FIELD REPORT 2022
Cetacean Research Programme
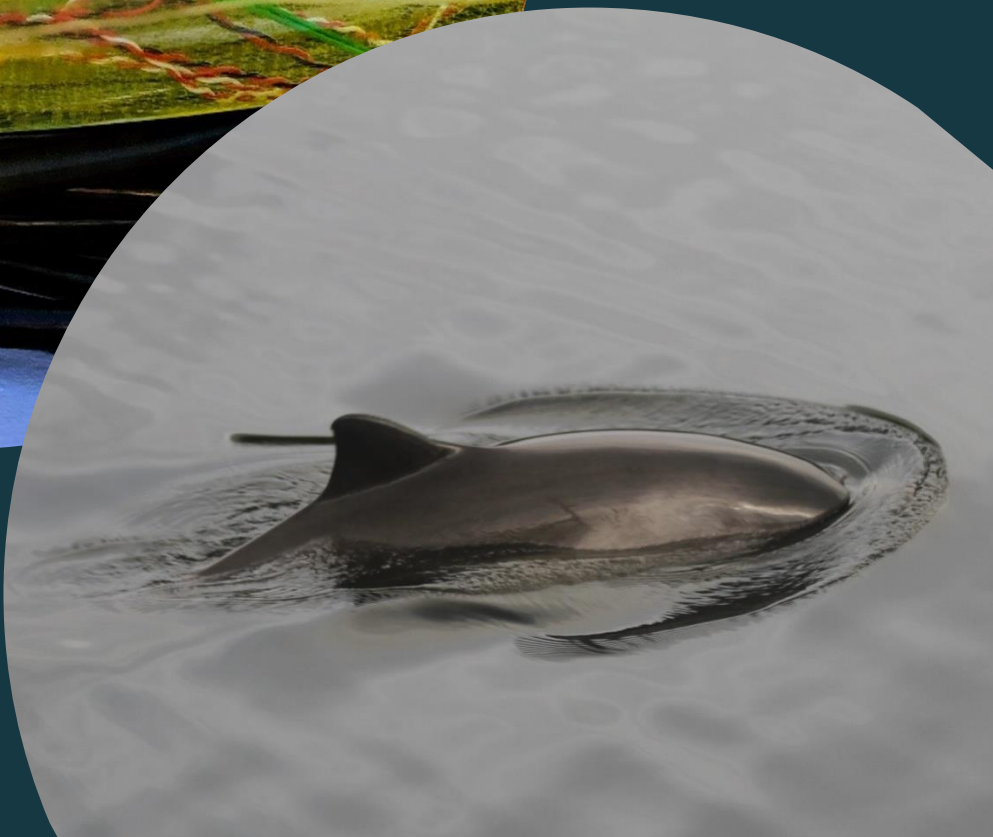
Contents

Project Overview

Visual survey platform of HWDT research vessel, Silurian, in excellent conditions, May 2022.

In 2022, HWDT delivered our first season with volunteers since the Covid-19 pandemic, allowing us to conduct dedicated visual, acoustic and photo-ID research expeditions onboard our specialist research vessel, Silurian. On board, we train volunteers in HWDT's data collection protocols. Our data has now been collected using the same rigorous survey methodology for the past 20 years ensuring the data collected are consistent and comparable between years.

We conduct dedicated visual and acoustic surveys using a standard straight line transect methodology for cetaceans travelling in random, straight line transects with distinct bearing changes at a constant speed across the west coast of Scotland. Surveying in this way provides a wide scale assessment of cetacean distribution and anthropogenic parameters, which can be used to understand the conservation implications and risks (such as underwater noise, entanglement). Volunteers record all marine animals, creels and rubbish that we encounter along the transects. The citizen scientists are also trained to listen and classify the sounds that are heard through our towed acoustic array every 15 minutes.

Acoustic data collection is a key part of our Cetacean Research Programme as it provides an accurate and consistent way of recording cetaceans. Acoustic recordings collected during these surveys can also be used to assess the changing soundscape of the west coast marine environment and the potential impacts of acoustic pollution on cetaceans in the region.

In 2022 we had a significant upgrade to our acoustic equipment and towed hydrophone arrays. We added two new mid-frequency hydrophone elements alongside our existing high frequency elements. This will allow us to detect sounds at lower frequencies than we were previously able to, whilst still being able to accurately detect high frequency harbour porpoise clicks to determine the number of animals and proximity to the vessel. In addition, we can now gain calibrated recordings of other biological and anthropogenic sounds. Our NI Sound card was upgraded to a bespoke SAIL DAQ pambox which can digitise the signals from 4 channels, generating 4 channels of full bandwidth continuous recordings for all acoustic transects.

Implementing this new acoustic system has changed how we handle our acoustic data. As we are still working through this process and the data preparation for our acoustic data, we will only present the visual survey results in this report. The results of all acoustic data will be reported on in March 2024 in the End of Project Report.

NatureScot's support has been, and will continue to be, instrumental to the development and continuation of HWDT's long-term research programme, supporting the generation of a comprehensive long-term dataset for cetaceans in the region, which has been successfully collecting data for twenty years.

SILURIAN RESEARCH EXPEDITIONS

HWDT conducted 18 research expeditions in 2022 between April and October. We visually surveyed 7,297 km over 128 days, during which time we encountered 4,431 animals from 11 species in 1140 sighting events.

Survey effort was not uniformly distributed, with more effort concentrated in areas close to the rendezvous points of Tobermory and Mallaig. Areas around the north of the Isle of Mull and the Small Isles also show more coverage (Figure 1). In 2022, we experienced persistent periods of poor weather for surveying, making it difficult to increase the coverage to more exposed parts of the survey area. Despite this, expeditions covered more ground in the west of the survey area compared to 2021, with five transects west of Harris and Uist. This year's coverage (the area covered by the surveys from the grid) extended between 58.582˚ in the north and 55.524˚ in the south and as far out west to -7.822˚.

