Caernarfon Bay Marine Management Project

Summary Report 2025

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1. Summary

Background

Current approaches to halt biodiversity loss through Marine Protected Areas (MPAs) in the UK are not resulting in the expected changes they are designed to deliver, and alternative governance structures need to be explored. Despite existing protective measures, biodiversity continues to decline due to ineffective management and lack of solid evidence or community engagement. Caernarfon Bay for the most part has no statutory protection and thus offers an opportunity for new approaches to be developed.

Er Llesiant Ein Môr/Wellbeing for our Seas project was launched in April 2023 with support from the Landfill Disposal Tax Communities Scheme and Bodorgan Estate. Its long-term goals include:

1. Building ecological knowledge of Caernarfon Bay.
2. Monitoring key species and habitats, from top predators to the seabed.
3. Raising public awareness among locals and visitors.
4. Developing a voluntary co-management scheme and potential habitat restoration efforts such as seagrass planting or reef creation.

The project emphasizes community involvement, citizen science, and education, aiming to create a self-sustaining model of community-based marine management. A base with office, intern housing, and a survey vessel has been established to support data collection and engagement efforts.

Study Area

Caernarfon Bay is a large bay on the north-west coast of Wales, fringed by Ynys Mon to the north and Pen Llyn to the east, the seabed beyond the coastline comprises gravel and sandy sediment to a depth of around 10-30m, reaching over 50m depth in some offshore areas. Biogenic reefs dominate much of the coastline where kelp and horse mussel beds create rich diversity. The areas to the north and south of Caernarfon Bay are designated as Special Areas of Conservation for various habitat features including sandbanks, estuaries and coastal lagoons as well as species such as harbour porpoise, bottlenose dolphins and grey seal. The northwest of Caernarfon Bay is a Special Protected Area for the nationally important sandwich tern colony breeding on the north coast of Anglesey.

Socially, the communities around Caernarfon Bay, while having an array of environmental, cultural and historical assets, have limited employment opportunities with the income below 60% of the UK average. Many local employment opportunities are seasonal and tourism based, as businesses close, or open for limited periods during the winter months.

Historically present species

Historically, Caernarfon Bay has been an important area for marine species such as herring, angel sharks, crawfish and native oysters, all of which are now absent or in low numbers. Seabird numbers have also seen a decline in the area, with species such as back guillemot now absent and reduced numbers of breeding shag, cormorant and gulls on the headlands around Ynys Llanddwyn, Bodorgan and Ynys Feirig. A number of tern species have historically nested at several sites across Ynys Mon.

Good records exist for the number of breeding pairs for all these seabird species. However, less information is available on the historic presence of marine mammals around Anglesey. Here, in the past we rely mainly upon stranding records to indicate presence of those species which are still typically observed in the area. These include harbour porpoise, common dolphin, bottlenose dolphin, Risso's dolphin, and grey seal. Notable strandings include a pygmy sperm whale, white-beaked dolphin and long-finned pilot whale, all species which are not usually found in this region.

Fishing activity

Fishing activity within Caernarfon Bay is limited to small vessels, generally less than 12m in length. Fishing gears utilised by commercial and recreational fishers include pots for crustaceans and whelks, lines for fish species including seabass, rays and mackerel, with some dredging for scallops and other demersal species in the central and outer reaches of the Bay. Fishing for cockles and mussels does occur is certain areas. Illegal fishing activity occurs for cockles in unpermitted areas such as the Cefni estuary as well as use of illegal methods such as gill nets being set for sea bass.

Marine Mammal monitoring

The project has carried out marine mammal and seabird surveys from a number of headlands, as well as line transect surveys carried out on the survey vessel *Luke Oliver*, moored in the Cefni Estuary, as well as surveys in Cardigan Bay contributing towards the bottlenose dolphin monitoring work undertaken by Sea Watch Foundation from its base in New Quay. Species of marine mammal observed are the grey seal, common dolphin, bottlenose dolphin, Risso's dolphin, and harbour porpoise. Grey seals are the most commonly encountered marine mammal species, followed by bottlenose dolphin, harbour porpoise and, on one occasion, common dolphin.

Observations of harbour porpoise were predominantly in the northern and western areas of Caernarfon Bay, while grey seals were seen throughout and bottlenose dolphin sightings were mainly in the northern areas of the bay. These species are observed throughout the year, with bottlenose dolphins being observed during every month. Bottlenose dolphin calves were also observed regularly throughout the year and feeding activity indicates this area to be an important feeding ground for the species. Through photo-identification methods, at least 12 individual bottlenose dolphins have been matched to the Sea Watch Foundation catalogue.

Seabird monitoring

During surveys for marine mammals at Pen y Parc on the Bodorgan headland, seabirds are also recorded, with species identification made along with number, behaviour and occupancy area, with the survey area being divided into quarters. Gull species, cormorant, shag, sandwich tern, gannet and auks were all observed at Pen y Parc, with feeding activity noted in all areas of the

survey. Nests at Pen y Parc are present for shag and raven. Some seasonal trends are present, but further data are needed to allow robust analysis which may highlight variations in numbers per species and their use of the site.

Intertidal habitat surveys

Baseline data were collected throughout 2024 to record species presence on the rocky shoreline of the estuary in front of the Boathouse on the Bodorgan Estate. The species recorded are as expected for this environment, no notable finds were recorded, and no concern has been raised regarding invasive species. Surveys will continue, whenever possible, to record changes over time.

Seagrass

Dwarf eelgrass, *Zostera noltei*, is present in a patchy distribution on the sandy areas of the Cefni Estuary to the north east of the Bodorgan Estate. This area was surveyed in summer 2024 to record the location and extent of its distribution which shows a more westerly location than patches surveyed by Natural Resources Wales in 2022. Work by Bangor University in 2025 will look at comparable conditions for seagrass to thrive within the estuary, in order to make recommendations for sites suitable for restoration efforts.

Outreach and Engagement

A range of events and talks have been given over the last two years, focusing on engaging with members of the public to encourage them to take part in public land watch events, and to teach them about the habitats and species found along the coastline of Ynys Mon. Interactive school visits have been delivered to all local schools in the area, and public events such as beach cleans, rockpooling, training sessions in species identification, and survey methods delivered to a range of community groups. Partnership events have also been delivered such as awareness raising events to support efforts to reduce wildlife disturbance with the local police force, along with beach cleans in partnership with Cyngor Mon. Social media accounts have been developed to enhance communication with a wide variety of audiences about our activities and how people can get involved. From July 2023 to December 2024, over 65,000 people were reached through either in-person or online interactions. Six beaches around the Bodorgan headland were cleared of beach litter, and regular beach cleans will continue in 2025.

Sea Watch map viewer

A new map viewer feature has been launched on the Sea Watch Foundation website to enable volunteer observers, coastal communities, and the general public to view their own sightings as well as those of others, and to better understand the relationships that different species have with their environment, and the various human pressures they face in particular areas. The maps show these clearly, and help the observer to learn more about the sightings they have submitted and how these fit into the bigger picture. The maps are not only important feedback to the volunteer network of observers but serve as a wider educational and research tool.

Engagement with fishers

With aspirations to create a community-led marine management programme, engagement with stakeholders such as fishers, managers and community members, is key to building relationships and understanding the issues faced by individuals and groups. The first phase in engagement is face-to-face meetings with key individuals from organisations involved in activities within the

project area, as well as individuals active in the area. Through conversations with fishers, similar trends were highlighted by several individuals:

- Increased sightings of dolphins in Caernarfon Bay in recent years;
- Increased numbers of spider crabs, seabass, and herring;
- Reduction in mackerel, with schools becoming more patchily distributed, and fish staying in the area for longer;
- Illegal cockle and seabass fishing occurs around the area (landing more than permitted or using illegal fishing gears).

Conversations with local people have also highlighted a significant decrease of blue mussel numbers within the last 20 years in the Cefni Estuary.

Community led marine management

Setting up a community-led marine management group requires a collaborative approach that starts with engaging diverse local stakeholders. The group should define shared objectives, establish clear governance, and facilitate open communication. Key elements include capacity-building through training, legal and regulatory compliance, and securing funding. Partnerships with government, NGOs, and networks like the Coastal Communities Network, are vital. Continuous monitoring and adaptive management will ensure long-term effectiveness and sustainability. This work has begun, and recent funding from the Landfill Disposals Tax Communities Scheme will support a Community Engagement Officer to take this work forward at pace. Underwater footage from around the Bodorgan headland will be collected through diving activities in 2025, as well as diving surveys to assess the health of these underwater habitats.

