampling ferry surveys, 396 effort based surveys from ferries and cruise ships and includes, for the first time, data from our new OceanWatchers programme.

Guests watching a humpback whale

Survey Overview

ORCA conducts cetacean focused surveys with teams of up to four people from platforms of opportunity, primarily ferries and cruise ships transisting around the world.


Marine Mammal Surveyor

Survey areas

ORCA regularly surveys nine regions (Figure 1): North Sea, English Channel, Celtic Sea, Irish Sea, Minches and West Scotland, Bay of Biscay and Iberian Coast, Arctic Waters, Wider Atlantic and the Mediterranean Sea. From 2018 onwards three more sea regions have been included in the geographical scope for cetacean surveys: the North Pacific, South Atlantic Ocean and Southern Ocean.

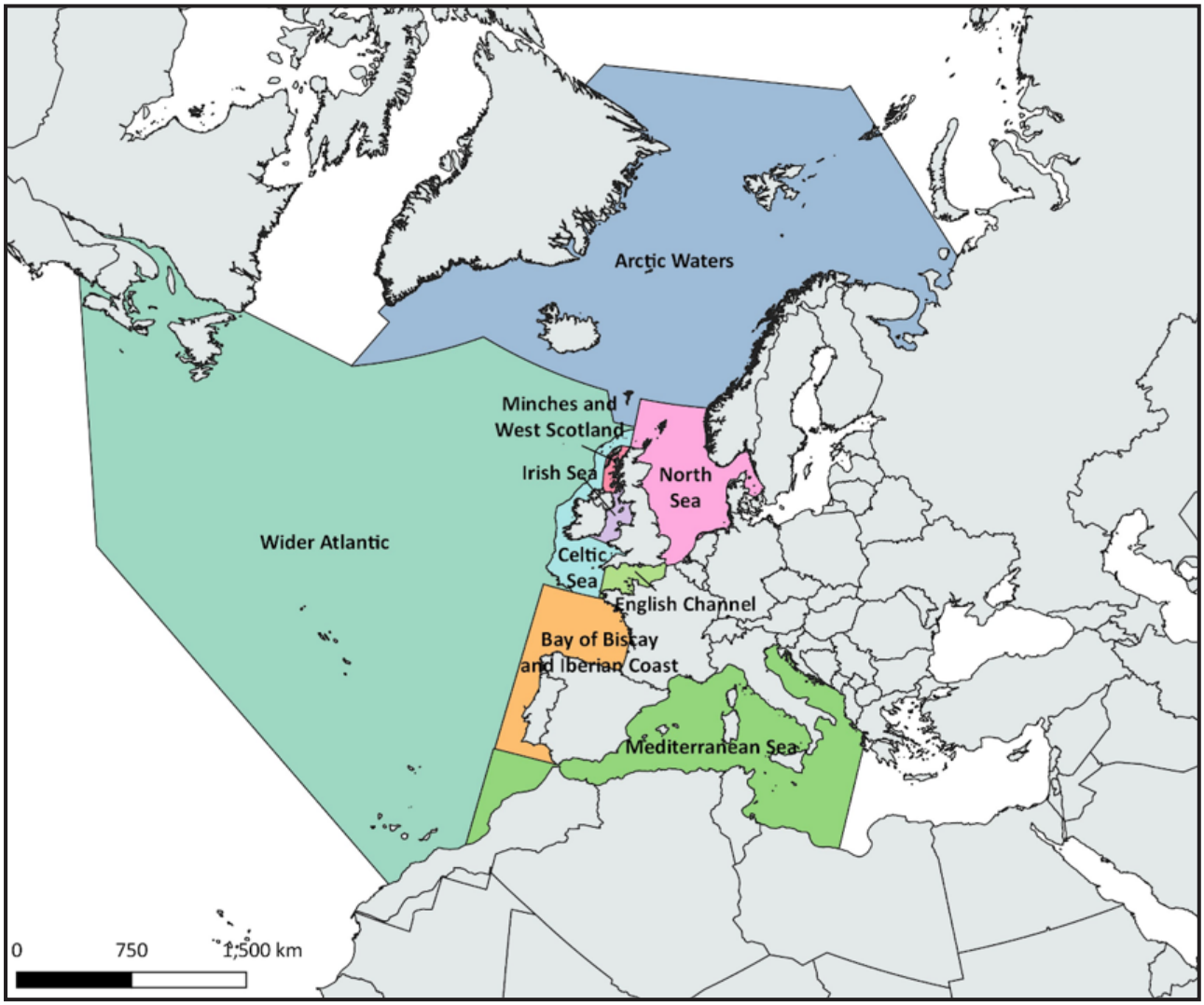


Figure 1: Sea regions regularly surveyed by ORCA

Since 2006, ORCA has conducted 721 distance sampling surveys from 22 ferry routes in partnership with 11 ferry companies. Effort based surveys conducted from both ferries and cruise ships involved 206 surveys with three ferry companies and 190 surveys in partnership with 12 cruise companies across the world's ocean; excluding the Indian Ocean (Table 1).

Table 1: Routes and sea regions surveyed by ORCA between 2006 and 2022

Sea Region	Route Code	Route	Years Active	Company
North Sea	NsId	Newcastle-IJmuiden	2009, 2011-2019	DFDS
	NcBg	Newcastle-Bergen	2006-2008	DFDS
	HwEb	Harwich-Esbjerg	2008-2014	DFDS
	ImGoBvIm	Immingham-Gothernburg-Brevik	2015	DFDS
	AbLw	Aberdeen-Lerwick	2016-2019	NorthLink
	Cruise	Various cruises	2006, 2009-2019, 2021-2022	Ambassador Cruise Line, Cunard, Fred. Olsen Cruise Lines, Hurtigruten Expeditions, P&O Cruises, Saga, Silversea
English Channel	PlRc	Plymouth-Roscoff	2014 – 2019, 2022	Brittany Ferries
	PlRcCk	Plymouth-Roscoff- Cork	2017	Brittany Ferries
	PmCa	Portsmouth-Caen	2014-2019, 2022	Brittany Ferries
	PoCb	Poole-Cherbourg	2017-2019, 2022	Brittany Ferries
	DvCl	Dover-Calais	2016-2020	DFDS
	PmFb	Portsmouth-Fishbourne	2015-2019	Wightlink
	LmYm	Lymington-Yarmouth	2015	Wightlink
	SoCo	Southampton-Cowes	2016-2019	Red Funnel
	Cruise	Various cruises	2007, 2010-2019, 2021-2022	Ambassador Cruise Line, Fred. Olsen Cruise Lines, Hurtigruten Expeditions, P&O Cruises, Saga, Silversea
Celtic Sea	PzSm	Penzance-St Mary's	2009-2019, 2022	Isles of Scilly Travel
	Cruise	Various cruises	2007, 2009-2019, 2022	Ambassador Cruise Line, Fred. Olsen Cruise Lines, Hurtigruten, Expeditions, P&O Cruises, Saga, Silversea
Irish Sea	HsPd	Heysham-Douglas	2011-2013, 2015-2016	Isle of Man Steam Packet Company
	Cruise	Various cruises	2008-2019, 2021-2022	Ambassador Cruise Line, Fred. Olsen Cruise Lines, Hurtigruten Expeditions, Saga, Silversea
Minches and West Scotland	UlSw	Ullapool-Stornoway	2017-2019, 2022	Caledonian MacBrayne
	ObCs	Oban-Castlebay	2017-2019, 2022	Caledonian MacBrayne
	ObTiCo	Oban-Coll-Tiree -Colonsay	2017-2019, 2022	Caledonian MacBrayne
	UiTa	Uig-Lochmaddy-Uig-Tarbert-Uig	2019, 2022	Caledonian MacBrayne
	ArCp	Ardrossan-Campbeltown	2019, 2022	Caledonian MacBrayne
	Cruise	Various cruises	2009-2019, 2021-2022	Ambassador Cruise Line, Fred. Olsen Cruise Lines, Hurtigruten Expeditions, P&O cruises, Saga
Bay of Biscay and Iberian Coast	PlSt	Plymouth-Santander	2006-2008, 2022	Brittany Ferries
	PlStPm	Plymouth-Santander -Portsmouth	2009-2019	Brittany Ferries
	Cruises	Various cruises	2007, 2010-2011, 2013, 2015-2019, 2022	Ambassador Cruise Line, Celebrity Cruises, Fred. Olsen Cruise Lines, Saga, Swan Hellenic

Table 1: Routes and sea regions surveyed by ORCA between 2006 and 2022

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

Ocean Conservationist

Protecting Vulnerable Populations

Estimating the abundance of highly mobile aquatic species such as cetaceans is a challenge. Distance sampling, where the area actually searched and the number of animals missed is calculated from the decreasing probability of detection with increasing distance from the sampling route, is a popular method for estimating the abundance of cetaceans. With repeated surveys, we can get an idea of the trajectory of populations over time.

Dedicated distance sampling surveys

ORCA has carried out surveys using this method from ferries and occasionally cruise ships since 2006 at a minimum of once a month per route. Using these platforms of opportunity as research vessels helps to increase monitoring efforts in sometimes difficult to access areas and provides increased coverage. This over time increases our ability to detect a change which can then be flagged for further research or management efforts.

Distance surveyed (effort)

In 2022 a total of 62 surveys across ten ferry routes operated by three companies were carried out, resulting in 12,811 km of effort. In the aftermath of the pandemic and in contrast to previous years (Table 2), no ferry surveys were carried out in the North Sea. Three routes (Portsmouth-Caen, Poole-Cherbourg, Plymouth-Roscoff) were surveyed in the English Channel, one (Penzance-St Mary's) in the Celtic Sea, one covered both of these areas plus the Bay of Biscay (Plymouth-Santander), and five routes were surveyed around the Hebrides (Ardrossan-Campbeltown, Oban-Castlebay, Oban-Coll-Tiree-Colonsay, Uig-Lochmaddy-Uig-Tarbert, Ullapool-Stornoway).