2022

Total survey effort (km)

- >0 – 5
- 5 - 10
- 10 - 25
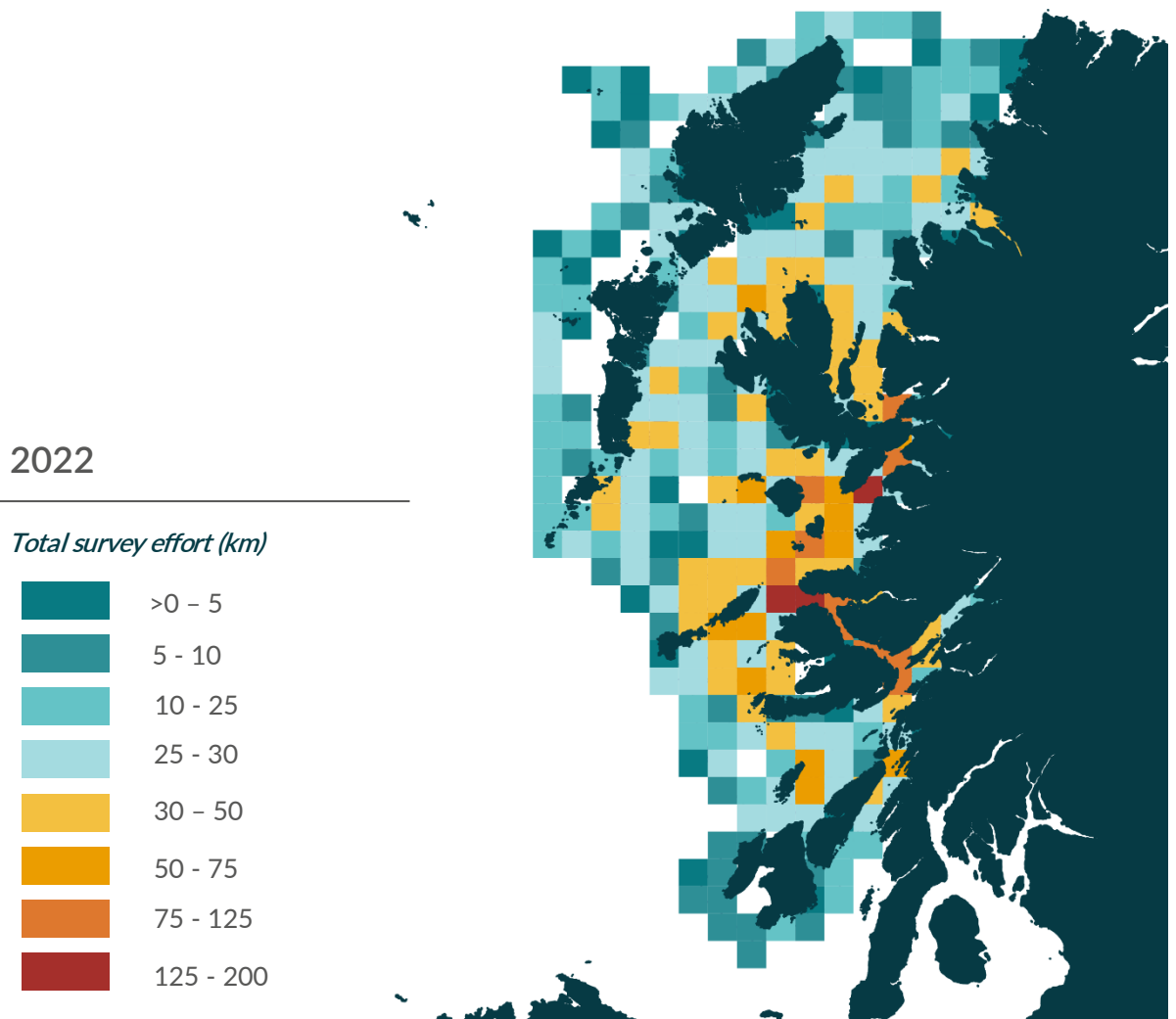- 25 - 30
- 30 – 50
- 50 - 75
- 75 - 125
- 125 - 200

Figure 1: 2022 visual and acoustic survey effort on *Silurian*. Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

COVERAGE WITHIN MPAS

HWDT conducted visual and acoustic survey effort in each of the three marine protected areas designated for mobile species; specifically, the Sea of the Hebrides Marine Protected Area (MPA), North-east Lewis MPA, and the Inner Hebrides and the Minches Special Area of Conservation (SAC). Seventy nine percent of the total effort we conducted was within the Inner Hebrides and the Minches Special Area of Conservation (SAC). Seventy nine percent of the harbour porpoise sightings (n=255) occurred within the SAC boundary. Sixty three percent of minke whale sightings (n=78) and 86% of basking shark sightings (n=6) recorded during surveys in 2022 were documented inside the Sea of the Hebrides Marine Protected Area (MPA). One sighting of Risso's dolphins was recorded in the North-east Lewis MPA in 2022, with a further seven sightings outside of the boundary.

INNER HEBRIDES AND THE MINCHES SAC

HWDT conducted 5,386 km of survey effort in the Inner Hebrides and Minches Special Area of Conservation, 74% of the total 2022 visual survey effort (Figure 2). Sixty eight percent (n= 864) of all sightings logged in 2022 were recorded within the SAC boundary (Figure 2) and 79% harbour porpoise sightings were recorded with in SAC boundary.
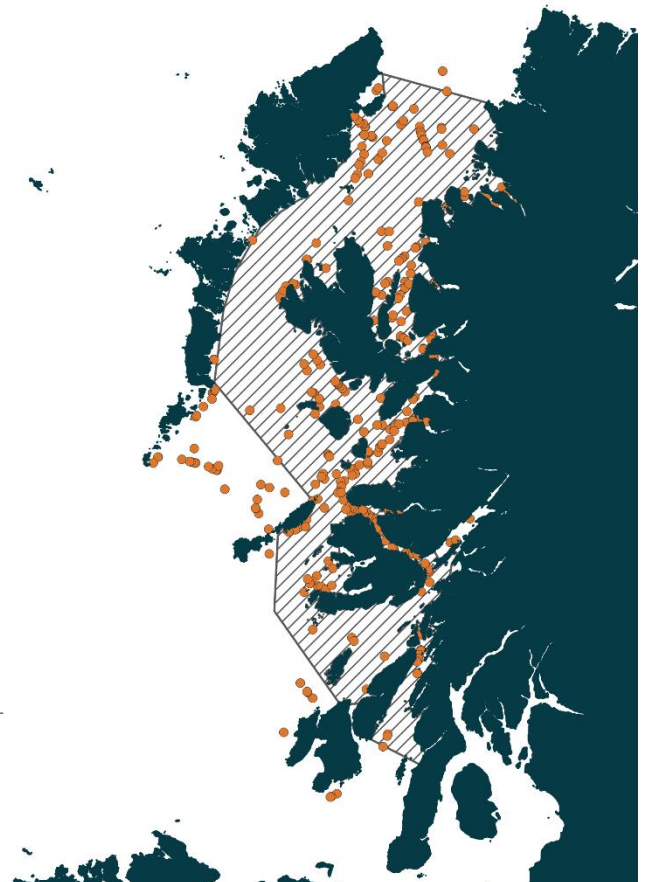

Harbour porpoise

■ Species presence

Figure 2: 2022 Harbour porpoise (Phocoena phocoena) presence recorded within and outwith the Inner Hebrides and Minches SAC, from visual only data. Effort is displayed on a grid of 100km² cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