2. Background

Although a relatively high proportion of the coastal seas of Wales receive some form of protection through Special Areas of Conservation for species and habitats, and Special Protection Areas for birds, there is a notable gap off west Anglesey stretching over much of Caernarfon Bay. Even where there are designated Marine Protected Areas (MPAs) across Britain and the rest of Europe, there have been continuing population declines in several species, degradation of habitats, and overall loss of biodiversity, indicating that current management is not fully working. There is an urgent need to address this and to do so requires two key ingredients: first, the evidence base to make appropriate management decisions; and second, full engagement of those sectors of society that have a stake-holding interest in the area being managed for protection. Much of the failure of MPA networks to achieve their conservation objectives is due to one or both of those ingredients being lacking or inadequate. To date, scarcely any part of the British Isles has adopted a community-based marine management scheme, and we badly need models to demonstrate how these can be self-sustaining. We aspire to this being one such model.

Our long-term aims therefore are to 1) build our knowledge of the marine ecosystem of Caernarfon Bay stretching out from west Anglesey; 2) establish some monitoring of key components, from the species at the top of the food chain, marine birds and mammals, through fish and cephalopod resources to invertebrates, crustaceans and molluscs, and the seabed habitat itself; 3) reach out to local communities as well as visitors to raise awareness of the full spectrum of marine species and habitats on their doorstep; and 4) fully engage with all stakeholders to develop a voluntary co-management scheme including zoning areas, some parts receiving full protection (operating as no-take zones); others having limited exploitation and restrictions on various human activities that generate pressures; and, finally, some areas where a greater range of activities may take place. Where appropriate, we would like to investigate the restoration of local marine habitats, for example by the planting of sea grass beds, cultivating oyster beds or creating artificial reefs. Throughout, the project aims to be a partnership between scientists and 'citizen scientists', and incorporate a major element of education and outreach.

Funding from the Landfill Disposal Tax Communities Scheme and the Bodorgan Estate enabled the development of this programme of work and the employment of a Community Engagement Officer. The *Er Llesiant Ein Môr* project started in April 2023 with the establishment of a base on the Bodorgan Estate including an office, intern accommodation and survey vessel. This has laid the foundations for scientific data collection on marine mammals, seabirds and other key species within Caernarfon Bay, which will support a better understanding of the ecological health of the local marine ecosystem and identify which areas could benefit from improved management. Any habitat restoration should be accompanied by a good understanding of the potential consequences of the management actions taken through development of a sound evidence base, and the establishment of experimental and control areas. A fundamental need is for full engagement with local communities so that they are actively encouraged and supported to take

guardianship of their coastal and marine environment thus reducing the need for external top-down regulation.

3. Description of Caernarfon Bay

Introduction

Caernarfon Bay is a significant coastal area in the northwest of Wales, to the west of the Menai Strait, which separates the Isle of Anglesey from mainland Wales (Fig 1). The bay stretches approximately 15 miles from east to west. The coastline of Caernarfon Bay is shaped by geological features such as the Eryri mountain range to the east, and the numerous estuarine and tidal flats that surround the area (Natural Resources Wales, 2018).

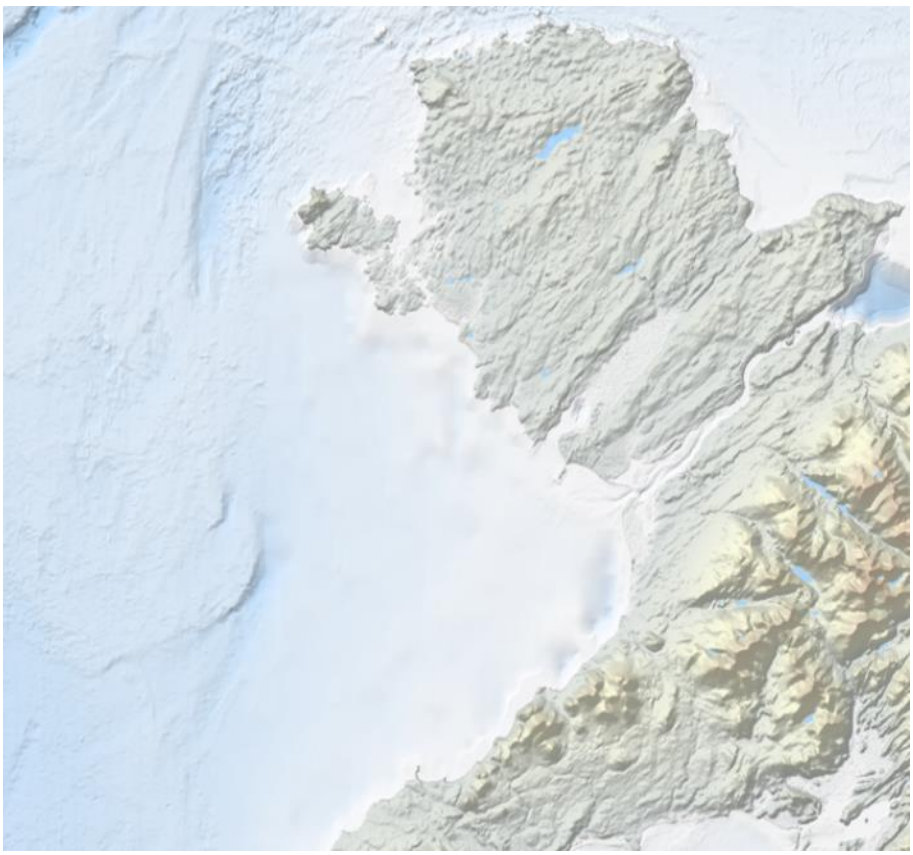


Figure 1. Map of Caernarfon Bay and the Isle of Anglesey

The bathymetry of Caernarfon Bay varies from shallow coastal waters to deeper sections further offshore (Fig 2). Near the shoreline, the depth is relatively shallow, with many areas less than 10 metres deep, particularly in the estuarine sections where the River Seiont and River Gwynant discharge. As one moves further from the coast, depths increase to around 30-40 metres in the

central part of the bay, with some areas reaching over 50 metres. The tidal range is moderate to high, which results in strong tidal currents that shape the bay's marine environment (Anglesey Sea Fisheries, 2020).

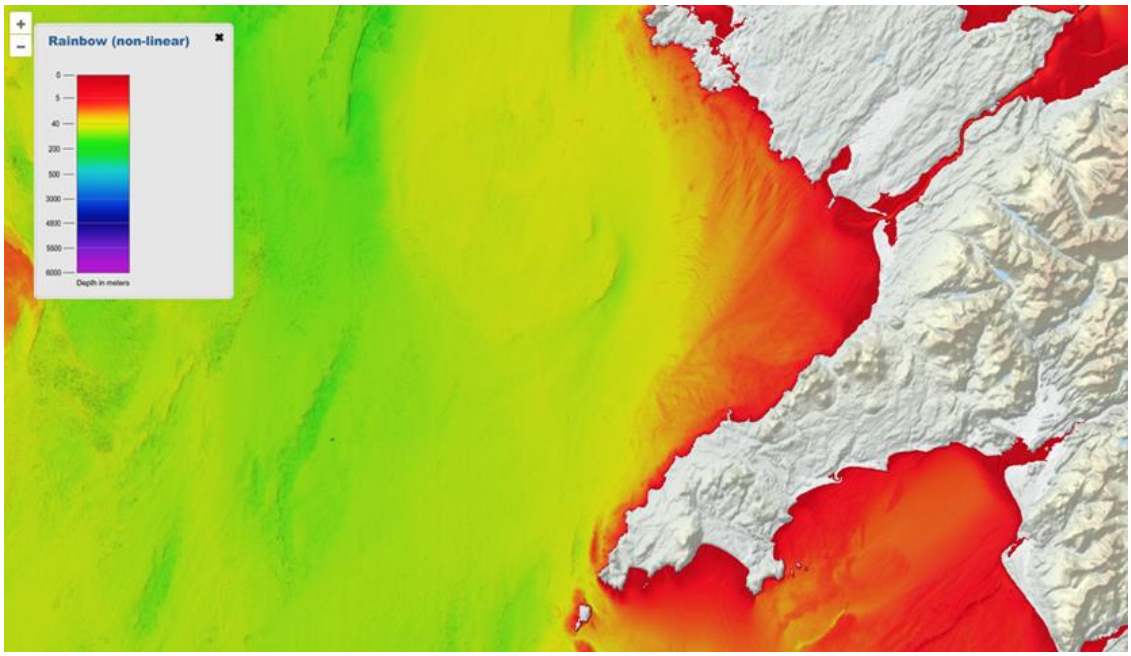


Fig 2. Depth of seabed in Caernarfon Bay averaging around 15m with deeper areas increasing to 50m.

The sediment types in Caernarfon Bay are primarily influenced by tidal action and the flow of water from rivers. In the estuarine areas, fine-grained sediments such as mud and clay dominate, especially around river mouths where deposition is influenced by freshwater inflow. These areas are important habitats for various marine organisms, including birds and fish species (Owen, 2017).