Table 2: Survey effort in kilometres by distance sampling survey route and year. Patterned cells indicate years that this route was not surveyed while the solid grey cells indicate years that no distance sampling surveys were carried out due to the pandemic. See Table 1 for route code meanings

Route code	NcBg	PlSt	HwEb	PlStPm	NsId	PzSm	HsPd	PlRc	PmCa	ImGoBv	LmYm	PmFb	DvCl	AbLw	SoCo	PlRcCk	PoCb	ObCs	ObTiCo	UlSw	UiTa	ArCp	Total effort (km)
Year																							
2006	8389	2115																					10504
2007	7522	3536																					11058
2008	7204	4453	333																				11990
2009			1770	5459	704	512																	8445
2010			163	4970		1622																	6755
2011			2544	5692	1855	1364	588																12043
2012			2882	4959	2210	1521	331																11903
2013			2903	4294	4087	1686	257																13227
2014			6168	5270	7532	1878		1420	212														22480
2015				4650	4706	2018	498	1123	1462	4297	45	95											18894
2016				3897	4107	1820	1219	1034	1694			110	382	916	111								15290
2017				6430	7282	4771		2708	2912			69	730	2109	50	385	891	210	122	188			28857
2018				5911	3612	2937		1184	1767			57	575	2632	67		983	1171	1003	590			22489
2019				3686	3920	2027		1339	2429			57	551	1971	67		1481	1682	869	984	839	348	22250
2020													76										76
2021																							0
2022		4388				1593		1064	2081								1424	734	380	489	337	321	12811
Total effort (km)	23115	14492	16763	55218	40015	23749	2893	9872	12557	4297	45	388	2314	7628	295	385	4779	3797	2374	2251	1176	669	229072

In 2022, survey effort was highest on the Penzance-St Mary's route and in the English Channel, both in the western English Channel on the Plymouth-Roscoff route and the Portsmouth-Caen and Poole-Cherbourg routes further east. Effort was also relatively high just offshore of Santander on the Plymouth-Santander route. Figure 2 shows the intensity of effort in different areas with lower effort grid cells shown in cool colours and higher effort grid cells in warm colours.

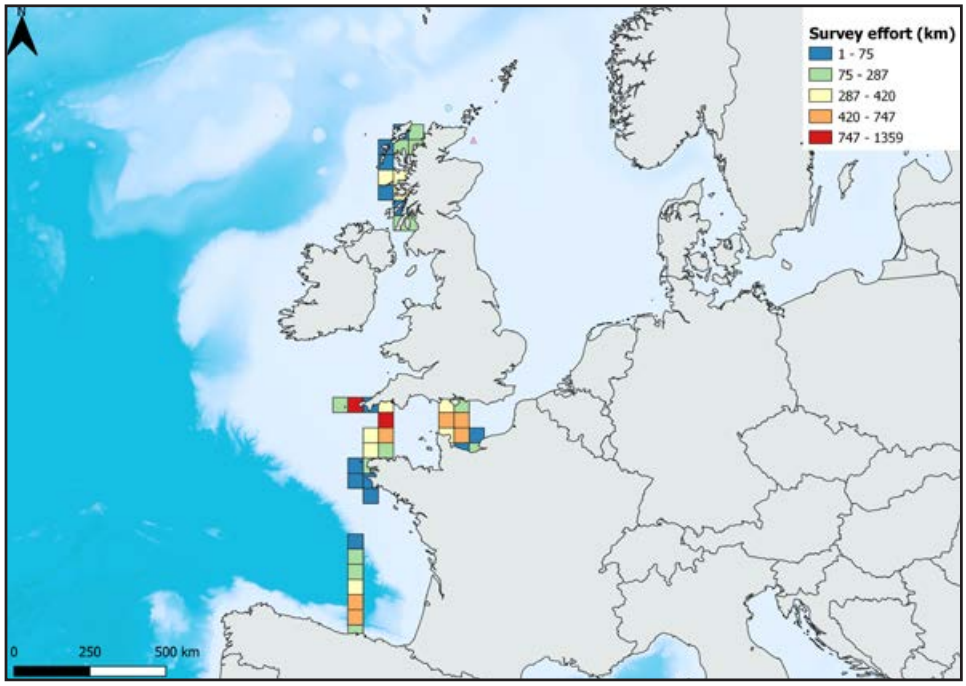


Figure 2: Amount of survey effort in kilometres per 50 km² grid cell in 2022

Cetacean sightings

There were 639 sightings of 4,069 cetaceans, of which 534 were identified to the species level with 13 species recorded in total (Table 3). The distribution of sightings is shown in Figure 3. Common dolphins were the most frequently encountered species with 353 encounters, followed by harbour porpoises with 85 sightings and then minke whales and bottlenose dolphins with 23 encounters. Most sightings were recorded on the Plymouth-Santander route with 222 sightings which were dominated by common dolphins, accounting for 159 of these. The dominance of common dolphins in 2022 likely reflects that survey effort was concentrated further to the west of the UK and Europe with no effort in the North Sea. Incursions of common dolphins in the North Sea only occur occasionally, whereas this species is more abundant in the Celtic Sea and Bay of Biscay, with high densities moving into the western English Channel during winter months due to oceanographic changes (Lambert *et al*. 2022). Survey data in future years will prove useful to monitor this trend and investigate the possible drivers.

Table 3: Sightings per species per survey route in 2022. A sighting can consist of a single animal or numerous animals in a pod

Route code / Species	PlSt	PzSm	PlRc	PoCb	PmCa	ArCp	ObCs	ObTiCo	UiTa	UlSw	Total sightings per species
Harbour porpoise	9	17	0	1	0	11	23	9	8	7	85
Bottlenose dolphin	7	7	1	3	0	2	1	1	0	1	23
Common dolphin	159	66	65	0	3	0	23	3	14	20	353
Pilot whale *sp*	1	0	0	0	0	0	0	0	0	0	1
Risso's dolphin	0	3	0	0	0	0	1	0	0	1	5
Striped dolphin	16	0	0	0	0	0	0	0	0	0	16
White-beaked dolphin	0	0	0	0	0	0	0	0	0	1	1
Orca	0	0	0	0	0	0	1	0	0	0	1
Cuvier's beaked whale	4	0	0	0	0	0	0	0	0	0	4
Sperm whale	4	0	0	0	0	0	0	0	0	0	4
Fin whale	14	1	0	0	0	0	0	0	0	2	17
Minke whale	7	4	1	0	0	0	2	0	2	7	23
Sei whale	1	0	0	0	0	0	0	0	0	0	1
Total sightings per route	222	98	67	4	3	13	51	13	24	39	534

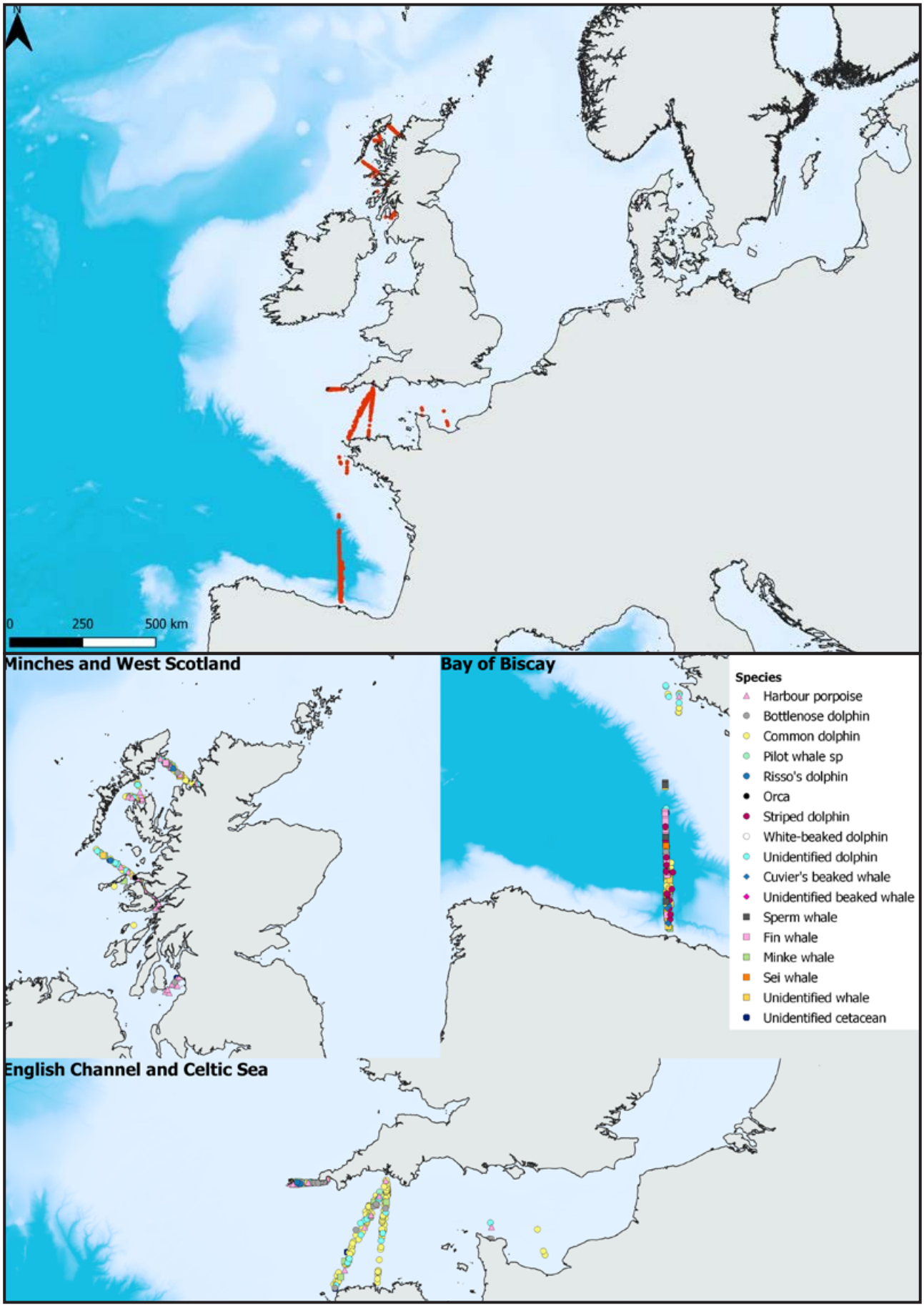


Figure 3: Overall distribution of cetacean sightings recorded during distance sampling ferry surveys in 2022 (top) detailed maps showing sightings in each of the surveyed sea region (bottom)