NORTH-EAST LEWIS MPA

HWDT conducted 120.6 km of survey effort in the North-east Lewis MPA, 1.7% of the total 2022 visual survey effort (Figure 3). In 2022 Risso's dolphins were encountered eight times, with only one sighting within the North-East Lewis MPA.
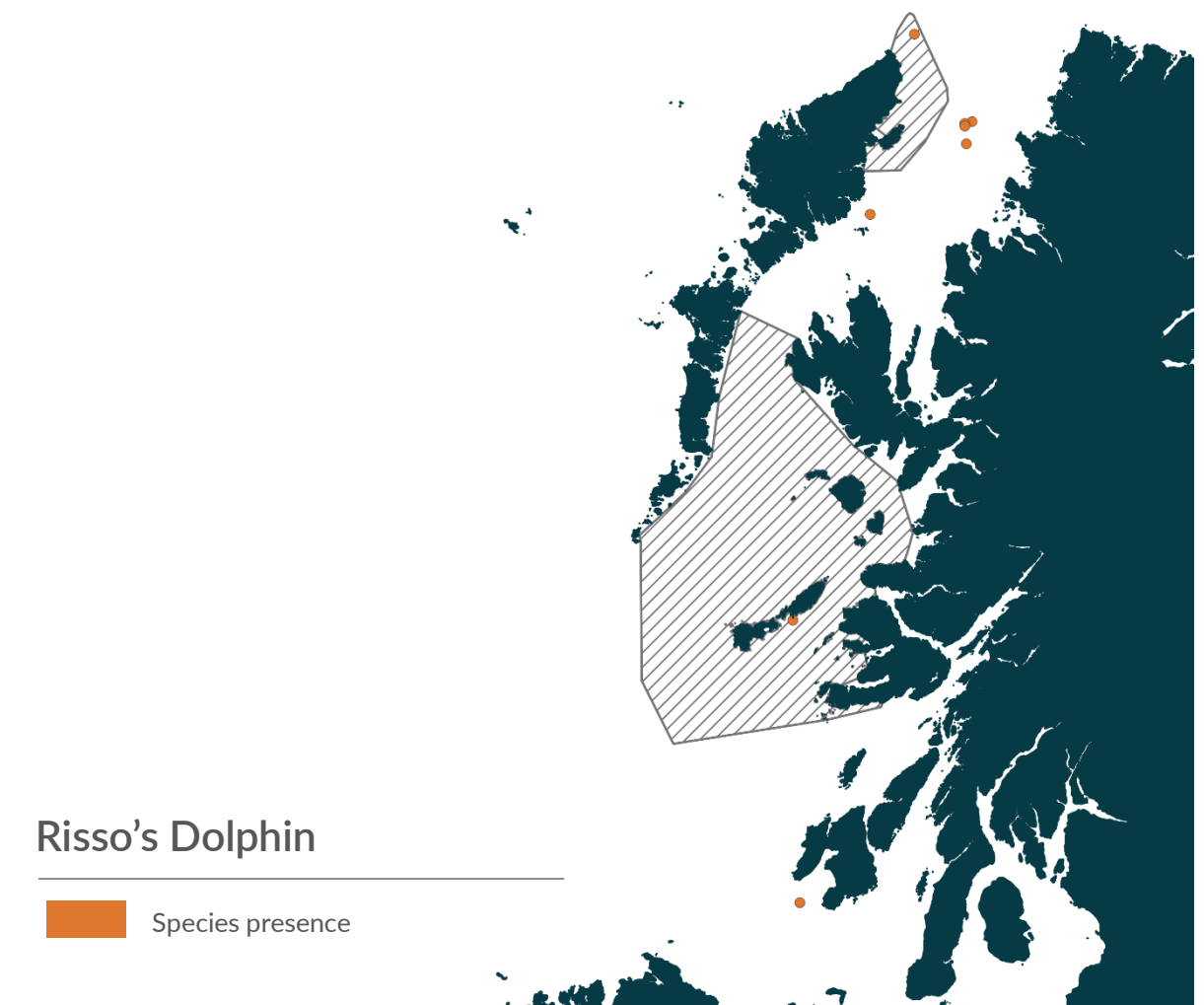

Figure 3: 2022 Risso's dolphin (*Grampus griseus)* presence recorded within and outwith the North-East Lewis MPA, from visual only data. Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

SEA OF THE HEBRIDES MPA

HWDT conducted 2,686 km of survey effort in the Sea of the Hebrides MPA, 37% of the total 2022 visual survey effort. Sixty three percent of minke whale sightings (n= 123) were recorded inside the MPA boundary (Figure 4).
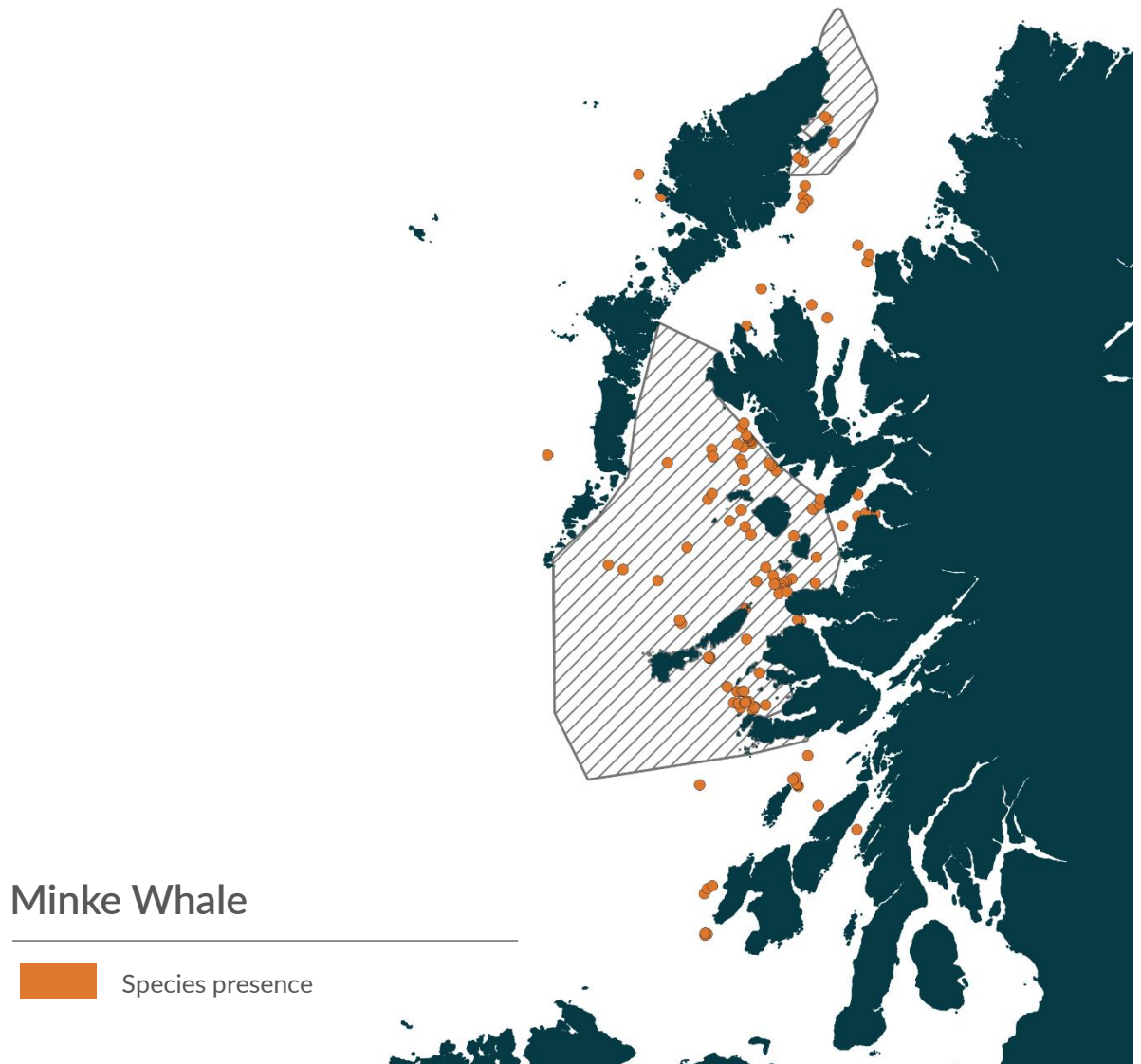