Further out into the bay, sandy and gravelly sediments are more common, where wave action is strong enough to prevent finer particles from settling. These sandy and gravelly areas provide habitats for invertebrates and fish species, such as crustaceans and flatfish. Additionally, rocky substrates are present along the shoreline and in certain deeper areas, where the seabed supports kelp forests and marine life that thrives in such habitats (Edwards & Stoker, 2004). Notably, biogenic reefs formed by species such as horse mussel and native oyster occur along the northern fringes between Ynys Llanddwyn and South Stack as well as to the southern coastal fringes between Trefor and Mynydd Mawr (Fig 3a&b).

The more durable coarse sediments, also present in the west, sustain encrusting fauna such as bryozoans and calcareous tubeworms (Robinson *et al*., 2009). There are a variety of faunal communities supported by the finer sand silt at the mouth of the Menai Strait. An arrangement of Carboniferous, Precambrian, and undivided lower Palaeozoic bedrock is covered in a layer of Quaternary sand and sandy gravel. Both the North and South Sands are examples of shifting sandbanks caused by mobile sediment; the mobile sediment contains active bed forms such as sand waves (Natural Resources Wales, 2015a). The north region of the bay comprises smooth, sandy sediment, sometimes atop coarse gravel-like sediment and muddy sands in other areas (Robinson *et al*., 2009).

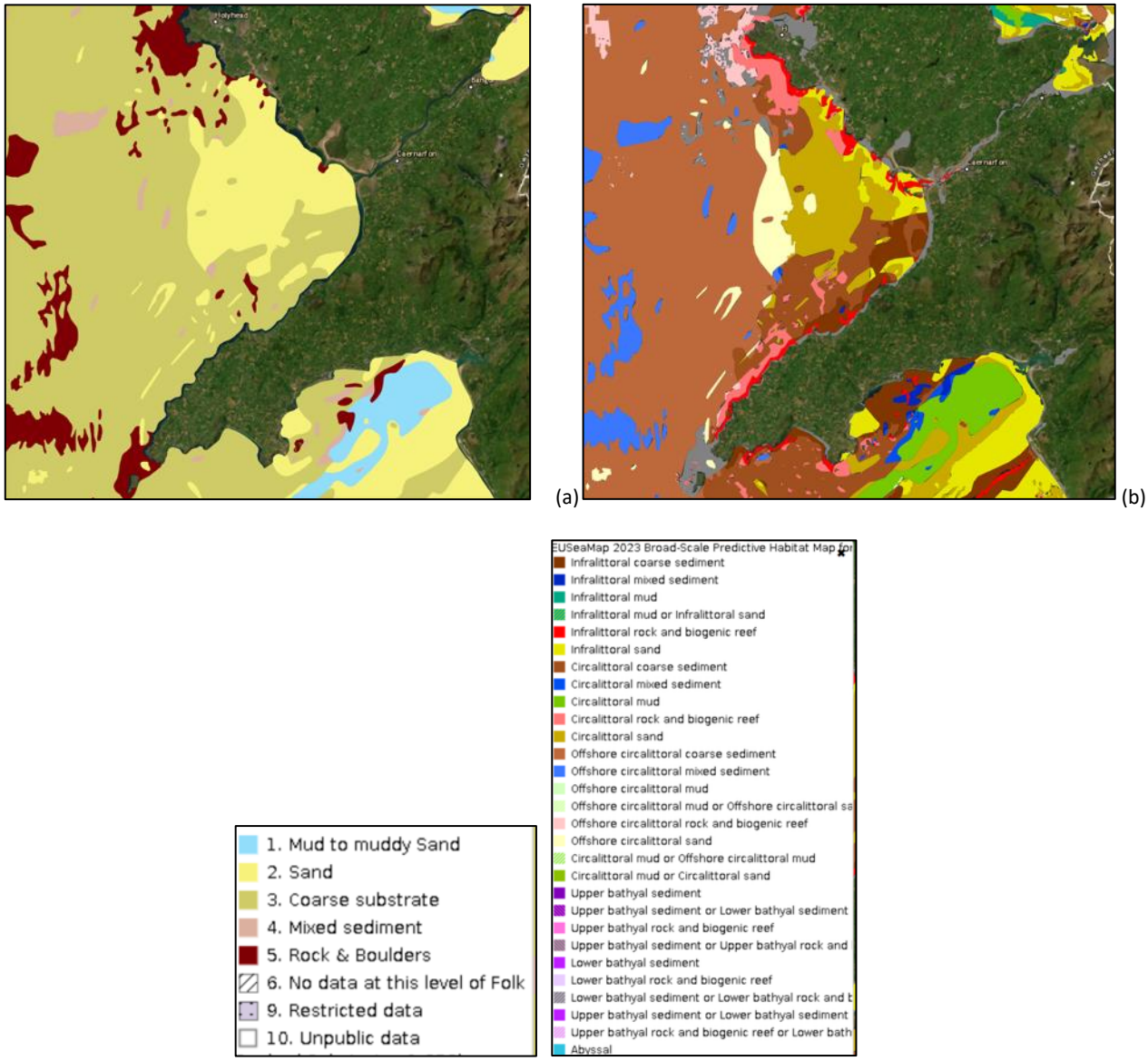


Fig 3. a) Main substrate types, and b) Detailed habitat types of Caernarfon Bay (source: EMODnet)

Protected areas

Due to environmental concerns, a number of conservation measures have been implemented to protect Caernarfon Bay's delicate ecosystems. Important ecosystems and species have been protected with designations such as terrestrial Sites of Special Scientific Interest (SSSIs) and marine Special Areas of Conservation (SACs). Caernarfon Bay sits between the protected sites of NW Anglesey Special Area of Conservation designated for harbour porpoise and the Pen Llyn a'r Sarnau Special Area of Conservation, designated for the sandbanks, estuaries, coastal lagoons and large shallow inlets and bays present, as well as the following protected species: bottlenose dolphin, grey seal and otter (Fig 4). Similarly, the entire Menai Strait is a SAC because of its diverse ecosystems, which include reefs, sandflats, sandbanks, and tidal mud flats (Natural Resources Wales, 2015a; Natural Resources Wales, 2024). Rhosneigr Reefs (marked for seaweed communities), Ty Croes (designated for heathland, grassland, and rock habitats), and Llyn Maelog (freshwater lagoon) are examples of SSSIs (Natural Resources Wales, 2015a). The Anglesey Tern Special Protection Area extends across northern Anglesey around the west coast

to Ynys Llanddwyn, in recognition of the important breeding and foraging habitats offered by this extensive area.

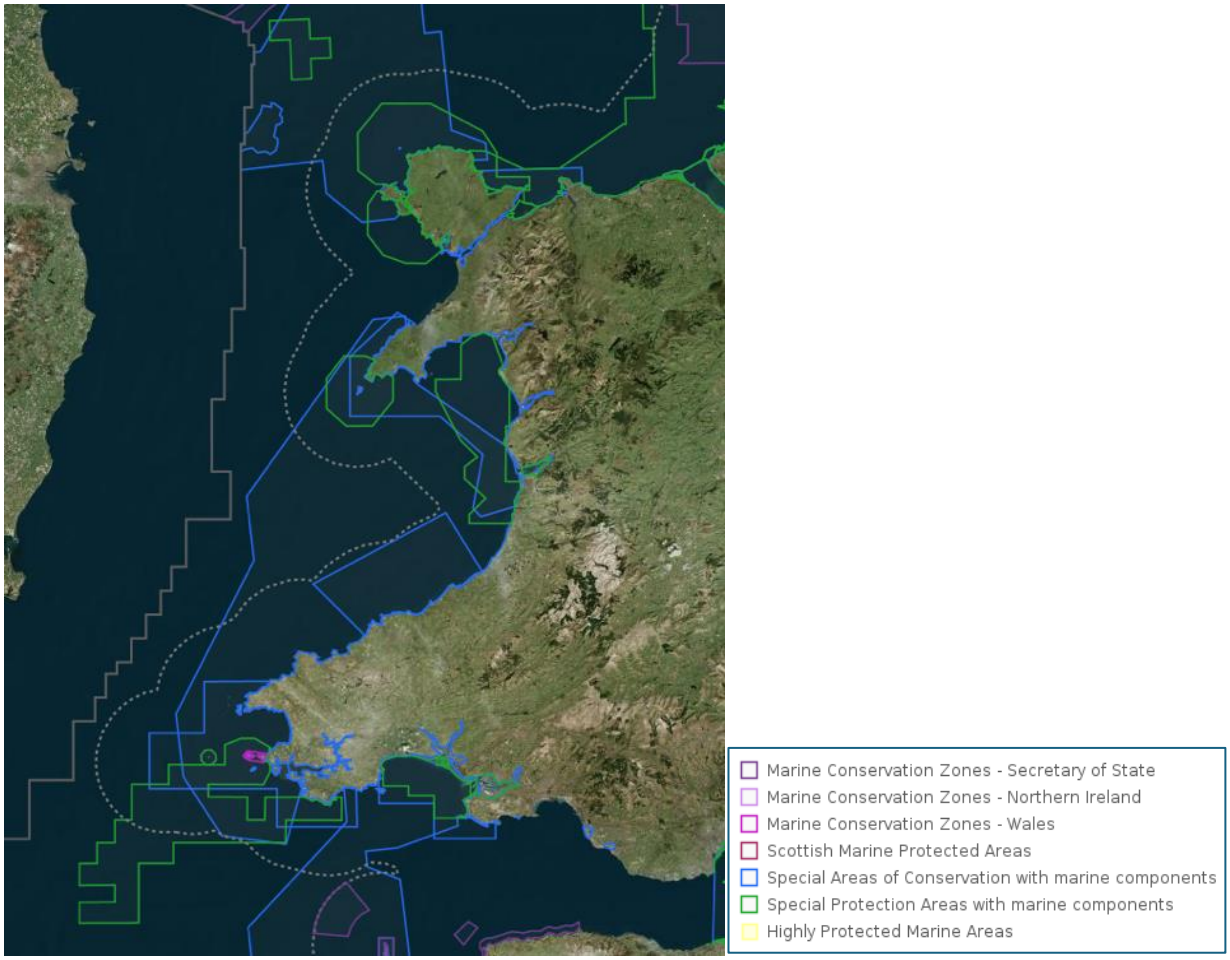


Fig 4. Marine Protected Areas: Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in Welsh Seas (source: JNCC)