Conserving Critical Habitats

One approach to managing human impacts on cetaceans is to protect specific areas of known high density which are often referred to as hotspots. However, dedicated surveys are expensive to conduct in offshore areas which are difficult to access, despite encompassing much of the available habitat for cetaceans. Human activities including fishing, military activities and deep sea mining are only increasing in offshore areas creating a new imperative to monitor cetaceans in these places. Additionally, marine ecosystems are dynamic, so cetacean habitats can be extremely variable on time scales ranging from decadal fluctuations due to climate patterns to small scale changes due to short-lived oceanographic processes. Sampling at a high resolution is necessary to capture this variability. By using platforms of opportunity, ORCA collects data in less well sampled areas and at a high frequency, contributing to our understanding of cetacean habitats in poorly sampled areas. ORCA's Ocean Conservationists and Marine Mammal Surveyors juggle this important task with the equally critical business of inspiring and educating the general public about the importance of cetaceans and the threats they face.

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

The regions visited in 2022 were the Northeast Atlantic (including the northwest European shelf), the Mediterranean Sea, the Mid-Atlantic Ridge (including the Azores), Arctic Waters (including Greenland, Iceland, western and northern Norway and Svalbard), parts of the Western Atlantic Ocean (including Canada), the Caribbean and South America, the coastal South Atlantic Ocean, Eastern Pacific Ocean, the Southern Ocean and for the first time, the Northwest Passage. Effort was most intense in the Northeast Atlantic Ocean, especially around northwest Europe, but effort was still fairly high elsewhere with the lowest effort recorded in the western Atlantic. The distribution of effort is shown in Figure 4 with cells with higher survey effort shown in warm colours and cells with lower effort in cool colours. A total of 141,348 km of effort was achieved.

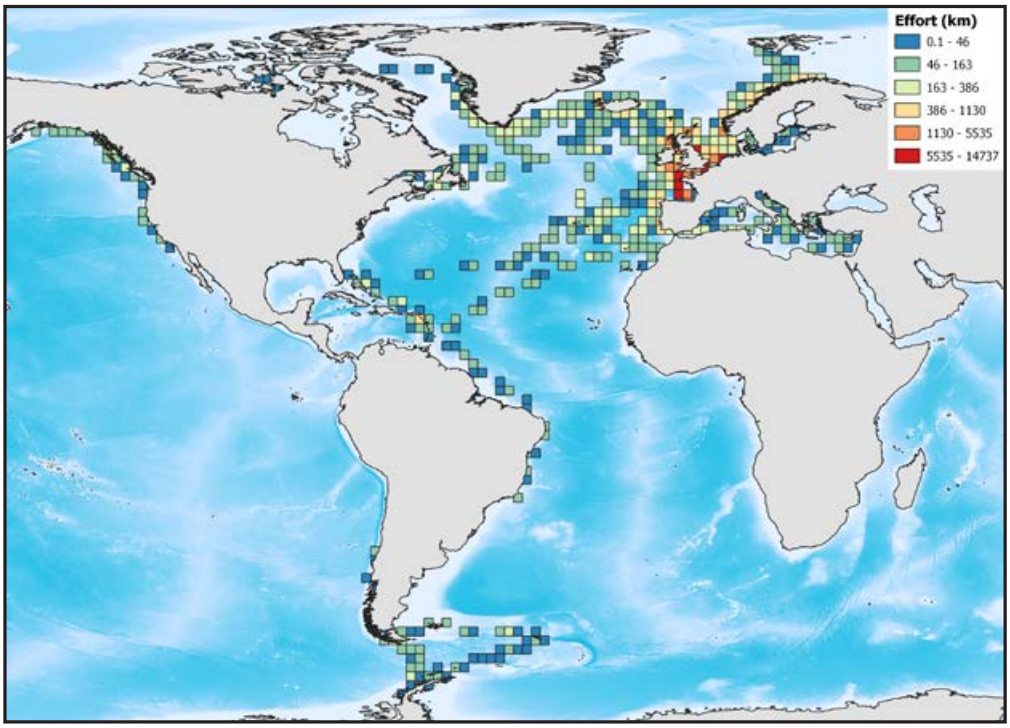


Figure 4: Distribution of effort from dedicated effort based ORCA surveys per 200 km2 grid cell in 2022

Cetacean sightings

Thirty-five species were seen in a total of 3,857 encounters with 20,997 individuals (Table 4). An additional 1,831 sightings of 4,001 individuals not identified to the species level were recorded, resulting in a total of 5,688 sightings of 24,998 individuals. The overall distribution of sightings is shown in Figure 5 while a detailed map of sightings in the main survey regions is shown in Figure 6.

Harbour porpoise - Elfyn Pugh

Table 4: Cetaceans identified to the species level in 2022 during dedicated ORCA effort based surveys. Bold indicates that this species was an ORCA first

Species	Number of sightings	Total individual animals
Dall's porpoise *(Phocoenoides dalli)*	26	119
Harbour porpoise (*Phocoena phocoena*)	764	1972
Atlantic spotted dolphin (*Stenella frontalis*)	30	525
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	25	337
Bottlenose dolphin (*Tursiops truncatus*)	88	509
Commerson's dolphin (*Cephalorhynchus commersonii*)	26	88
Common dolphin (*Delphinus delphis*)	1463	11662
Dusky dolphin (*Lagenorhynchus obscurus*)	11	83
Hourglass dolphin (*Lagenorhynchus cruciger*)	8	105
Orca (*Orcinus orca*)	41	234
Pacific white-sided dolphin (*Lagenorhynchus onliquidens*)	8	70
Peale's dolphin (*Lagenorhynchus australis*)	5	22
Pilot whale, long-finned (*Globicephala melas*)	28	196
Pilot whale, short-finned (*Globicephala macrorhynchus*)	3	14
Pilot whale, unidentified (*Globicephala sp.*)	36	264
Risso's dolphin (*Grampus griseus*)	18	67
Rough-toothed dolphin (*Steno bredanensis*)	1	10
Spinner dolphin (*Stenella longirostris*)	1	6
Striped dolphin (*Stenella coeruleoalba*)	110	1169
White-beaked dolphin (*Lagenorhynchus albirostris*)	111	1257
Blainville's beaked whale (*Mesoplodon densirostris*)	1	4
Cuvier's beaked whale (*Ziphius cavirostris*)	19	40
Northern bottlenose whale (*Hyperoodon ampullatus*)	8	36
Sowerby's beaked whale (*Mesoplodon bidens*)	5	11
Beluga (*Delphinapterus leucas*)	12	226
Narwhal (*Monodon monoceros*)	1	10
Sperm whale (*Physeter macrocephalus*)	54	105
Blue whale (*Balaenoptera musculus*)	21	40
Fin whale (*Balaenoptera physalus*)	331	653
Humpback whale (*Megaptera novaaengliae*)	379	819
Minke whale, Antarctic (*Balaenoptera bonaerensis*)	4	4
Minke whale, common (*Balaenoptera acutorostrata*)	195	307
Sei whale (*Balaenoptera borealis*)	22	31
Southern right whale (*Eubalaena australis*)	2	2
TOTAL	3857	20997

Overall, common dolphins were the most commonly seen cetacean species with 1,463 sightings, reflecting the greater intensity of effort in the Northeast Atlantic Ocean, although the most abundant species varied by region. For example in high latitude areas in both hemispheres, large whales such as humpback, fin and sei whale were the most commonly seen although the latter was much more abundant in the Southern Ocean than in Arctic and subarctic waters (Figure 6). This is likely a reflection of the cruise season in these areas coinciding with the brief, but large magnitude peak in productivity driven by high nutrient levels and long periods of daylight towards the poles in the summer. This makes these areas important feeding grounds for these species who may acquire much of the energy needed for the rest of the year in these areas, especially in those species who undergo long migrations or breed in nutrient deficient areas (Bannister 2001). Hourglass dolphins, narwhals and southern right whales were recorded for the first time during dedicated ORCA surveys in 2022.