Minke Whale

Species presence

Figure 4: 2022 Minke whale (*Balaenoptera acutorostrata)* presence recorded within and outwith the Sea of the Hebrides MPA, from visual only data. Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

Eighty five percent of basking shark sightings (n=7) were recorded inside the MPA boundary (Figure 5).
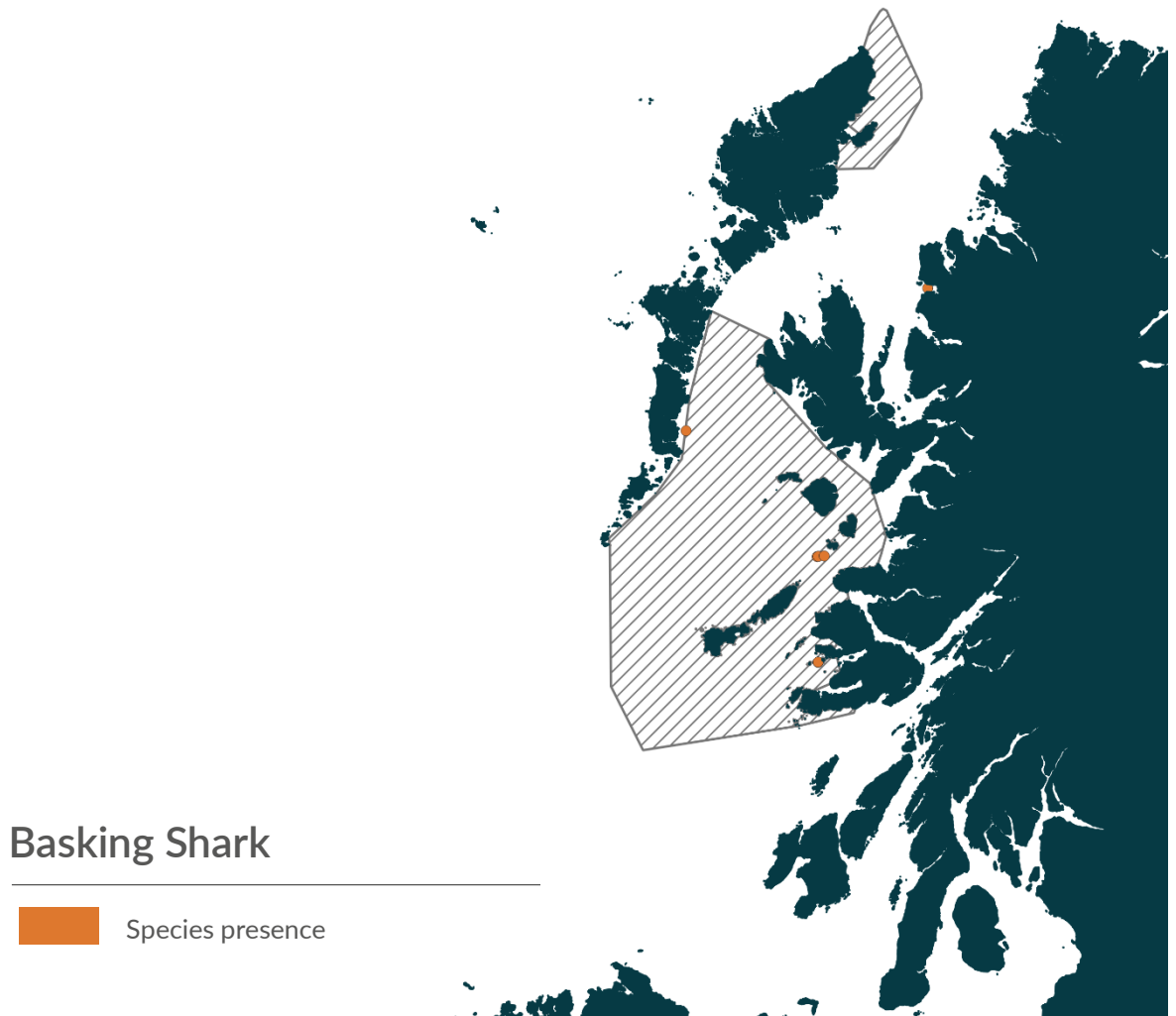

Basking Shark

          Species presence

Figure 5: 2022 Basking Shark (*Cetorhinus maximus)* presence recorded within and outwith the Sea of the Hebrides MPA, from visual only data. Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

SIGHTINGS SUMMARY

During the 2022 survey season, nine marine mammal species and three fish species were recorded on dedicated visual surveys. Cetacean species recorded, in order of prevalence, are harbour porpoise, common dolphin, minke whale, white-beaked dolphin, bottlenose dolphin, Risso's dolphin and killer whale. In addition to cetacean species, harbour and grey seals were encountered along with basking sharks, sunfish and yellow fin tuna. In total, there were 1,140 sightings of cetaceans, pinnipeds, sunfish, and basking sharks recorded with 4,431 individual animals (Table 1).