4. Socio economic Background

Under the Well-being of Future Generations (Wales) Act 2015, the Gwynedd and Anglesey Board undertook an assessment by area in 2021-22. South-west Anglesey is covered by the Bro Aberffraw and Bro Rhosyr area and encompasses Newborough and District. This area was recognised as having an array of special assets including environmental and social heritage, but also a range of deep deprivation issues - few employment opportunities, and lack of enterprise know-how within the community. Of the 3,669 households in the area, income is below 60% of the UK average.

There are 3,669 households in Bro Aberffraw and Bro Rhosyr, the wards, which encompass the Newborough and District area, which we cover. 33% of households in Bro Aberffraw earn below 60% of the average GB income; this equates to 547 households (2016 Paycheck data). In Bro Rhosyr, the same applies to 558 households. This means that in 2016, 1,105 households in the area had a total annual income of less than £17,000. The conclusion was that “the key need is to create employment opportunities and new enterprises in the area, and that these could be based on the significant natural resources and natural beauty of the area, whilst contributing to the

enhancement of the environment." Many local employment opportunities are seasonal and tourism based, as businesses close or open for limited periods during the winter months.

5. Historical distribution of species

In order to explore the potential for ecological restoration work, it is important to understand the historical extent and presence of species and habitats within the area. A number of culturally, economically and ecologically important species are documented as being present throughout Caernarfon Bay in significant numbers including herring, angel shark and native oysters. Herring can still be found within the area; however, viable populations of angel shark and native oysters are not believed to currently exist here.

Angel shark

Angel sharks were once widespread across Wales. Welsh records show that they were especially concentrated specifically within Caernarfon Bay, Cardigan Bay, and Swansea Bay (Fig 5, Ellis *et al*., 2020). It is thought that these bays acted as essential habitats for the species. However, despite the once significant abundance, angel sharks can no longer be found in Caernarfon Bay. They have not been sighted since 2007 and appear to have survived only in Cardigan Bay (Hiddink *et al*., 2019).

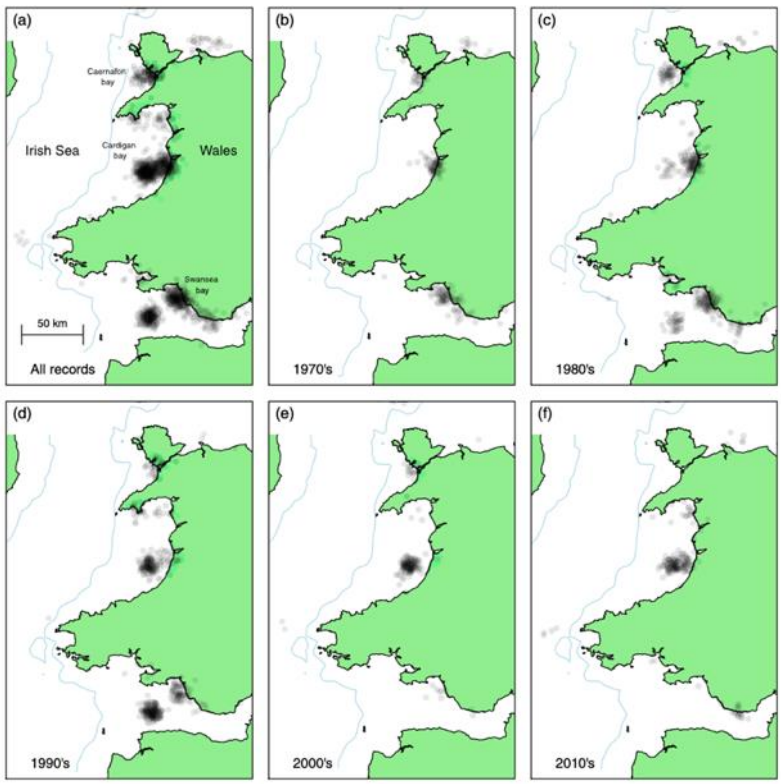


Fig 5. Distribution of Angel shark records in Wales (Hiddink et al., 2019).

Herring

Herring has been an abundant fish species in North Wales across centuries, with earliest records noting large abundance, going back at least as far as the year 1206 (Fig 6) (Moore *et al*., 2024). The exceptional abundance of herring has supported many predators in the area, nourishing seabirds, sharks, and marine mammals. Herring have played a significant economic, social, and cultural role in the area, as highlighted by a fishery located off the north coast of the Llŷn Peninsula (Moore *et al*., 2024).

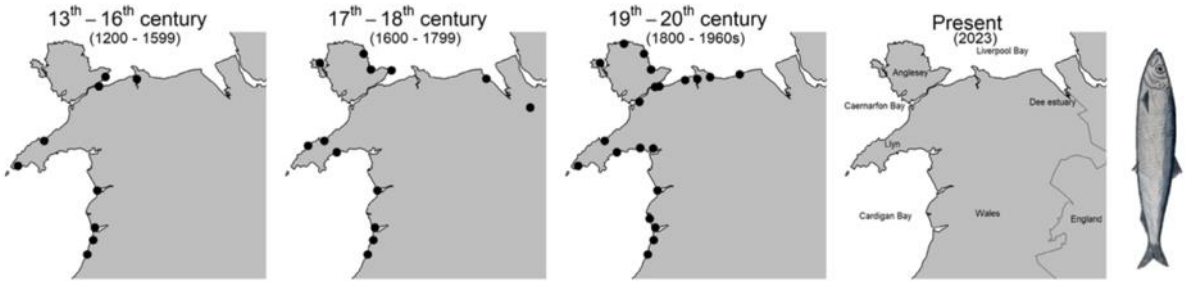


Fig 6. Century-scale persistence and the recent loss of significant inshore herring fisheries. Black circles are settlements with evidence of significant herring fisheries on the Irishe Sea coast of Wales (UK) within the given time period. Herring illustration by Lewis-Morris, -1740s (Morris n.d) supplied by National Library of Wales.

Flatfish and Crawfish

Many flatfish species have been reported in Caernarfon Bay as early as the mid-18th century to the mid 20th century. Crawfish in particular have been historically targeted on the coast of North Wales. Once common around the Llŷn Peninsula, fisheries have caused the species to become commercially extinct with no record of the species since 2016 (Fig 7). Crawfish are now rare generally in the UK, and of conservation concern (Moore *et al.* 2024)

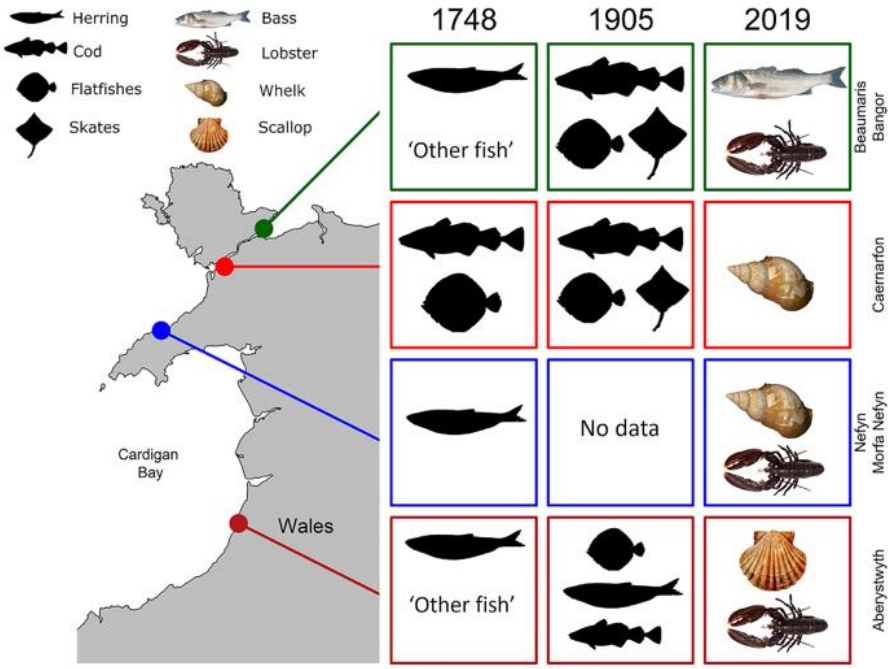


Fig 7. Century-scale changes in principal fishery species in a temperate marine ecosystem. Sources for the four ports in northern Wales are 'principal commodities' (Morris, 1748); 'principal kinds of fish caught' (Board of Agriculture and Fisheries, 1906); and taxa collectively comprising a minimum of 80% landed value Excludes sessile/intertidal bivalves and salmon. (Marine Management Organisation, 2020).