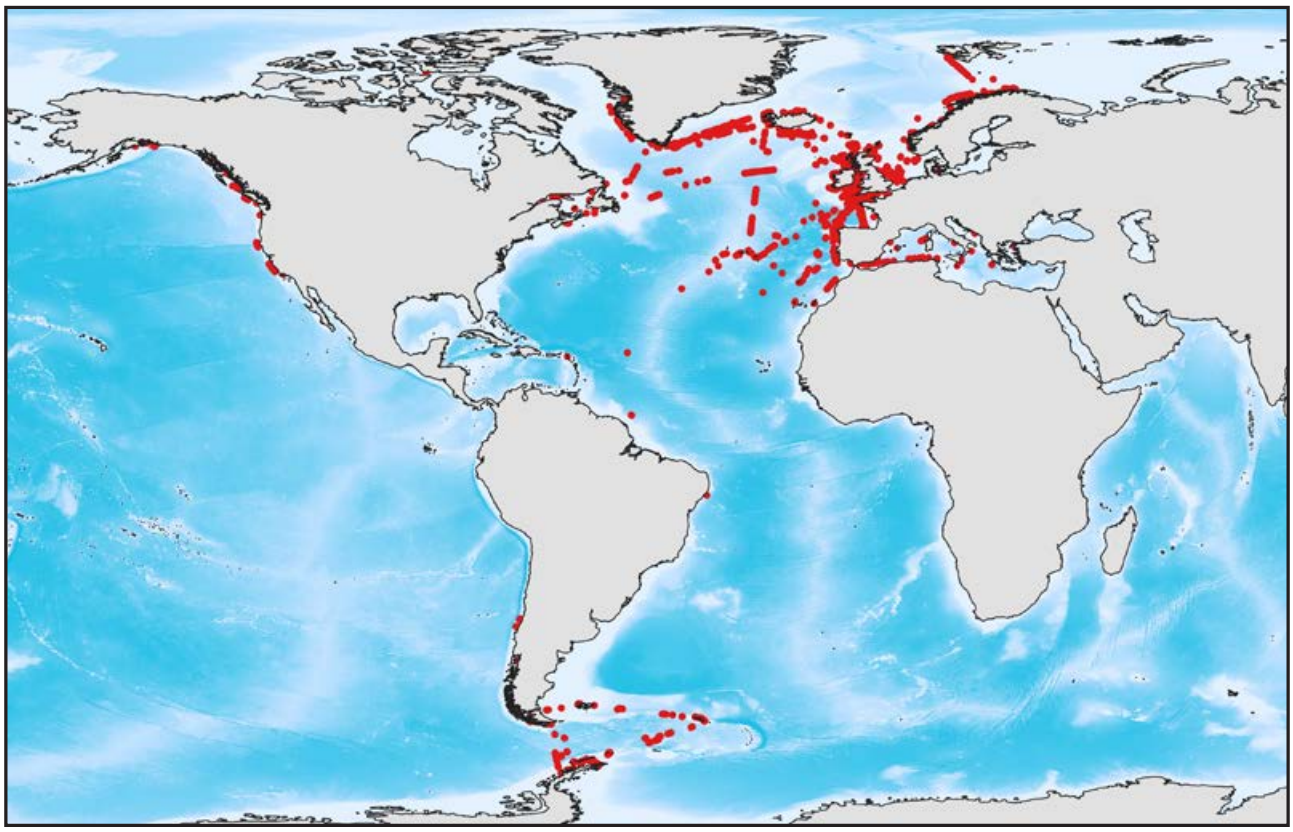


Figure 5: Distribution of sightings from dedicated effort based ORCA surveys in 2022

Hourglass dolphin

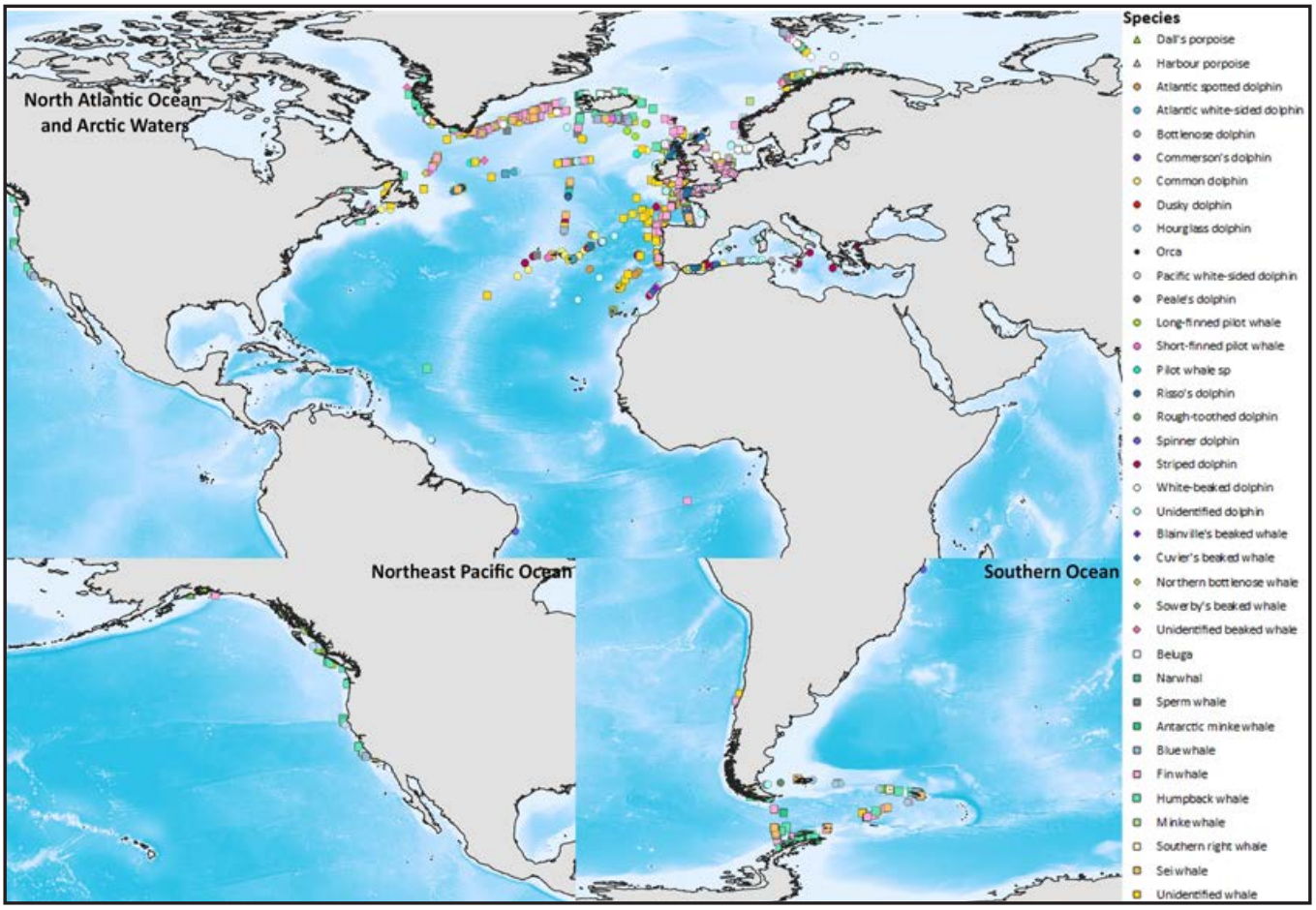


Figure 6: Detailed map of sightings during dedicated effort based ORCA surveys in 2022

Striped dolphins - Richard Lovelock

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 survey effort significantly. These trained OceanWatchers conduct surveys in their own time from land or at sea.


Bottlenose dolphins - Kev Barwell


Land-based watch

Survey effort

A total of 1,623 km of effort was conducted in 2022. Most effort was collected from cruise ships (884 km), followed by ferries (454 km) and least from other boats (285 km), a category which included user's personal craft, wildlife watching vessels and other pleasure boats. The most surveyed regions were the Northeast Atlantic Ocean, Wider Atlantic Ocean and the Mediterranean Sea, but surveys were also conducted in the Northeast Pacific Ocean, Southern Ocean and for the first time, the Indian and Southwest Pacific Oceans. The distribution of effort is shown in Figure 7 with higher effort indicated by warmer colours and lower effort shown by cooler colours.

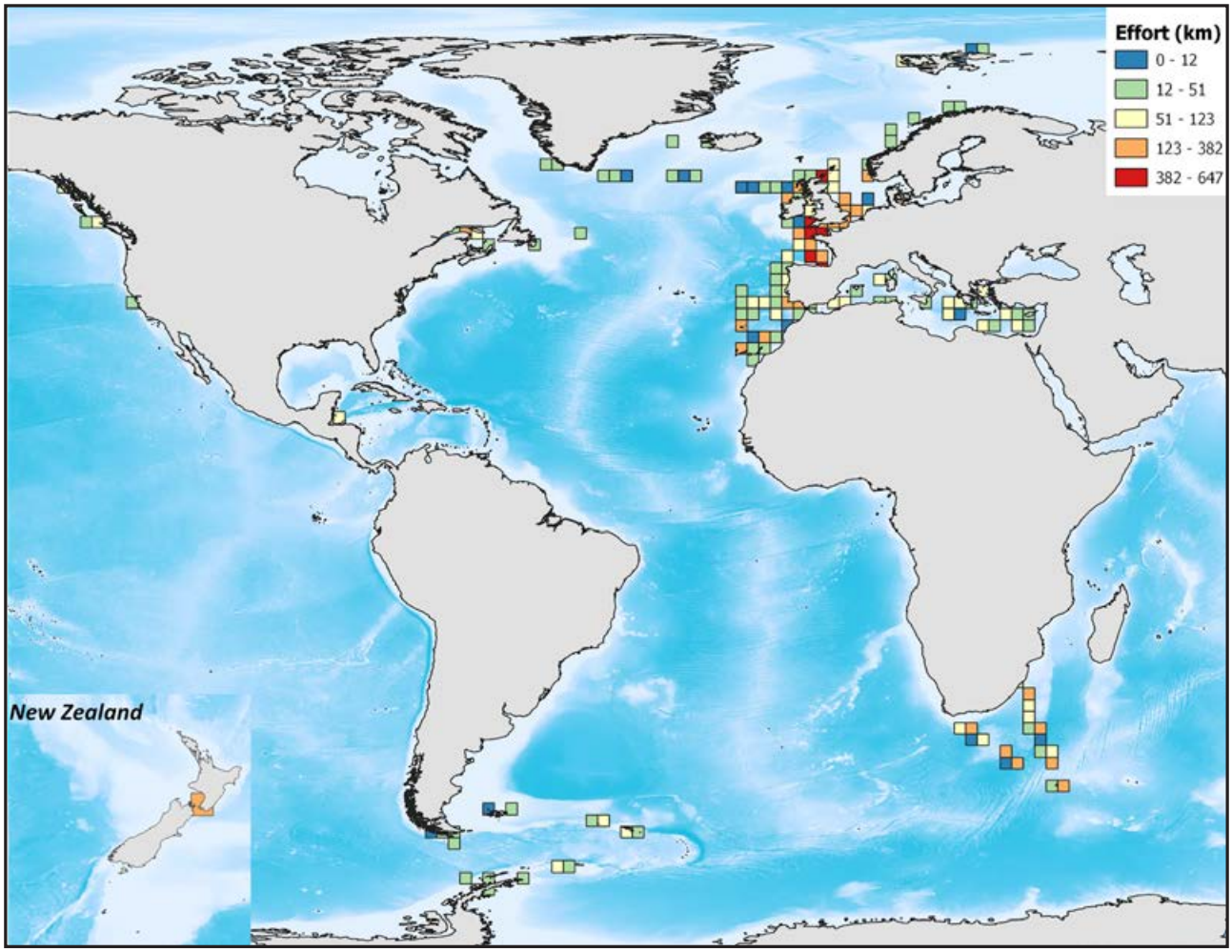


Figure 7: Distribution of survey effort in kilometres per 200 km2 grid cell during OceanWatchers at sea surveys in 2022

Cetacean sightings

A total of 321 sightings consisting of 2,090 individuals were recorded of which 275 sightings and 1,707 individuals were identified to one of 21 species (Table 5).