Other notable opportunistic sightings for the year (where the animals were sighted outside of dedicated effort-based visual surveys) include a Sei Whale. This was the first time the species has been recorded from *Silurian.*

Table 1: Summary of sightings recorded during the 2022 Silurian survey season

Species	Scientific name	Sighting	Individuals	Max group size	Mean group size
Basking shark	*Cetorhinus maximus*	7	8	1	1
Bottlenose dolphin	*Tursiops truncatus*	8	33	8	3.87
Common dolphin	*Delphinus delphis*	203	3068	300	25
Common seal	*Phoca vitulina*	77	90	1	1
Grey seal	*Halichoerus grypus*	334	390	3	1.02
Harbour porpoise	*Phocoena phocoena*	265	494	14	2
Killer whale	*Orcinus orca*	3	6	2	2
Minke whale	*Balaenoptera acutorostrata*	106	141	8	1.35
Risso's dolphin	*Grampus griseus*	7	23	6	3.63
Sunfish	*Mola mola*	4	4	1	1
White-beaked dolphin	*Lagenorhynchus albirostris*	9	38	8	4.4
Unidentified baleen whale	N/A	3	3	1	1
Unidentified dolphin	N/A	22	38	8	1.96
Unidentified seal	N/A	57	59	2	1
Unknown	N/A	35	36	6	2.25
TOTAL		1140	4431	N/A	N/A

Following two years with no dedicated visual survey effort, we were able to conduct our full cetacean monitoring programme in 2022. Sightings per unit effort (SPUE) (Figure 6) were calculated to account for uneven effort across the survey area. Effort for each cell was calculated as the number of kilometres travelled. A SPUE value of 1 means that there was on average one sighting per kilometre surveyed within that cell, while a SPUE of 0.01 shows one sighting per 100 kilometres surveyed. Maps do not account for sea state and are a visual representation of this years data only. Cells with low survey effort have not been removed from these plots so there may be some small sample effects seen towards the edges of the survey effort.
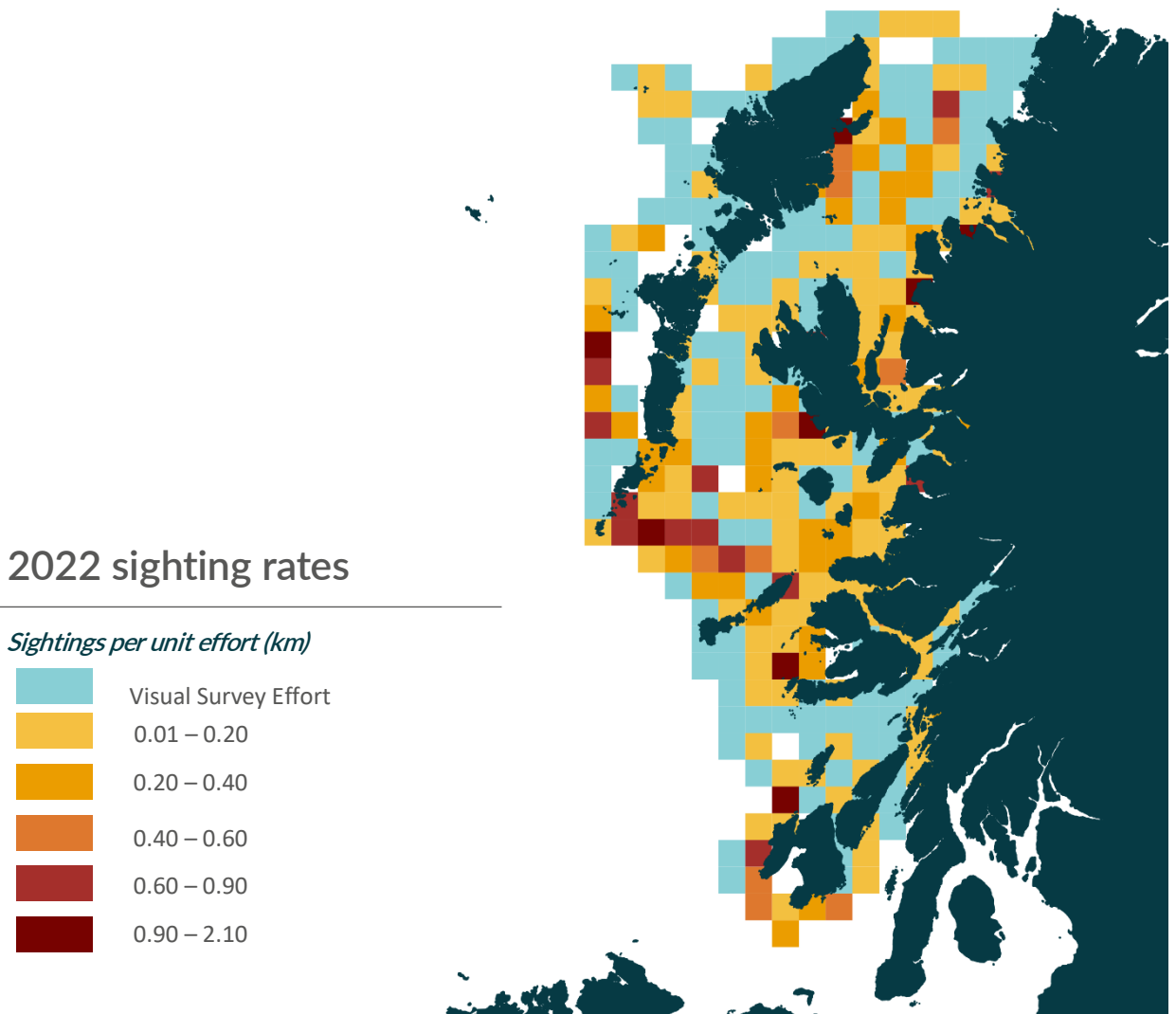

2022 sighting rates

Sightings per unit effort (km)

- Visual Survey Effort
- 0.01 − 0.20
- 0.20 − 0.40
- 0.40 − 0.60
- 0.60 − 0.90
- 0.90 − 2.10

Figure 6: 2022 sightings per unit effort (SPUE) for all sightings. Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

The effects of low effort can be seen in the SPUE map for all species (Figure 6). This is most predominant west of Uist, where encounters along just two transects have increased the relative encounter rates (SPUE) for those cells.

Species presence was not evenly distributed throughout the surveyed area. Species Richness has been calculated from the number of species encountered in each cell without accounting for effort (Figure 7) to reduce the impact of low effort.

The highest diversity of species were recorded to the north west of Mull and around the Small Isles, where nine species were encountered in a single 100km^2.