Oysters

Historically, oyster beds were prolific in North Wales. They are mostly found around Puffin Island (south-east Anglesey), Red Wharf Bay (north Anglesey), Caernarfon (Gwynedd), Bardsey Island, and parts of the Llŷn Peninsula among many others. Until the late 1700s, they were harvested conservatively. Increased competition among fisheries resulted in a decline of the oysters. In 1894, due to a shortage of the native species, new species were imported from America and France (*Crassostrea virginica* and *Crassostrea angulata).* The attempt at rejuvenation was unsuccessful as the new species could not withstand the cold temperatures and disease. Another attempt was made in 1910, but again oysters eventually succumbed to disease (Hayden-Hughes, 2022).

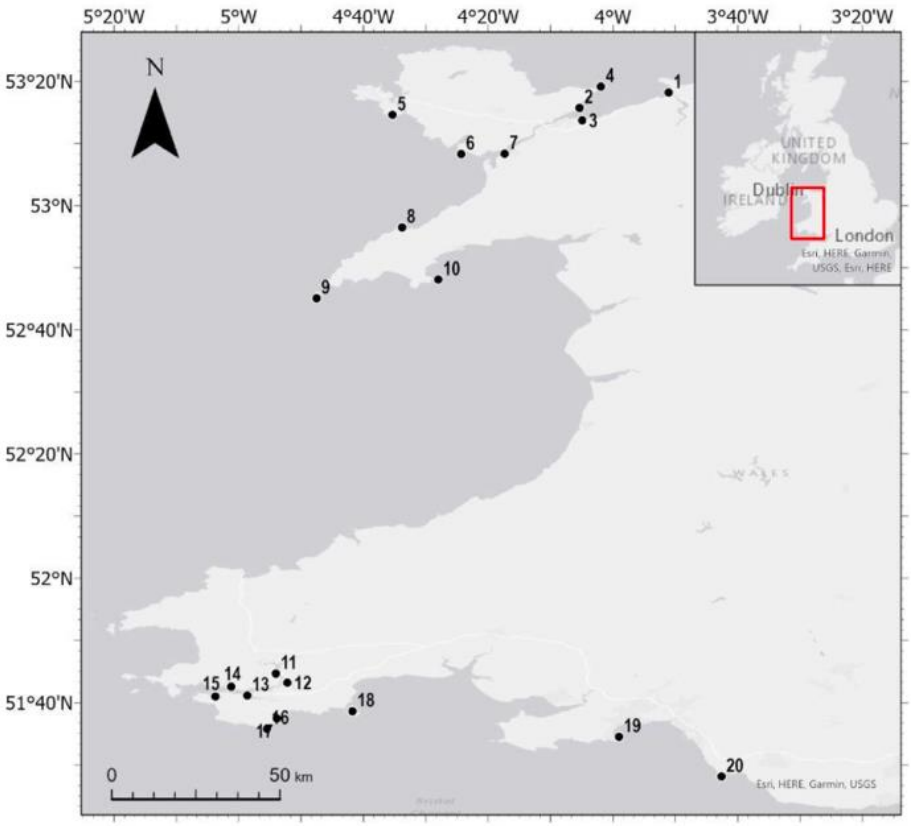


Fig 8. Map of known historical native oyster culture sites in Wales – Conwy (1), Beaumaris (2), Ogwen River (3), Puffin Island (4), Rhoscolyn (5), Llanddwyn Island (6), Caernarfon (7), Porthdinllaen (8), Bardsey Island (9), Saint Tudwals Islands (10), Llangwm (11), Lawrenny (12), Pennar (13), Castle Pill (14), Angle (15), Saint Govan's Head (16), Stackpole (17), Caldey Island (18), The Mumbles (19), Porthcawl (20).

Seabirds

The low rocky shore, beaches and dunes that characterise the region of South-west Anglesey has shaped its marine avifauna. The lack of high cliffs has resulted in an absence of colonial cliff-nesting birds such as kittiwake, common guillemot, razorbill and puffin, whilst the black guillemot, which favours low cliffs and breeds at several sites along the coast of north Anglesey, no longer appears to be breeding in this region. Formerly, the species did occur in the area, with Pennant (1810) recording a few pairs breeding at Ynys Llanddwyn, whilst Forrest (1907) also mentions an individual there in June 1901.

Plate 1. Common guillemot (left) and Puffin (right). Photos: PGH Evans.

The offshore rocks are used as roosts and at some sites for breeding, by cormorants and shags. These include (from north to south): Ynys Feirig and Cerrig-y-Gwyr near Rhosneigr, Carreg Glydan, Ynys Meibion, Carreg-y-trai near Aberffraw, Dinas Bach and Dinas Fawr, Caseg Malltraeth, Ynys yr Adar and Ynys-y-Cranc off Llanddwyn. They also occupy headlands, and at Bodorgan Head, there were 138 apparently occupied cormorant nest sites between 1998 and 2002, reduced to 28 between 2015 and 2019 (Dodd, 2021a). Shag numbers have also declined, mirroring a UK-wide trend. At Bodorgan Head, the number of apparently occupied shag nest sites declined recently from 43 in 1969-70, 33 in 1985-88, 45 in 1988-2000, to only 14 in 2015-19 (Dodd, 2021b), and at Ynys yr Adar off Llanddwyn, corresponding declines in occupied nest sites were from 51 in 1969-70, 28 in 1985-88, 35 in 1988-2000, and then 19 in 2015-19 (Dodd, 2021b).

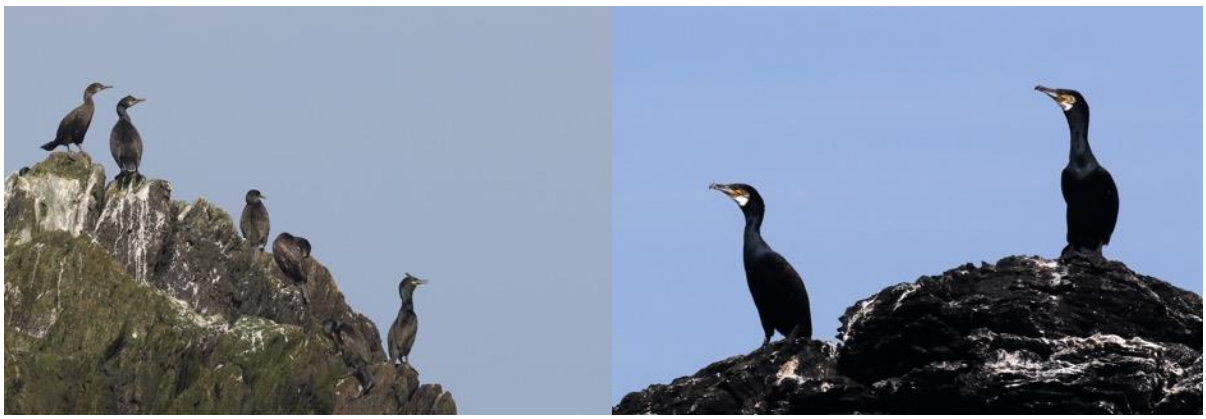


Plate 2. Shag (left) and cormorant (right) roosts. Photos: PGH Evans.

Causes for these declines are not known with certainty. Both species experience mortality from ground predators such as rats where they have been present, entanglement in discarded fishing gear, prey shortages (e.g. sandeel availability), and storms (which are becoming more frequent with climate change). The general declines in shag populations across the UK are of particular conservation concern.

Another seabird family that is particularly vulnerable to human activities and has seen declines in many areas are the terns. In Wales, Anglesey has long been a stronghold for several species of terns, with the main breeding colonies on the north coast, hence the designation of a Special Protection Area for terns in this part of Anglesey. However, the south-west of Anglesey once hosted tern colonies as well.