Table 5: Species sightings and number of individuals from OceanWatchers at sea surveys in 2022

Species	Number of sightings	Total number of individuals
Dall's porpoise (*Phocoenoides dalli*)	13	160
Harbour porpoise (*Phocoena phocoena*)	47	84
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	1	1
Bottlenose dolphin (*Tursiops truncatus*)	11	79
Common dolphin (*Delphinus delphis*)	66	779
Pilot whale, long-finned (*Globicephala melas*)	1	20
Pilot whale, short-finned (*Globicephala macrorhynchus*)	7	25
Pilot whale, unidentified (*Globicephala sp.*)	1	1
Orca (*Orcinus orca*)	5	32
Risso's dolphin (*Grampus griseus*)	7	46
Rough-toothed dolphin (*Steno bredanensis*)	1	1
Striped dolphin (*Stenella Coeruleoalba*)	8	125
White-beaked dolphin (*Lagenorhynchus albirostris*)	5	58
Cuvier's beaked whale (*Ziphius cavirostris*)	1	2
Northern bottlenose whale (*Hyperoodon ampullatus*)	1	1
Sperm whale (*Physeter macrocephalus*)	4	12
Fin whale (*Balaenoptera physalus*)	7	14
Humpback whale (*Megaptera novaengliae*)	65	233
Minke whale, common (*Balaenoptera acutorostrata*)	20	24
Minke whale, Antarctic (*Balenoptera bonaerensis*)	1	1
Sei whale (*Balaenoptera borealis*)	1	2
Southern right whale (*Eubalaena australis*)	2	7
TOTAL	**275**	**1707**

Common dolphins were the most commonly seen (66 encounters), likely reflecting high levels of effort on the northwest European shelf (Figure 7), closely followed by humpback whales (65), possibly reflecting high levels of effort from popular cruise itineraries to humpback whales' high latitude feeding grounds in both hemispheres. Harbour porpoises (47) and common minke whales (20) were also abundant, again reflecting high levels of effort in northwest Europe. The overall distribution of sightings is shown below (Figure 8) accompanied by a more detailed breakdown of species distribution shown in Figure 9.