Species Richness

Number of species encountered

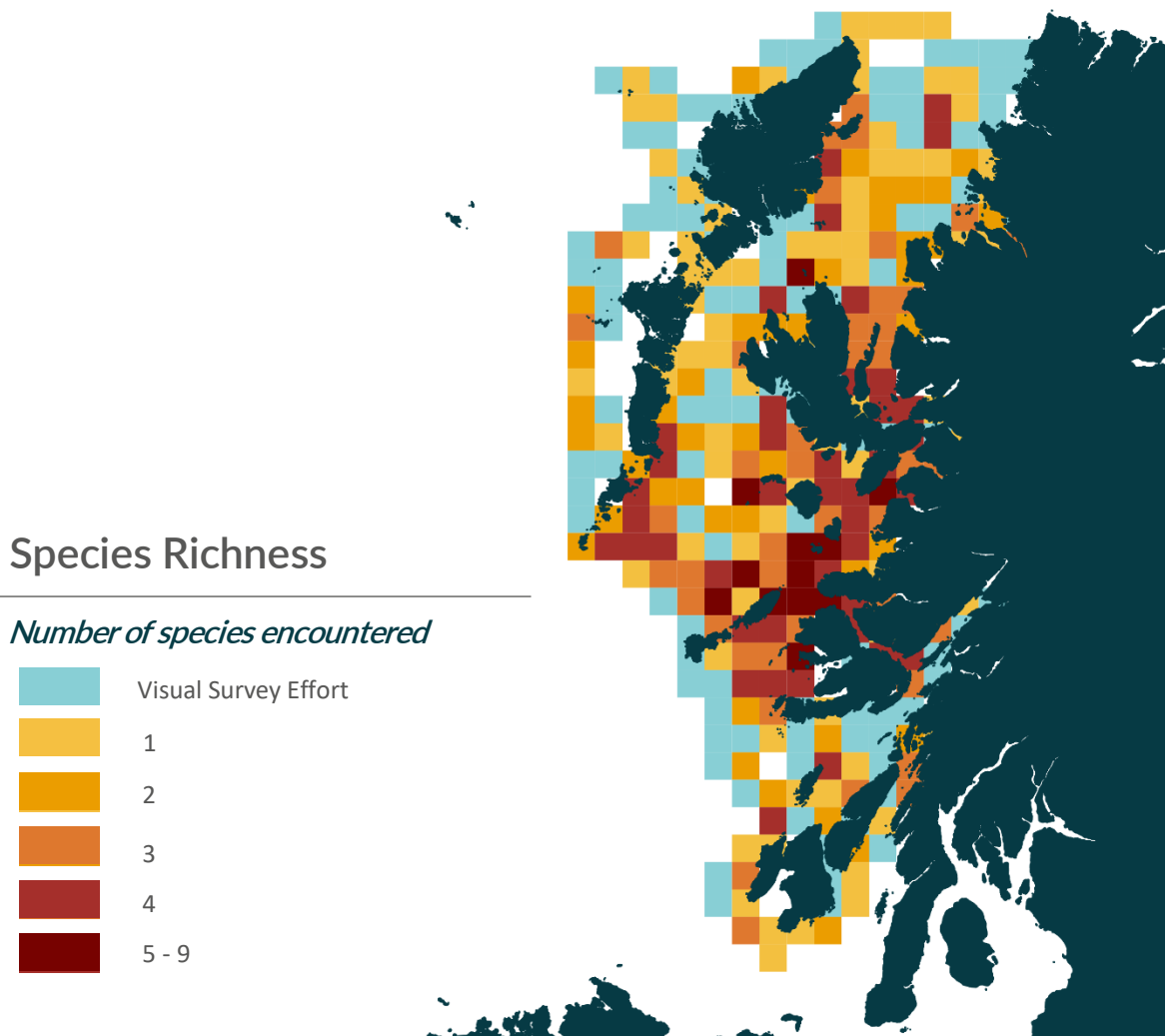|	
	Visual Survey Effort
	1
	2
	3
	4
	5 - 9

Figure 7: 2022 Species Richness. The number of species recorded in each cell without accounting for effort. Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

Minke whales were widely distributed throughout the survey area in 2022 (Figure 8), with most sightings recorded in the Sea of the Hebrides MPA. There was also a high concentration of sightings in coastal waters in the north Minch. Fig 8 displays the impact of low effort for sightings recorded around Islay.
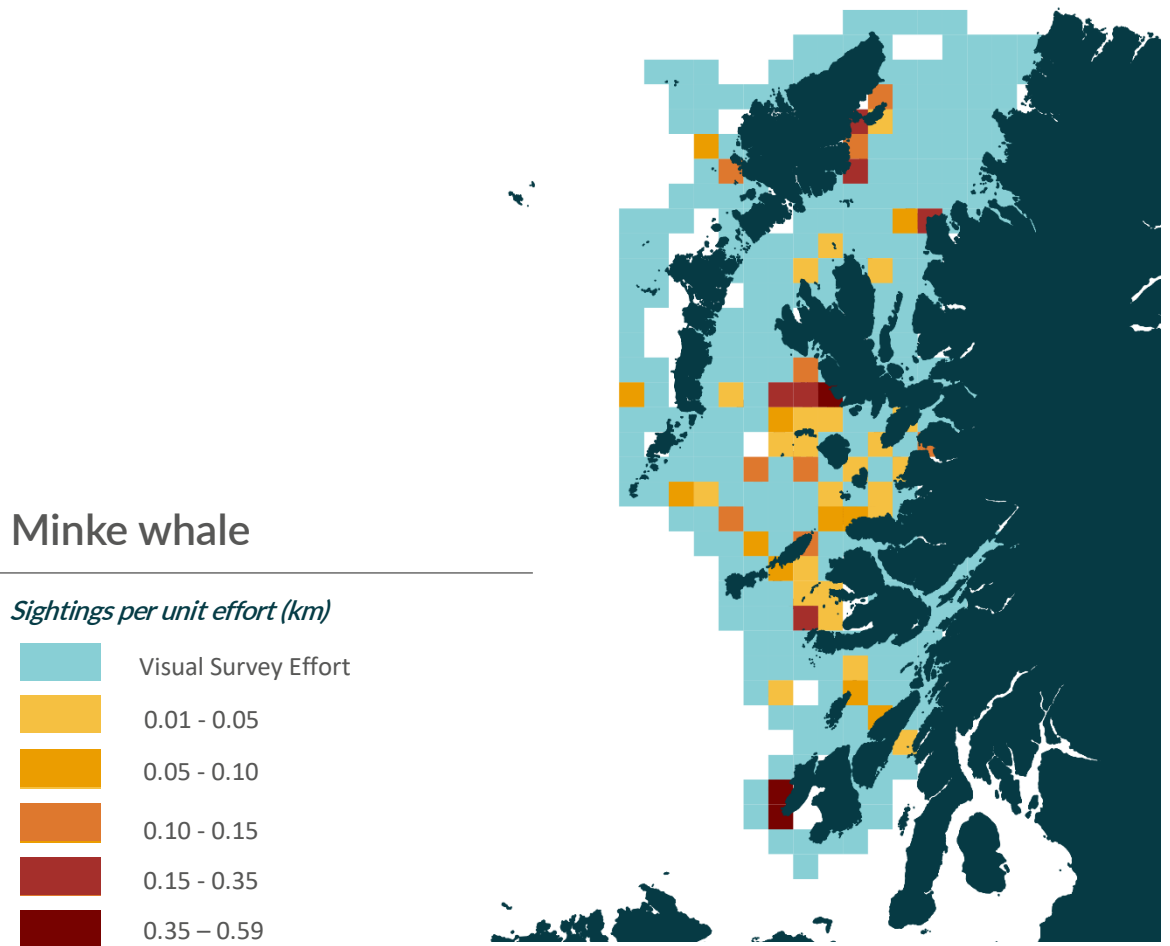