The rarest of all of Britain's breeding tern species, the roseate tern (*Sterna dougallii*) used to breed on the small rocky stacks off Ynys Llanddwyn, with a colony established about 1900, and by 1915 it was said to number several hundreds of pairs, and thought to be one of the largest colonies in Europe (Forrest, 1919). The birds there nested under tree mallow (*Malva subovata*) (Coward, 1922). There were 100 pairs in 1924, but only one pair in 1925, although "a good many" were recorded as breeding at Rhoscolyn Beacon to the north in 1916 (Cook & Pritchard, 2021). The cause for declines in the last century were breeding failure due to predation by gulls and rats, and at the end of the nineteenth century, shooting for sport and for plumes to decorate ladies' hats. The latter prompted Ynys Llanddwyn and neighbouring Newborough Warren to become the RSPB's first bird reserve in Wales, and the species to be closely wardened. During the 1950s, small numbers bred once more on one of the stacks off Ynys Llanddwyn, but from 1959 the main site on Anglesey was at Ynys Feurig. Between 100 and 200 pairs bred at three sites in the region during the 1970s and 1980s but in 1987 there was a large decline, to 77 pairs at four colonies (Cook & Pritchard, 2021). The Ynys Feurig colony suffered from predation by brown rats and

peregrines, as well as a fox in 1986, and the population here declined from 200 pairs in 1986 to 40 pairs in 1987, with gull predation leading to a complete failure of the colony in 1990 (Cook & Pritchard, 2021). The results of ringing birds showed that birds from Ynys Feurig then moved to eastern Ireland, mainly to the colony at Rockabill in Dublin Bay. This colony has been increasing in recent years, and sporadic breeding on Anglesey currently appears to be of birds originating from Ireland (Cook & Pritchard, 2021).

Plate 3. Sandwich (left) and Roseate (right) terns. Photos: left (PGH Evans); right (Brian Burke)

Three other tern species have bred in the region: common (*Sterna hirundo*), arctic (*Sterna paradisaea*) and Sandwich tern (*Thalassius sandvicensis*), all formerly having colonies at several sites on Anglesey. Forrest (1907) reported several colonies of common tern on Anglesey in the early years of the 20th century, with the species outnumbering arctic terns at Newborough Warren, where there was a colony of up to 120-130 pairs in sand dunes towards Abermenai Point, from at least 1902 to 1974. Common terns also outnumbered arctic terns on Ynys Llanddwyn. Forrest (1907) reported that in 1903, on a rocky islet and neighbouring stack "so thickly was the surface covered with nests that it was impossible to avoid treading on some of them". Egg harvesting by local farmers was reported in the 1950s, and the colony at Llanddwyn remained active until at least 1958 (Coffey, 2021). On Rhoscolyn Beacon, a few pairs nested among more numerous arctic terns in 1916, but by 1925, the 56 pairs outnumbered the arctic terns (Coffey, 2021).

Plate 4. Arctic (left) and common (right) terns. Photos: PGH Evans.

Although the main arctic tern colony in Anglesey has long been on the Skerries off the north coast, the species has also bred in west Anglesey with a colony at Rhoscolyn recorded from at least the early twentieth century (Forrest, 1907). There were 200-300 pairs in the Rhoscolyn colony between 1884 and 1910, but numbers then declined to "a few" by 1925 (Cook, 2021a). Up to 75-100 pairs nested at Ynys Llanddwyn during 1909-24, with sporadic breeding nearby at

Abermenai/Newborough Warren in 1915 and 1951, and Ynys Gorad Goch in the Menai Strait in 1959 (Cook, 2021a). Further north, common terns breed on a privately owned site where numbers increased from an average 215 pairs in the 1990s to an average of 475 pairs in the 21st century with a recent peak of 635 pairs in 2010 (Cook, 2021a).

The largest breeding colony of Sandwich terns in Wales is at Cemlyn lagoon in north Anglesey. However, there are no records of breeding in Wales for this species until the twentieth century. Forrest (1907) knew of only one record in North Wales, at the Skerries in 1902, but then a colony of 40 nests was found on a stack off Ynys Llanddwyn in 1915, with the species also present there the previous year (Jones & Whalley, 2004). Numbers here dwindled after 1915, and in 1924 and 1925, there was only one pair (Cook, 2021b). There were only occasional breeding attempts on Anglesey over the next 40 years, including at Newborough and Rhoscolyn Beacon (Cook, 2021b). In 1970, twenty pairs nested at Ynys Feurig, increasing to 100 pairs in 1971 and 200 pairs in 1972. Numbers varied through the remainder of the 1970s and early 1980s, peaking at 241 pairs in 1983, since when there have been few breeding attempts (Cook, 2021b).

All of the tern species are vulnerable to predation from rodents and gulls, and human disturbance, whilst their breeding success depends a lot upon local food availability. The present and historic nesting colonies all share proximity to sandy substrates that are important habitat for sand eels, their main prey. Our surveys in South-west Anglesey show that in spite of many of the sites in the area no longer holding colonies of breeding terns, the region is regularly utilised as a feeding ground. There is, therefore, potential for nesting to return to some of those sites if the human-related pressures upon breeding birds can be reduced.

Plate 5. Great black-backed gull (top left); Lesser black-backed gull (top right); Herring gull (bottom left and right). Photos: PGH Evans.

The other family of seabirds inhabiting the region are the gulls – herring gull (*Larus argentatus*), great black-backed (*Larus marinus*) and lesser black-backed gull (*Larus fuscus*). Great black-backed gulls nest in small numbers, often solitary pairs, along the coast of South-west Anglesey, whilst colonies of herring gull and lesser black-backed gull occur mainly on offshore islands, with greatest numbers in Anglesey breeding on the Skerries off the north coast. Lesser black-backs started breeding at Newborough Warren around 1951, with numbers increasing to a peak of around 2,000 pairs in 1969, before declining to zero by 1982, following the arrival of foxes on Anglesey in the late 1960s, habitat change with the planting of conifers, and a local outbreak of botulism were also believed to have caused herring gull declines here (Jones & Whalley, 2004). There was a large colony at Bodorgan Head with around 2,000 pairs reported in 1986 but only 740 in 1987, 386 in 1989, and just three pairs in 2018 (Sutcliffe, 2021).

Marine Mammals

Information on historical changes in the distribution and abundance of marine mammals, particularly cetaceans, in South-west Anglesey is much weaker compared to birds. Before the 1980s, we rely largely upon the strandings record and some anecdotal observations on relative status. However, even the strandings record is very poor until from around 2000 (Table 1). A greater number of cetaceans almost certainly stranded in the region before 2000 than is showing here when comparing records across 20-year time periods in the last century, due to under-reporting and so it is not possible to determine trends from the historical data.

With regards to status in the nineteenth century, Forrest (1907) refers to all four of the cetacean species that currently occur regularly in the region: harbour porpoise, common dolphin, bottlenose dolphin and Risso's dolphin (Plates 6-9). Harbour porpoise is mentioned as occurring in the Menai Strait, although Forrest (1907) refers to this in the context of sightings at the Orme and Conwy Bay, so he is probably referring to the eastern end of the strait.

Plate 6. Harbour porpoise (*Phocoena phocoena*). Photo: P Anderwald

Plate 7. Bottlenose dolphin (*Tursiops truncatus*). Photo: PGH Evans.

Plate 8. Common dolphin (*Delphinus delphis*). Photo: PGH Evans

Plate 9. Risso's dolphin (*Grampus griseus*). Photo: PGH Evans.

Plate 10. Minke whale (*Balaenoptera acutorostrata*). Photo: PGH Evans

The grey seal is a common inhabitant of Caernarfon Bay and around Anglesey with major breeding sites at Bardsey Island and the Skerries off NW Anglesey (Baines & Evans, 2012). Small numbers of grey seals breed in sea caves around Anglesey with the nearest surveyed sites in west Anglesey being on Holy Island (Westcott & Stringell, 2003). During a survey between September and November 2002, 35 pups were located in sea caves around Holy Island. In 2003, surveys were continued and Westcott & Stringell (2004) reported that seals were seen occasionally using outlying rocks at Carreg y Trai near Aberffraw and at Ynys Llanddwyn. However, regular visits were not made to these sites because of time constraints. On the north coast of the Llyn Peninsula, seals were recorded at Carreg Ddu, Rhosgor, Porth Gwyland and Porth Vidlin (Westcott & Stringell, 2004). At Carreg Ddu, no pups were found but up to 22 were counted on 30 July 2002 although more than five were seen on only two occasions. Rhosgor was used by seals through the year but was used most heavily during the late summer and autumn. Counts showed assembly size varied between one and thirty. According to the farmer below whose land the seals assemble, seal numbers seem not to have changed noticeably over the last 20 years (Williams, in Westcott & Stringell, 2004). The Porth Vidlin coast is only occasionally, and very lightly used by seals. Local fishermen reported this part of the coast having been used as a breeding location in the 1990s, although this was not confirmed by surveys (Westcott, 2002; Westcott & Stringell, 2003). Seals were often present in low numbers, counts showing between one and four (the maximum count was recorded on 2 October), mainly on rocks to seaward of Porth Vidlin. Regular counts were not made in 2001, so comparisons could not be made (Westcott & Stringell, 2004).