Minke whale - Steve Truluck

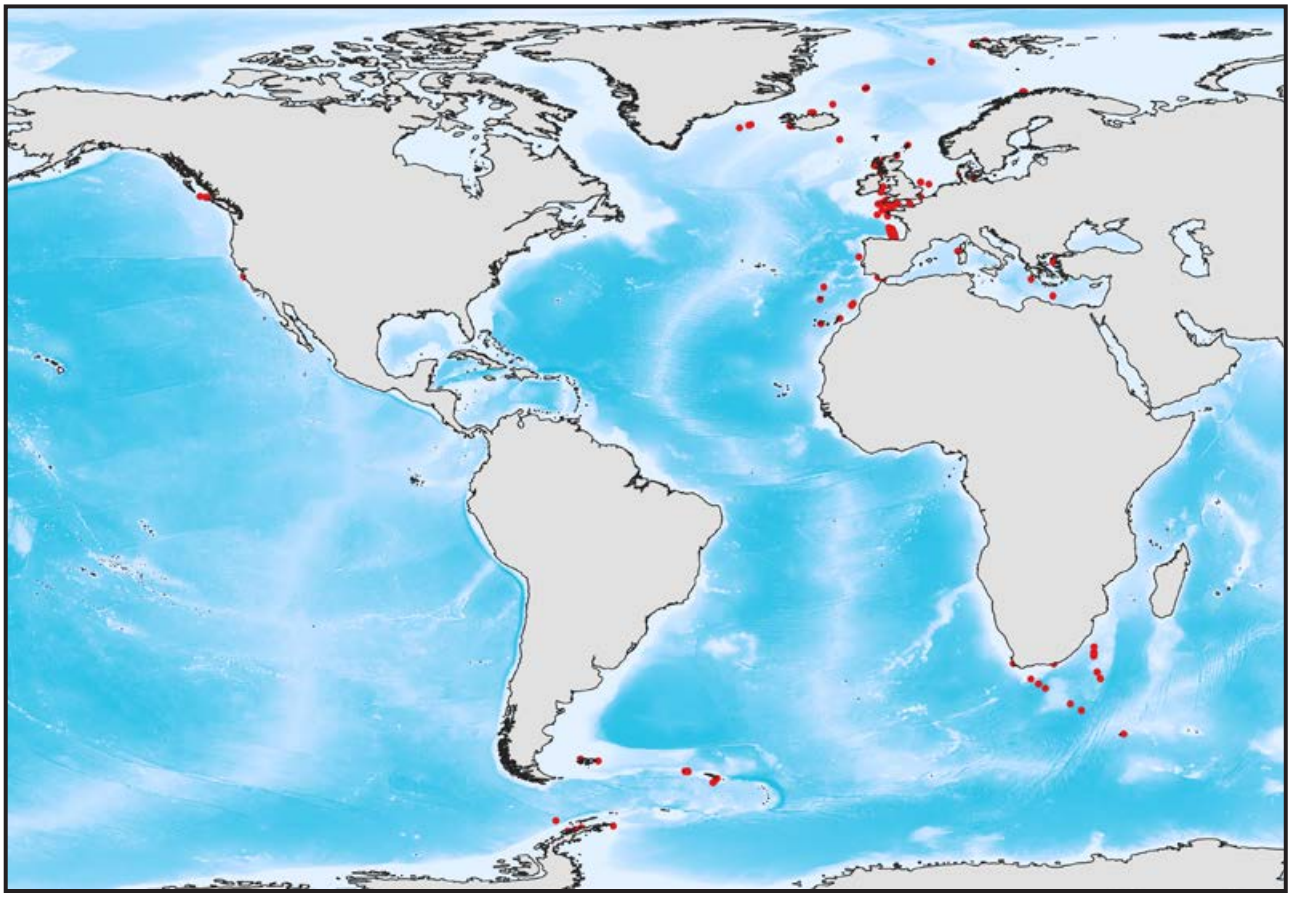


Figure 8: Distribution of sightings from OceanWatchers at sea surveys in 2022

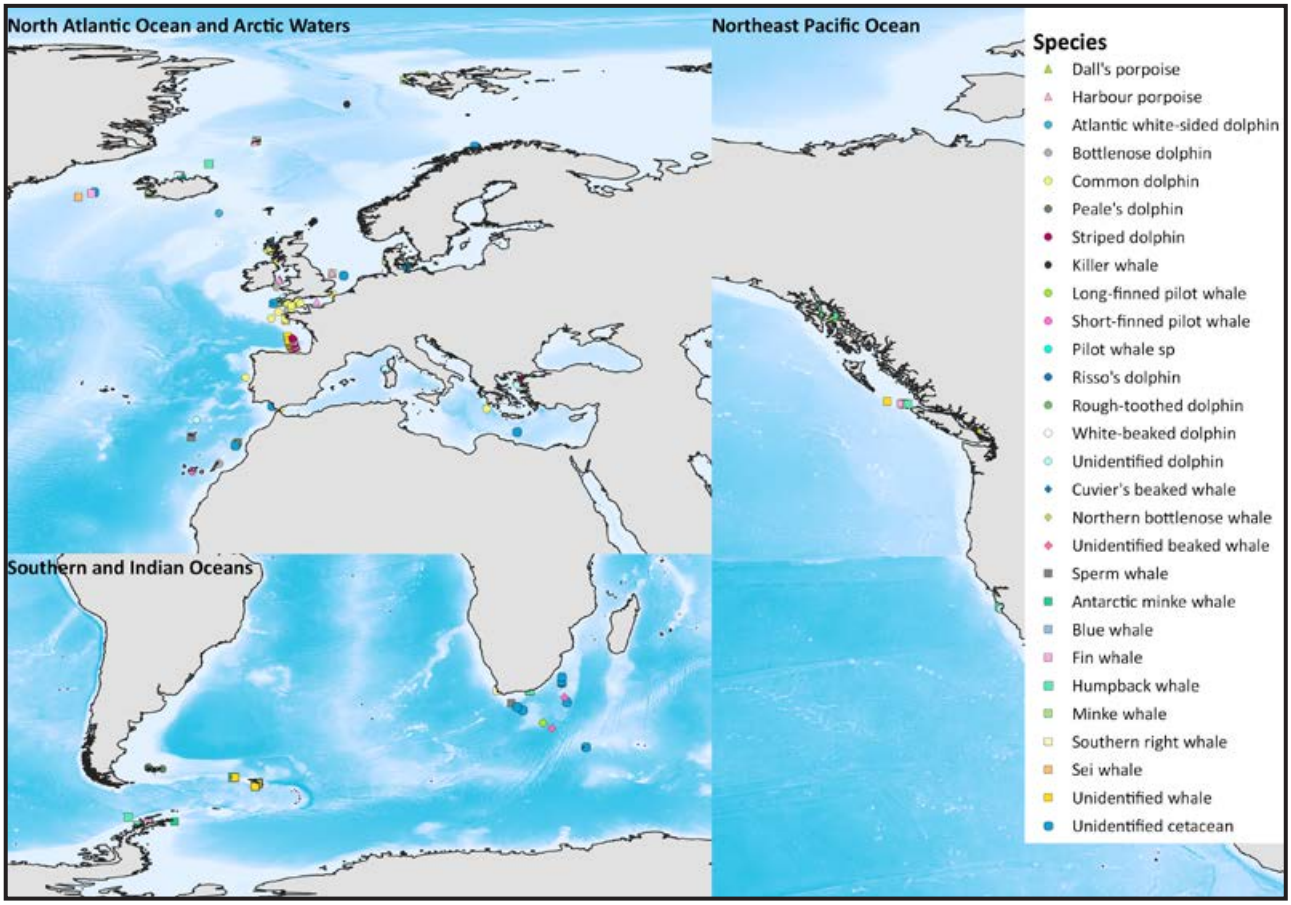


Figure 9: Detailed map of sightings in the three sub regions surveyed during OceanWatchers at sea surveys in 2022

OceanWatchers on land

Land-based surveys of cetaceans are a low cost method for monitoring coastal species which are more exposed to human activities. Observing from land also limits disturbance compared to boat-based surveys. Additionally, repeated surveys of the same sites over time can increase our ability to detect trends and reveal fine scale patterns in habitat use. The ORCA OceanWatchers app allows users to conduct surveys from fixed observation points on land or while walking along the coast.

Effort and sightings

A total of 281 hours of effort were undertaken from land in 2022 resulting in 163 sightings of which 149 were identified to the species level. The most watched regions within the UK were Cornwall, particularly the north coast, Wales, especially Anglesey, Devon and the coast of Northumbria (Figure 10). Outside the UK, land-based surveys were also conducted in the Netherlands, France, Madeira and South Africa which yielded sightings of Heaviside's dolphins, a first in ORCA's dataset.

The most commonly seen species during surveys conducted in the UK were harbour porpoises (95 sightings) followed by common dolphins (21), bottlenose dolphins (20), and common minke whales (6). Tides can generate predictable feeding opportunities close inshore, particularly around headlands which are often used as vantage points for land-based cetacean surveys which could explain the high number of harbour porpoise sightings from land.

The number of hours surveyed in each region of the UK is shown in the left hand panel of Figure 10 while the number of sightings per hour of watching in each region is shown in the right hand panel. The size of the red dots is in proportion to the amount of effort and sightings per hour respectively.

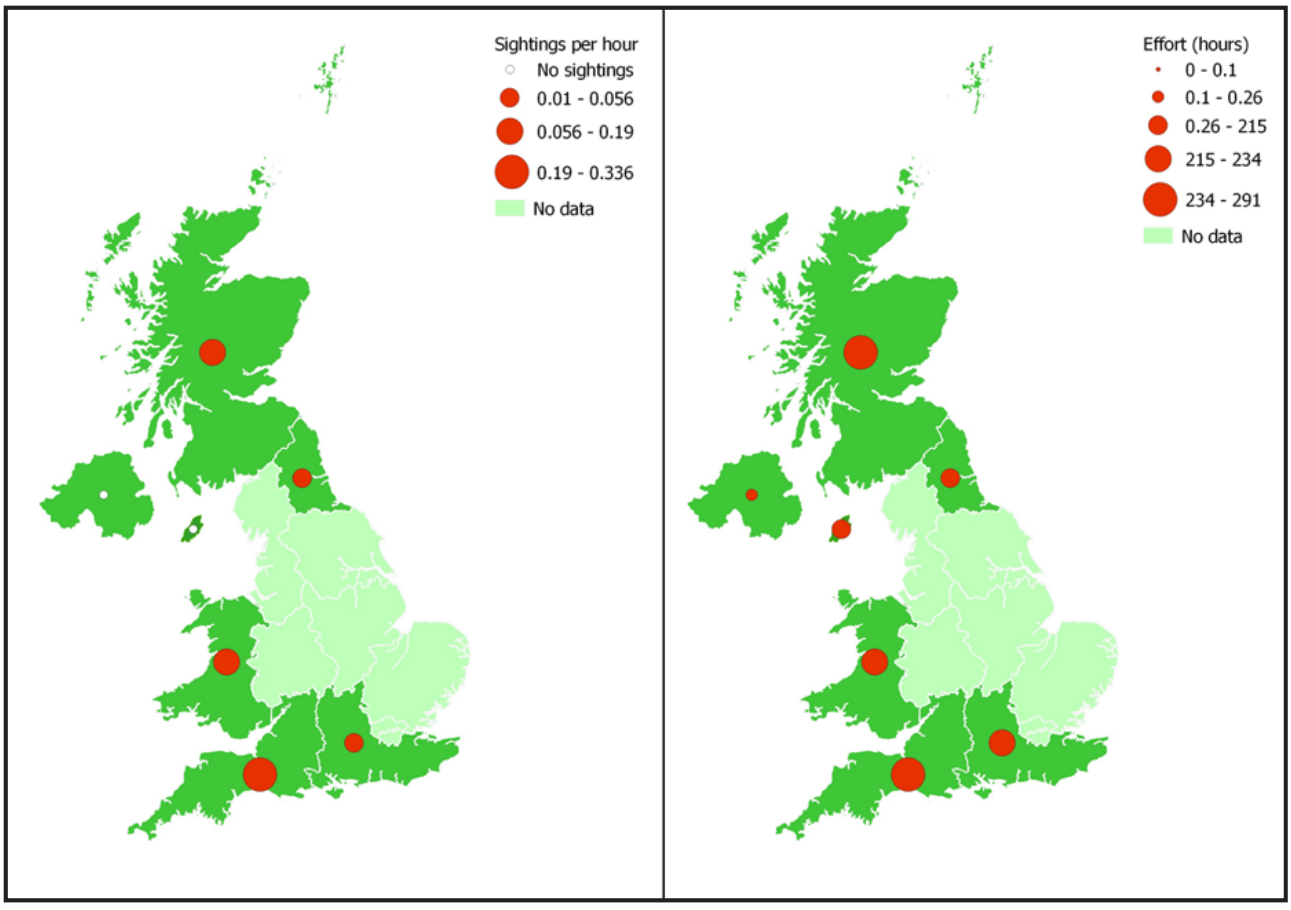


Figure 10: Sightings per hour (left) and hours of effort per UK region (right) during OceanWatchers land-based surveys in 2022

Table 6: Species sightings and number of individuals from OceanWatchers land-based surveys in 2002. Bold font indicates that this species is an ORCA first

Species	Number of sightings	Total number of animals
Harbour porpoise (*Phocoena phocoena*)	95	191
Bottlenose dolphin (*Tursiops truncatus*)	20	90
Common dolphin (*Delphinus delphis*)	21	330
Heaviside's dolphin (*Cephalorhynchus heavisidii*)	**2**	**12**
Risso's dolphin (*Grampus griseus*)	2	7
White-beaked dolphin (*Lagenorhynchus albirostris*)	1	2
Sperm whale (*Physeter macrocephalus*)	2	5
Minke whale (*Balaenoptera acutorostrata*)	6	8
TOTAL	**149**	**645**

Land-based watch

Saving Large Whales from Ship Strike


Orca - Helen Alexander

The world's ocean is a busy place, full of human activity, with tens of thousands of ships transiting the world. As vessel traffic increases, collisions between ships and cetaceans are a growing concern (Thomas *et al.* 2016), and this worldwide threat is termed 'ship strike'. Shipping lanes overlap with cetacean migration routes, feeding grounds and breeding grounds (Erbe *et al.* 2020), putting many species at risk constantly, and during critical life stages.

It is widely accepted that large whales (such as fin whales, sperm whales and North Atlantic right whales) are most at risk from ship strike (Laist *et al.* 2001; Schoeman *et al.* 2020), likely due to their reduced mobility, behaviours (such as surface feeding) and longer periods spent at the surface between dives (Parks *et al.* 2012; Owen *et al.* 2016).

The outcome of a ship strike event is most likely fatal but non-fatal incidents cause severe injuries which can lead to long-term injuries and significant welfare implications (Smith *et al.* 2020; Rae *et al.* 2022). The threat of ship strike is driving many local populations of large whale species to extinction. At the population level, ship strike can be an impediment to whale population growth due to the removal of individuals, particularly females of breeding age, low survival rates of calves, or the reduced reproductive fitness of survivors (Laist *et al.* 2001; Arrigoni *et al.*, 2011; Laist *et al.* 2014).

Ship strike events often go unnoticed and unreported (Van Waerebeek *et al.* 2007), therefore the true number of strikes is likely underestimated (Vanderlaan *et al.* 2009). With fatalities usually sinking to the sea floor, a low percentage of carcasses that arrive ashore and the even smaller percentage of these for which it is possible to determine ship strike as the cause of death, makes it even more difficult to understand the true population impacts (Constantine *et al.* 2015).

ORCA are in a unique position to help mitigate the impacts of shipping activity on cetaceans, through our relationships across the shipping sector and our work now spanning across the world's ocean, crossing hotspots for collision risk such as the Antarctic Peninsula and the Northeast Pacific, as well as European waters where we have extensive surveying experience and records (for example the Bay of Biscay).