Minke whale

Sightings per unit effort (km)

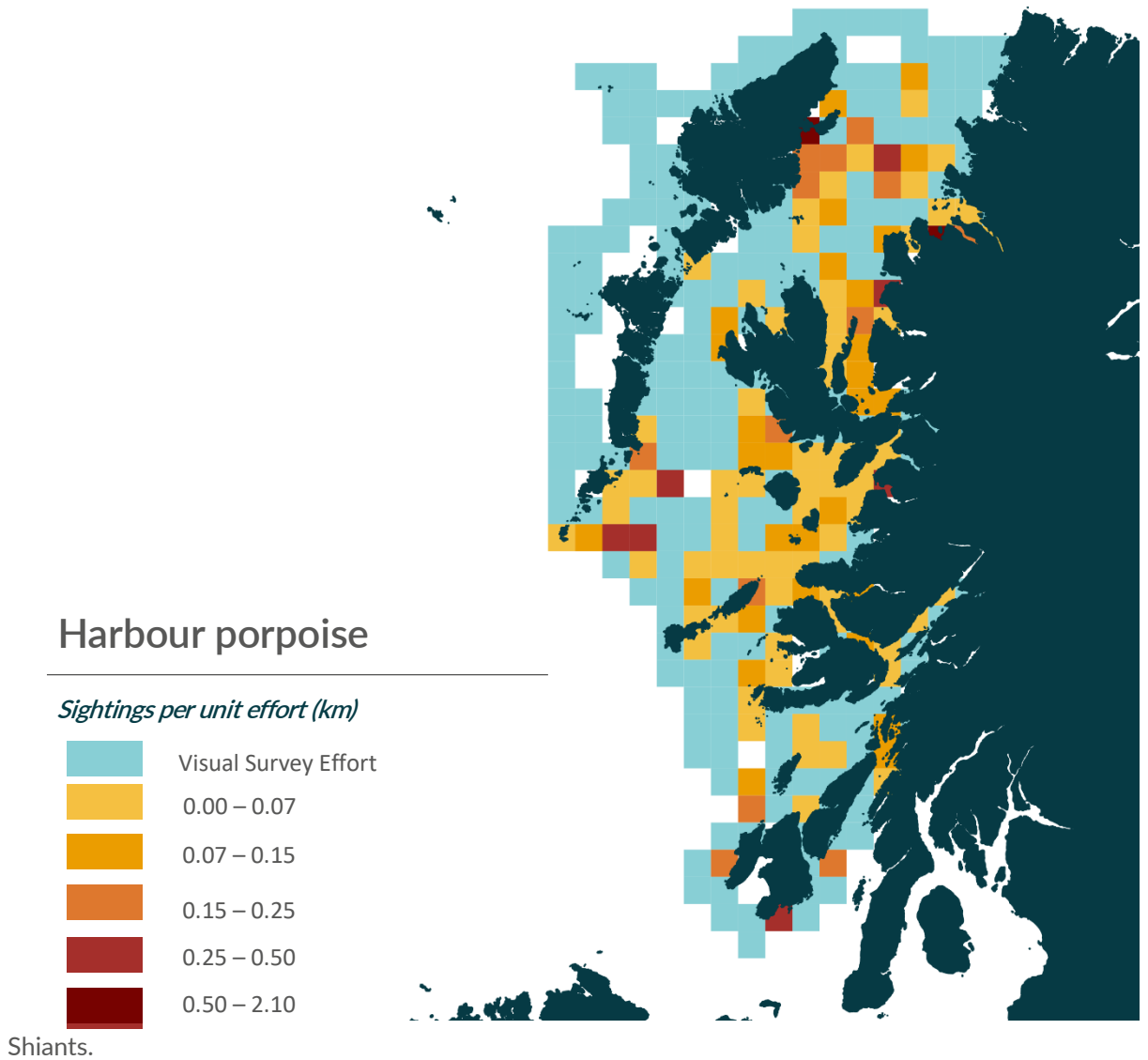|	
▇ (light blue)	Visual Survey Effort
▇ (yellow)	0.01 - 0.05
▇ (orange)	0.05 - 0.10
▇ (dark orange)	0.10 - 0.15
▇ (red)	0.15 - 0.35
▇ (dark red)	0.35 − 0.59

Figure 8: 2022 Minke whale (*Balaenoptera acutorostrata)* sightings per unit effort (SPUE). Effort is displayed on a grid of 100km^2 cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

Harbour porpoises were seen across the survey area (Figure 89High sightings rates for porpoise were recorded in coastal areas, particularly to the north of Mull, around the Small Isles and north of the

Harbour porpoise

Sightings per unit effort (km)

	Visual Survey Effort
	0.00 – 0.07
	0.07 – 0.15
	0.15 – 0.25
	0.25 – 0.50
	0.50 – 2.10

Shiants.