The next seal survey of the area was in 2017 (Robinson *et al*., 2023). Along the north coast of the Llyn Peninsula, two age class I-IV pups and two unmatched age class V pups were recorded throughout the 2017 season. The first two pups were age class V pups recorded at two sites on the 8 and 20 October 2017 respectively, with estimated dates of birth of 15 and 27 September 2017. One age class IV and one age class II pup were later recorded at the same site on the 20

October and 3 November respectively, with estimated dates of birth of the 2 and 26 October. No new pups were subsequently recorded on the North Llyn, giving an estimated pupping season of 42 days across the area.

Plate 11. Grey seal (*Halichoerus grypus*) adult and juvenile. Photo: PGH Evans

For North Wales in general, a small increase in production between 2001 and 2002 was followed by a small decrease between 2002 and 2004. This was followed by a large increase between 2004 and 2017. Pup production in 2017 showed an increase of >120% since 2002, and 180% since 2004, increasing from 102 pups to 279 pups (age class I-V) in the period 2001 – 2017 (Robinson *et al.,* 2023). However, in and around Caernarfon Bay, no increase was observed. Pup production at Holy Island, however, has remained relatively constant, at around 27 pups, over years for which data are available. The numbers of pups born on the north Llyn Peninsula approximately halved, decreasing from nine pups in 2002 to four in 2017. No pups were recorded from the West Anglesey coast south of Holy Island, although it is not clear how well this area was surveyed.

The strandings record also reflects the present day in terms of the species that occur in the region, with harbour porpoise and common dolphin, followed by bottlenose dolphin and Risso's dolphin being the most frequently recorded species (Table 1). The live stranding of a pygmy sperm whale at Newborough is exceptional, the normal habitat of the species being deep waters of subtropical and tropical seas far to the south of the British Isles. The individual first live-stranded on 20 November 2014 but after re-floating it stayed in the area finally coming ashore on 26 November five miles away at Dinas Dinlle in Gwynedd (Penrose, 2015). Cause of death was believed to be a generalised bacterial infection.

Table 1. Number of strandings in Caernarfon Bay between 1900 and 2019 (data from CSIP Strandings Reports, 1913-2019)

Species	1913-19*	1920-39	1940-59	1960-79	1980-99	2000-19
Harbour Porpoise	-	0	1	3	5	63-72
Bottlenose Dolphin	1	1	1	0	0	5
Common Dolphin	0	0	0	0	1	11-13
Risso's Dolphin	0	0	1	0	0	3
Minke Whale	0	0	1	0	0	1
Striped Dolphin	0	0	0	0	0	2
White-beaked Dolphin	0	1	0	0	0	0
Long-finned Pilot Whale	0	0	0	0	0	1
Pygmy Sperm Whale	0	0	0	0	0	1

Another species of warmer waters is the striped dolphin. It is easily confused with the common dolphin and may also travel in groups of common dolphins so making it challenging to identify at sea. It is a rare visitor to the Irish Sea although with climate warming, it is likely to become more regular (Evans & Waggitt, 2020). There have been just two confirmed strandings in Caernarfon Bay since the strandings recording scheme started in 1913, both in the last 25 years: one live stranded at Morfa Nefyn on 27 June 2000 (Penrose, 2001), and the second at Dinas Dinlle on 1 September 2013, with two others stranding further south in West Wales later in the month; all were in a state of slight decomposition (Penrose, 2014). Striped dolphins occur mainly off the continental shelf in the Bay of Biscay, around the Iberian Peninsula and in the Mediterranean. Finally, a long-finned pilot whale calf live stranded at Rhosneigr on 1 August 2017 (Penrose, 2018). This species occurs mainly along the shelf edge west of Britain and Ireland and is rare in the Irish Sea (Evans & Waggitt, 2023).

On 7 September 1923, a white-beaked dolphin stranded at Caernarfon. This species is a rare visitor to the Irish Sea (Evans & Waggitt, 2023). The only stranding in the region of a minke whale was on 7 January 1956 at Caernarfon. This species is a regular inhabitant of the Irish Sea but generally in deep waters of 50 metres or more (Evans & Waggitt, 2023).

6. Fishing activities in Caernarfon Bay

Historically, fishing has been a crucial industry for the local communities,

- Commercial Fishing: Fisheries within Caernarfon Bay primarily target species such as sea bass, cod, and flatfish, and the bay's estuarine areas, rich in nutrients, provide an ideal environment for bivalve molluscs, including mussels and cockles contributing to the local shellfish industry (Jensen, 2018).
- Recreational Fishing: Recreational fishing is also popular in Caernarfon Bay, with many anglers targeting fish species such as cod, sea bass, whiting, and flatfish. Both shore-based and boat-based fishing are common, and the area is recognized for its diversity of fish species. It is also a popular destination for recreational anglers targeting mackerel, rays, and other marine species (Hughes & Wynne, 2012).

Cockle Fishing

Illegal and unlicensed cockle fishing activities in the Cefni Estuary have been highlighted by the Bodorgan Estate as a key concern. During conversations with Natural Resources Wales (NRW) and local fishers, this activity has been confirmed at a number of locations around Caernarfon Bay including the Cefni Estuary and Traeth Melynog. The activity is reported to be carried out by several individuals from the Liverpool area rather than by local people. Sea Watch will be meeting with a number of key contacts locally to find out further details as well as meeting with the Police Officer from the North Wales Wildlife Crime Unit who has been assigned to NRW. Traeth Melynog is the only area within Caernarfon Bay with a cockle fishery order which allows permit holders to fish for cockles between 1st September 2023 and 31st August 2024, taking no more than 168 tonnes in total throughout the season (Welsh Government, 2024a). Access ways, vehicle use and days of fishing activity are all restricted. However, the remote location of this site and lack of resources available to both NRW and the Welsh Government Fisheries team do not allow for all restrictions to be enforced.

Whelk Fishing

Permits were introduced in March 2022 to fish commercially for whelk in Welsh waters, allowing for this valuable species to be fished sustainably (Welsh Government, 2024b). The total annual catch limit for Welsh waters was 4,768 tonnes between 1st March 2024 and 28th February 2025. Within Caernarfon Bay, a number of whelk fishers operate out of Nefyn, with restrictions to whelk potting gear using securing anchors on the area of horse mussel bed near Porth Dinllaen. This fishery is well placed to also report locations of the occurrence of the invasive non-native slipper limpet *Crepidula fornicata* as this has been found in Caernarfon Bay. Sea Watch aims to work with whelk fishers to track the distribution of *C. fornicata* in Caernarfon Bay, and explore options for reducing the spread of this species, which can alter habitats by out-competing other seabed dwelling species.

Lobster and crab fishing

Potting for lobster and crab occurs around the rocky coastlines of Caernarfon Bay by both commercial and recreational fishers. Recreational fishers must apply for a permit to catch lobster and crab, which imposes a catch limit of:

- 2 lobsters per day
- 1 crawfish
- A combined total of 5 crabs (edible, spider, and velvet)
- 1 kilogram of prawns
- 5 kilograms of whelks

All catches must be landed on the same calendar day they are caught and cannot be stored in keep pots at sea (Welsh Government, 2024c).

Protection of V-Notched Lobsters: It is illegal to fish for, or take, any lobster that is V-notched (marked with a "V" shape in the tail) or otherwise marked to indicate it has been previously caught and released. Such lobsters must be returned immediately to the sea.

Daily catch limits apply to individuals fishing from boats registered under the current regulations and holding a valid fishing licence issued by the Marine Management Organisation (MMO) or the Welsh Government. These commercial fishers are subject to the following conditions (Welsh Government, 2024d):

- Permit Requirements: Commercial fishers must obtain a permit that limits the number of pots or traps they can use and the quantity of shellfish they can land each day. The permit will provide a registration number to display on any boat used and all fishing gear.
- Minimum Conservation Reference Size (MCRS): The MCRS for lobsters in Welsh waters is 87mm carapace length. Lobsters below this size must be returned to the sea immediately to allow them to reach maturity and contribute to the breeding population.
- Protection of V-Notched Lobsters: It is illegal to fish for or take any lobster that is V-notched (marked with a "V" shape in the tail) or otherwise marked to indicate it has been previously caught and released. Such lobsters must be returned immediately to the sea.
- Catch Reporting: Commercial fishers are required to report their catches regularly to assist in monitoring and managing lobster and crab populations. These data help inform sustainable fishing practices and stock assessments.

Sea Bass

Fishing for sea bass occurs widely throughout Caernarfon Bay by both recreational and commercial fishers.

Due to concerns over the sustainability of the bass fishery in England and Wales, the Sea Fisheries Regulations 2021 (Welsh Government, 2021) was introduced and subsequent amendments in 2022 and 2023 imposed stricter measures, including:

- Closed Seasons: Prohibiting bass fishing during certain periods to protect spawning populations.
- Catch Limits: Setting maximum catch limits for commercial and recreational fishers.
- Gear Restrictions: Limiting the types of fishing gear that can be used to catch bass.