With maritime trade volumes set to triple by 2050 (Cariou, 2020), understanding the ship strike threat and mitigating the impacts is of paramount importance. Through linking with industry, we can educate seafarers about ship strike, whilst also working at a corporate level to make changes needed to reduce this threat. We are also in the unique position where our teams of Marine Mammal Surveyors and Ocean Conservationists are stationed on board these vessels to conduct vital research into the threat in real time and can offer advice to seafarers.

Currently, the only proven effective measures for reducing ship strike risk are to avoid areas with known concentrations of whales and in instances where this is not feasible, for vessels to slow down (IWC, 2023). Speed restrictions have been shown to be vital in reducing ship strike of large whales. Seasonal/dynamic speed restrictions of ≤10 knots in areas that are deemed 'critical habitats' could reduce lethal ship strikes by 80-90% (Conn and Silber, 2013). Therefore, encouraging responsible vessel practices, raising awareness amongst seafarers, and understanding the distribution and behaviour of cetaceans are three key components to reducing the risk of ship strike, and is where ORCA focusses its work.

Understanding whale behaviour around large vessels along the Pacific Seaboard

Due to the difficulty in understanding the true population impacts of ship strike, there is an increased interest in quantifying encounters between ships and whales that could have resulted in a collision but did not as a proxy for actual strikes (Ritter *et al.* 2016). This will help to better understand the potential population impacts and the factors involved in collisions. These events are referred to as 'near misses'.

In 2022, ORCA conducted a pilot study on board a large cruise vessel in Alaska to test a possible approach to a near miss definition and investigate which factors were involved in their occurrence. The Northeast Pacific Ocean, particularly the coastal waters of Alaska, has previously been 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, which makes it an important area to monitor close encounters between vessels and whales. In 2019, 37 cruise ships delivered 1.3 million cruise visitors to this region (CLIA, 2019). Thousands of humpback whales migrate to the waters of Alaska in summer to feed (with some that are resident all year around), plus other large baleen whales such as fin whales (Nichol *et al.* 2017).

An ORCA Marine Mammal Observer (MMO) was placed on board a cruise ship during the 2022 Alaska cruise season (May-July). 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.

Throughout the cruise the MMO collected data on all whale encounters as per the ORCA effort based data collection protocol (Figure 11) (see Conserving Critical Habitats section), with further detailed data collected when whales came into a 'near miss zone'.

Preliminary data analysis has shown that the chances of near miss events were heightened where the whales involved were feeding or resting. A further study is underway for the 2023 Alaska cruise season, whereby a refined data collection protocol has been developed to gain a deeper understanding of the factors involved in close encounters and near misses between whales and vessels.

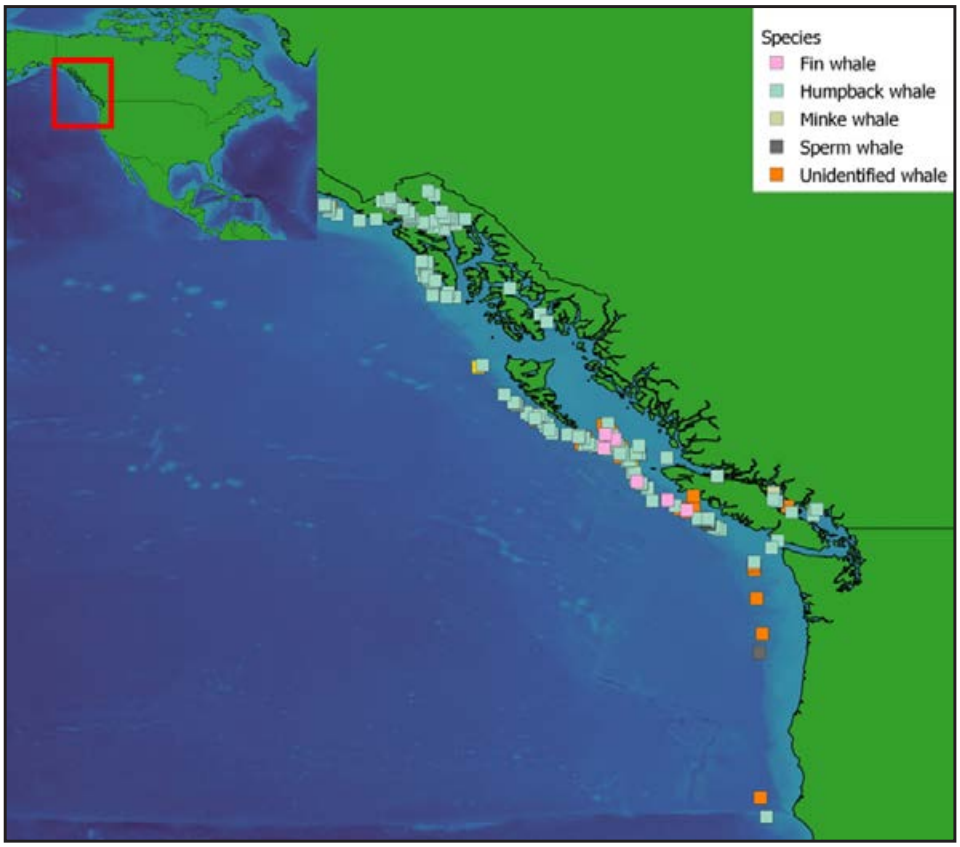


Figure 11: Distribution of whale sightings recorded during the 2022 Alaska field work

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

The Bay of Biscay is another area of the world where large whale species occur in high densities and overlap with high intensities of vessel traffic. Fin whales, who are reported to be one of the species most at risk of ship strike worldwide (Jensen *et al.* 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). Peltier *et al*'s (2019) research on strandings in the region makes it clear that ship strike in the Northeast Atlantic Ocean is a significant conservation concern.

In 2023, Brittany Ferries is hosting an ORCA Research Scientist on board the Galicia vessel, one of their E-flexers, which crosses the Bay of Biscay numerous times a week. In order to understand how whales perceive and react to large ships, a 'critical zone' needs to be defined; where the whale will potentially interact with a vessel. Defining this zone is key. Current research does not have an agreed definition of this zone which renders mitigation measures difficult, therefore the purpose of this project is to calibrate this.

Data on whale occurrence across the Bay of Biscay will be collected from the Galicia's bridge using a bespoke data collection protocol. In addition to following line-transect distance sampling methodology, whale behavioural data will be collected on video, with a bespoke camera set-up using both wide-angle lenses in fixed locations and zoom lenses on a mobile camera operated by the Research Scientist.

Once recorded, video will be processed to identify times when a whale is seen, along with the angle and distance from the vessel. By analysing this data, we hope to determine if it is possible to identify at what point the whale's behaviour changes in relation to the vessel and what trends are seen in the way the animal responds to the ship. Analysis of such trends will help longer term to develop mitigation measures to help large ships to avoid hitting whales globally. Defining the 'critical zone' (angle and distance from the ship) is a vital step in understanding how whales behave in proximity to large vessels and could give us an important new insight into the way that these animals perceive shipping traffic.

This research builds upon ORCA's research and understanding of ship strike in the Bay of Biscay from Ruth Coxon's 2017 MSc project (Nottingham Trent University) and James Robbin's PhD project (University of Portsmouth). Results from the 2023 study will be available early 2024.

Figure 12: ORCA Research Scientist collecting data on large whale behaviour from the bridge of the Galicia using a bespoke camera system

Identifying critical hotspots for large whales in the Southern Ocean

South Georgia's importance as a feeding ground for whales led it to being the epicentre of a global whaling industry in the early twentieth century. Here, whales were processed on an industrial scale, with 175,250 whales killed in factories across South Georgia between 1904 to 1965 (South Georgia Heritage Trust, 2023). After this time, whales largely disappeared from the region. However, in hugely positive news, recent surveys suggest the return of large baleen whales to the region (Calderan *et al.* 2020; British Antarctic Survey, 2020), with some sightings of over 1,000 whales recorded in the last few years (National Geographic, 2022).

But the end of whaling in this area does not mean that these animals are no longer at risk from anthropogenic activities. Tourism in the Southern Ocean is booming, and therefore cruise ship traffic around South Georgia has increased, and is set to increase further (IAATO, 2022). This means that there is a need to address the risk of collisions between ships and whales. As previously mentioned, large whales (the same species that were subject to exploitation during the whaling era in South Georgia) are particularly at risk of ship strike.

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, 2020). In 2019, the International Association for Antarctic Tour Operators (IAATO) members unanimously adopted mandatory procedures to mitigate ship strike risk from vessel operations in the Antarctic Peninsula region. This was in response to studies suggesting that humpback whale populations were growing and in recognition of the Antarctic Peninsula being an area of significant human activity.

Two IAATO geofenced time areas were designated around the Antarctic Peninsula, where a mandatory <10 knot speed restriction is in place for certain months of the year. In South Georgia, for the first time in 2022, a voluntary <10 knot speed restriction was also put in place (Figure 13).