Common dolphins were widely distributed (Figure 10), with most sightings recorded in the Sea of the Hebrides, Hawes Bank, the southern Minch, and the Small Isles. We recorded 3,068 common dolphins this year, where the largest group size was 300 common dolphins.
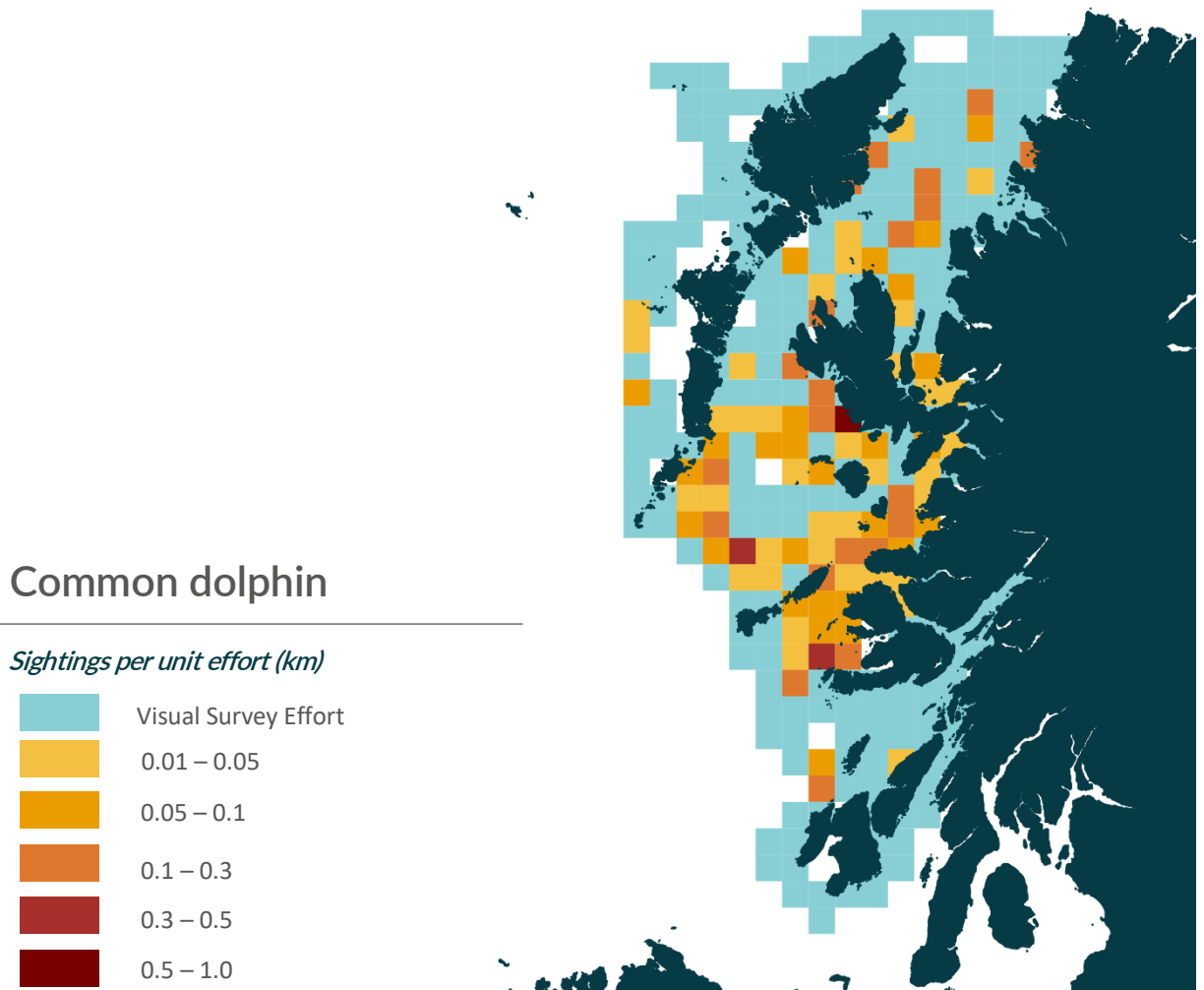
Common dolphin

Sightings per unit effort (km)

- Visual Survey Effort
- 0.01 – 0.05
- 0.05 – 0.1
- 0.1 – 0.3
- 0.3 – 0.5
- 0.5 – 1.0

Figure 10: 2022 Common dolphin (*Delphinus delphis*) sightings per unit effort (SPUE). Effort is displayed on a grid of 100km² cells (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

Bottlenose dolphins where encountered seven times in 2022. Bottlenose dolphin presence rather than SPUE (Figure 11) is presented because of a small sample size. Bottlenose dolphins were observed in very coastal areas, most often on the way in to an anchorage near the end of a transect.

Bottlenose dolphin

🟧	Species presence

Figure 11: 2022 Bottlenose dolphin (*Tursiops truncatus) presence through visual survey data* (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

White-beaked dolphins were only encountered to the north of our survey area (Figure 12). They were recorded in nine different encounters in 2022, therefore presence has been displayed rather than SPUE to minimise the impact of small sample size.

White-beaked dolphin

Species presence

Figure 12: 2022 White-beaked dolphin (*Lagaenorhynchus albitrostris) presence through visual survey data* (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

Killer whales were encountered three times throughout the season (Figure 13), with two encounters on the same day. Each encounter recorded the same two individuals of the West Coast Community (John Coe and Aquarius) and each was close to Ardnamurchan Point.

Killer whale

Species presence

Figure 13: 2022 Killer whale (*Orcinus orca) presence through visual survey data* (base maps © OpenStreetMap Contributors, openstreetmapdata.com).

ACOUSTIC MONITORING

Passive Acoustic Monitoring plays a key role in HWDT's data collection. It provides an accurate and consistent way of monitoring cetacean species, such as the harbour porpoise, which can be particularly difficult to visually detect as sea state increases.

Silurian started using a towed hydrophone system to detect cetaceans back in 2002, and since then, HWDT has compiled a comprehensive acoustic dataset, spanning 20 years and comprising over 9,000 hours (Over a year) of underwater recordings. As well as species monitoring, these recordings are increasingly called upon to assess the changing soundscape of the west coast marine environment and the potential impacts of acoustic pollution on the population, distribution and behaviour of cetaceans in the region.

During all surveys, the hydrophone array is deployed and the passive acoustic monitoring software, PAMGuard, is run at all times. This makes a continuous broadband (up to 250 kHz) recording while running detectors for porpoise and dolphin clicks and producing spectrograms. In addition, volunteers monitor the hydrophones for a minute every 15 minutes (the engine is throttled back to facilitate this) to make an aural assessment of natural sounds (dolphin whistles and shrimp) and man-made sounds (i.e. acoustic deterrent devices used at fish farms, vessel noise, military sonar), recording standardised assessments of these in Logger. At the end of each survey, the recordings are re-analysed using PAMGuard. Porpoise acoustic encounters are identified and ranges of these from the boat's trackline are calculated. This allows distance analysis techniques to be used to provide absolute density estimates to be calculated for porpoises.

During the 2022 survey season 4,993 km of acoustic effort was carried out. We have been completing harbour porpoise mark up throughout the winter season, and this work is ongoing. The analysis and data will be provided in March 2024.

Twenty twenty-two was the first year that Acoustic Deterrent Devices (ADDs) around fish farms were not aurally detected on listening stations in the field. We are assessing the change in detection rates of ADDs from *Silurian* over the past 20 years and will present the results in a poster at the European Cetacean Society Conference in O Grove, Spain in April 2023.

WINTER MONITORING

Winter surveys provides critical year-round monitoring, expanding the current evidence available to inform the effective management of priority marine species (particularly harbour porpoise). During the winter expeditions 1,083 km of acoustic survey was conducted, with over 93 hours of acoustic recordings collected. The acoustic data from all winter surveys will be analysed and included in the end of project report.