Humpback whale

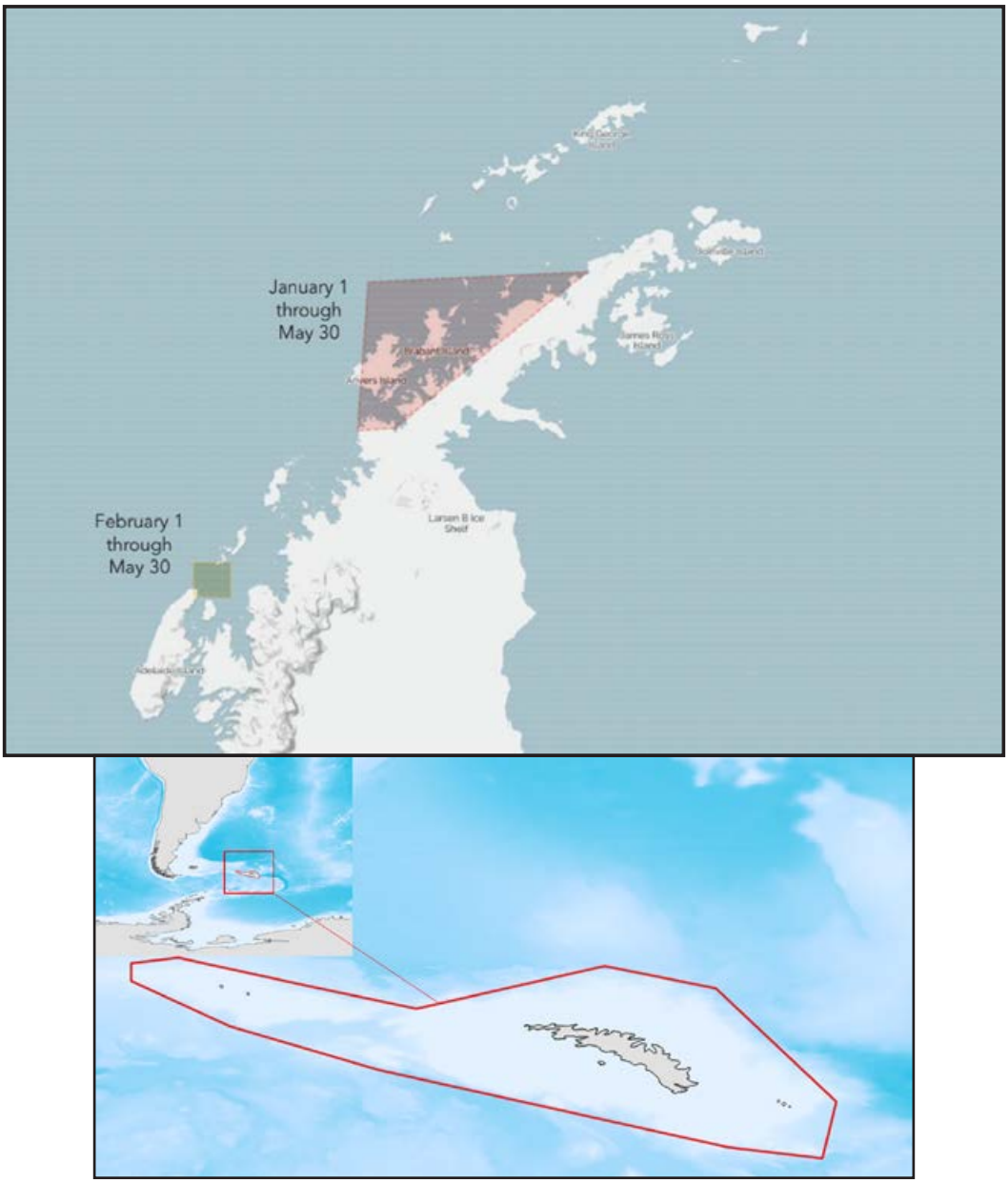


Figure 13: IAATO geofenced areas around the Antarctic Peninsula (top, IAATO 2021) and around South Georgia and the South Sandwich Islands (bottom) - *{adapted from Government of South Georgia and South Sandwich Islands, 2022}*

As large whales are highly mobile, migratory species, these designated areas are only effective if they are designated in the right places, at the right time of year, and this is where ORCA comes in.

For the 2022/23 Antarctica season, ORCA worked in collaboration with the British Antarctic Survey, Hurtigruten Expeditions, IAATO and the Government of South Georgia and the South Sandwich Islands to undertake research aimed to better understand the abundance and distribution of recovering humpback whale populations in and around South Georgia and the Antarctic Peninsula.

ORCA are experts in distance sampling for cetaceans using platforms of opportunity and we devised and conducted a research project utilising this survey methodology during the 2022/23 Antarctic cruise season on board Hurtigruten Expeditions' MS Fram.

The aim of the study was 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. Analysis is currently underway for this exciting project. It is the first time ORCA has conducted distance sampling surveys from platforms of opportunity in this region.

Working with seafarers

Through ORCA's work with seafarers, we have devised bespoke training to ship's crews all around the world about effective ship strike mitigation measures. Education is the fundamental basis for the implementation of mitigation measures and for compliance with regulations, because crew need to understand the risk of ship strike to the animals, to their vessel, to crew and passenger safety, and the locations where they are likely to encounter the species most at risk, and what they can do to avoid a collision (Ritter, 2012; Flamm and Braunsberger, 2014).

ORCA's training involves working with Officers to help them understand whale hotspots on their specific vessel's itineraries, including overlapping Important Marine Mammal Areas over their ship's routes. The training also includes how to identify the species of whale at risk in the sea regions they transit and the cues of their presence, steps to take to reduce ship strike risk whilst transiting and how to behave responsibly around whales. We also work closely with itinerary planners to educate on high risk ship strike areas and how to best reduce this risk during the voyage planning stages.

Figure 14: Marine Mammal Surveyor in South Georgia

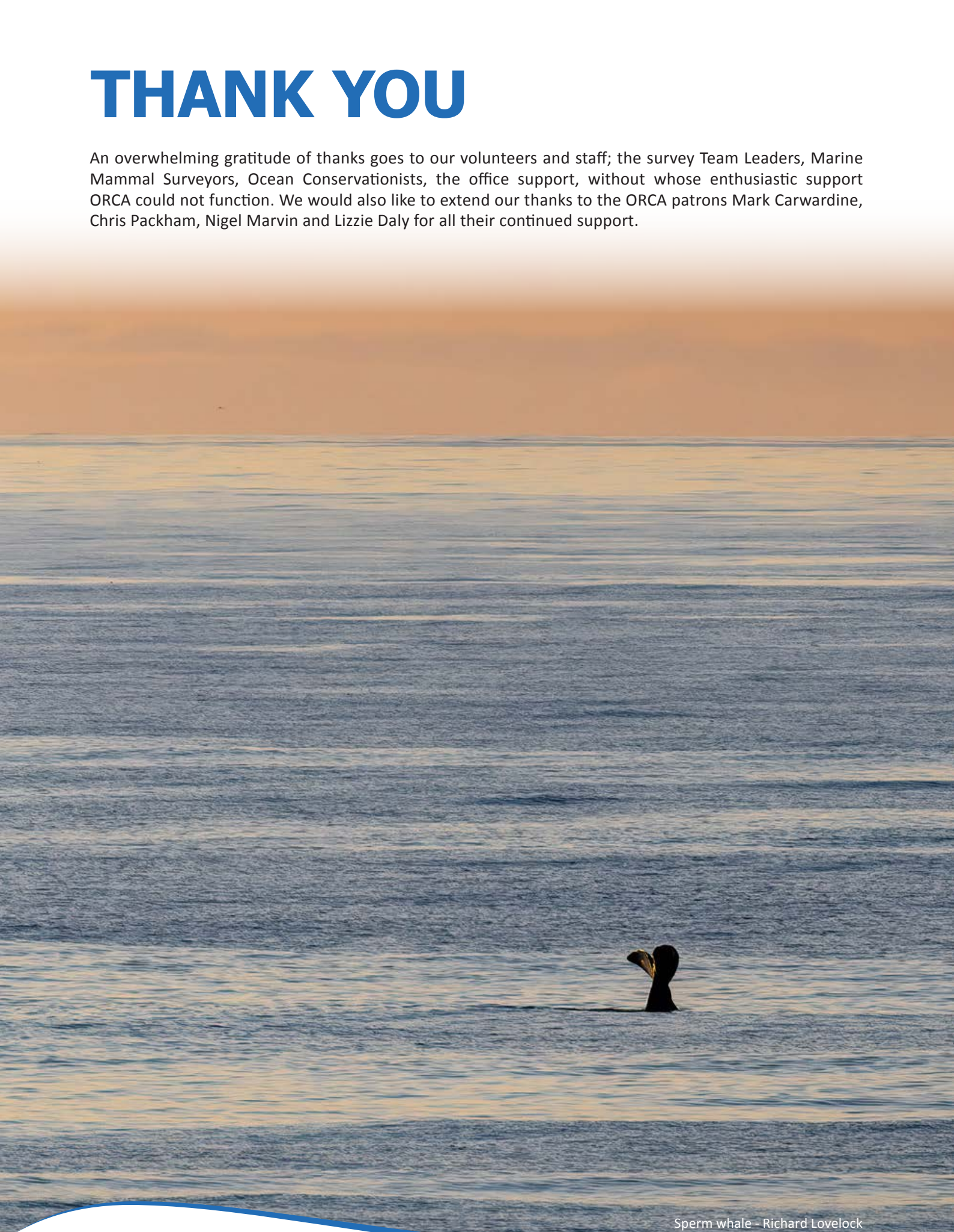
To date, ORCA has worked with over 300 crew members on freight, cruise and ferry vessels across the world's ocean to increase the knowledge of the ship strike threat and to increase awareness of mandatory and voluntary measures put in place in known large whale hotspots. It is hoped that our seafarer education programmes will increase compliance and lead to active engagement.

It is only through the collection of high quality data and working in collaboration with industry, research bodies, governments and key decision-makers that we can truly understand the threat of ship strike and in turn inform mitigation measures to reduce this risk. This is where ORCA continues to focus its work.

Figure 15: ORCA staff working with bridge crew in Alaska to educate them on practice measures for ship strike mitigation

THANK YOU

An overwhelming gratitude of thanks goes to our volunteers and staff; the survey Team Leaders, Marine Mammal Surveyors, Ocean Conservationists, the office support, without whose enthusiastic support ORCA could not function. 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.



Sperm whale - Richard Lovelock

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“If we can’t look after animals as awe-inspiring, enigmatic and downright remarkable as cetaceans, what can we do?”

Mark Carwardine
ORCA patron, zoologist, conservationist and author

Front cover:
Minke whale - Shenaz Khimji

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