Commercial bass fishing in Caernarfon Bay is governed by the Sea Fisheries (Amendment) (No. 2) Regulations 2024. Key points include:

- Closed Season: Fishing for bass is prohibited during February and March.
- Gear Restrictions:
    - Demersal Trawls and Seines: Bass catch is limited to 10% by weight of all marine organisms per trip, with an annual unavoidable by-catch limit of 3.8 tonnes per vessel.
    - Hooks and Lines: Annual limit of 6.8 tonnes per vessel.
    - Fixed Gillnets: Annual by-catch limit of 1.8 tonnes per vessel.
    - Other Gears: Bass catches are prohibited.
- Authorisations: Commercial fishers must obtain written authorisation from the Welsh Government to catch and retain bass using certain gears. Authorisations are issued to vessels with a track record of landing bass during the reference period of 1 July 2015 to 30 September 2016.

Recreational bass fishing in Caernarfon Bay is also regulated:

- Closed Season: 1 February – 31 March: Catch and release only.
- Open Season: 1 April – 31 January: Bag limit of 2 bass (42cm or over) per person per day.
- Gear Restrictions: Use of fixed or drift nets is prohibited.

To understand the spatial distribution and amount of fishing effort within Caernarfon Bay, fishing effort statistics were accessed for the Celtic Seas ecoregion from the ICES fisheries overview (ICES, 2022). Compiled average fishing effort as the mean annual fishing effort in mW fishing hours was available in 0.05 by 0.05 (roughly 3.5 by 5.5 km) degree grids from 2018 to 2021 from vessels using Vessel Monitoring Systems (VMS). VMS is a system where satellites track the at-sea positions of fishing vessels greater than 12 m in length, reporting their position roughly every two hours. Therefore, when reviewing the fishing effort, it must be considered that the distribution only relates to larger vessels; vessels less than 12 m in length will not be compiled into the fishing effort grids, so are not presented here. These data were plotted across the extent of Caernarfon Bay to understand the distribution and amount of fishing effort in this area (Figs 9-12).

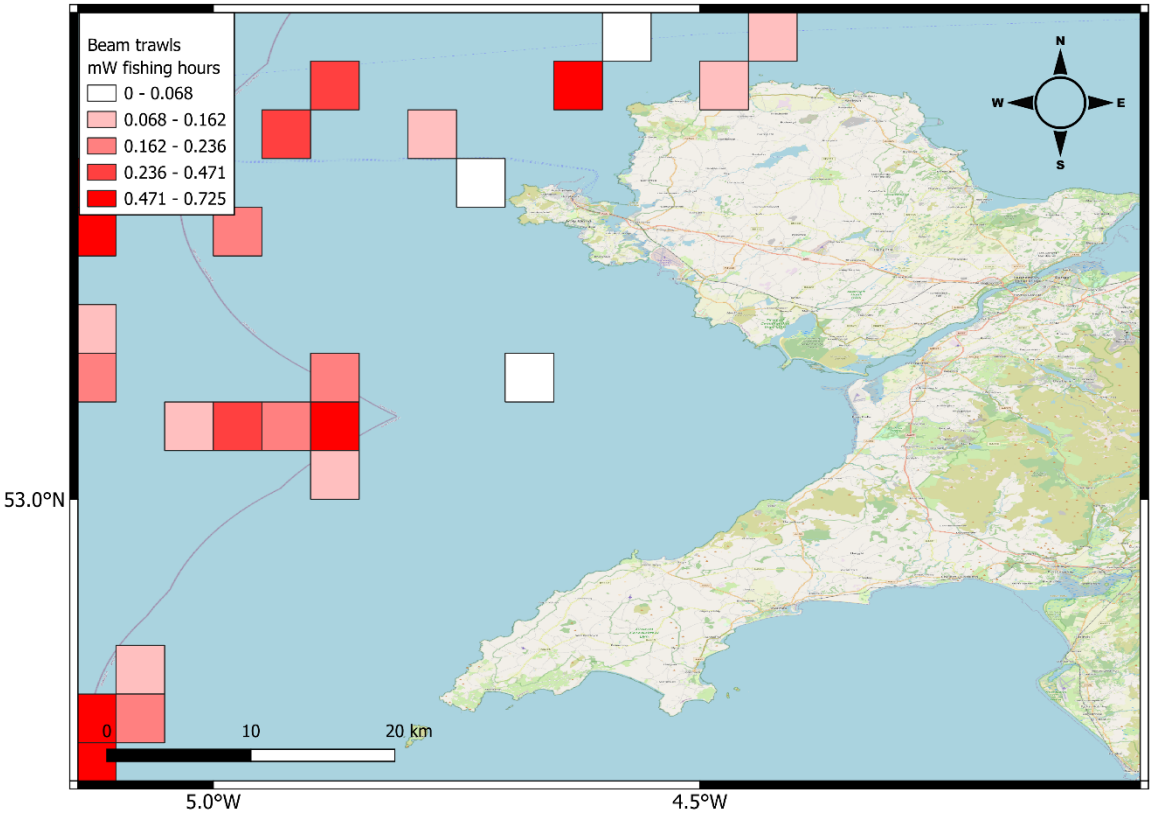


Fig 9. Fishing effort of beam trawls within Caernarfon Bay, 2018-2021

Fishing effort of beam trawls was generally beyond the extent of Caernarfon Bay with the majority of fishing effort being conducted beyond the 12 NM limit or northwest of the Isle of Anglesey (Fig 9). Dredging from larger vessels occurs at relatively low effort levels throughout Caernarfon Bay, with higher levels occurring more seaward of the 12 NM limit and north of Red Wharf Bay in NE Anglesey (Fig 10). Pelagic trawls do not really occur in Caernarfon Bay (Fig 11).

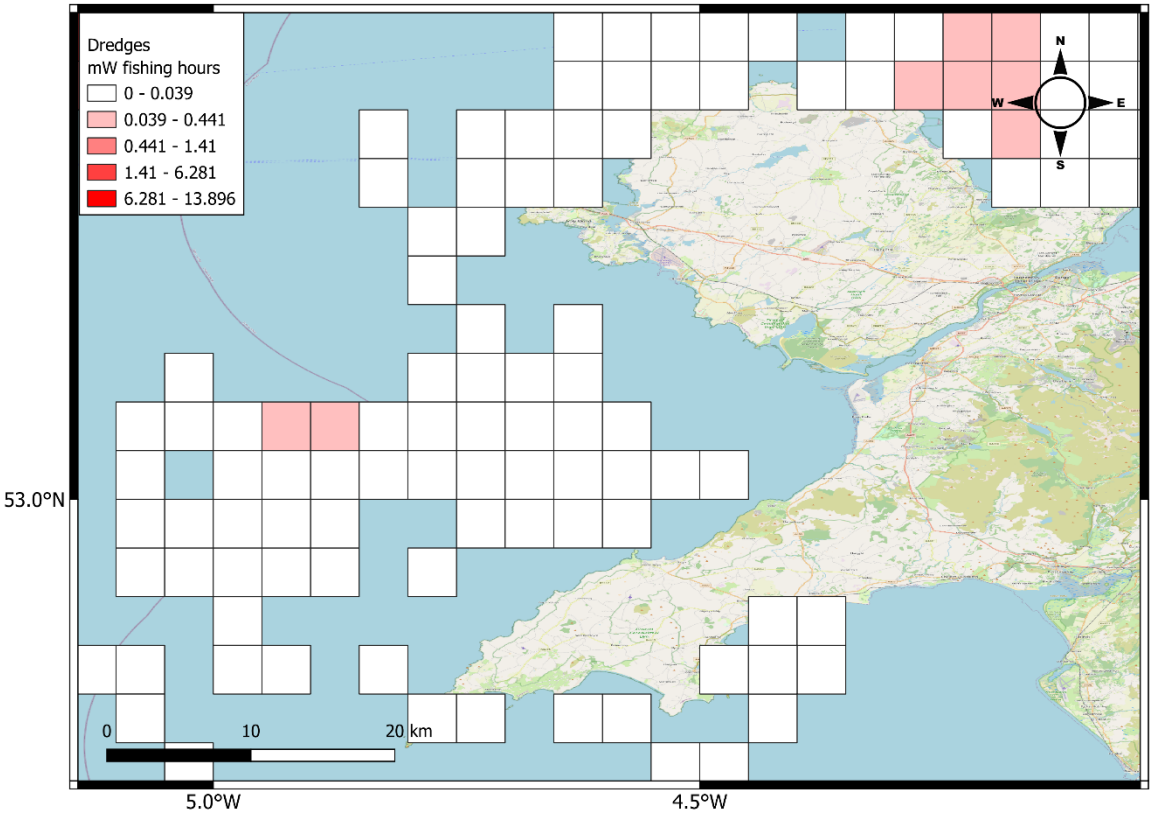


Fig 10. Fishing effort by dredging within Caernarfon Bay, 2018-2021

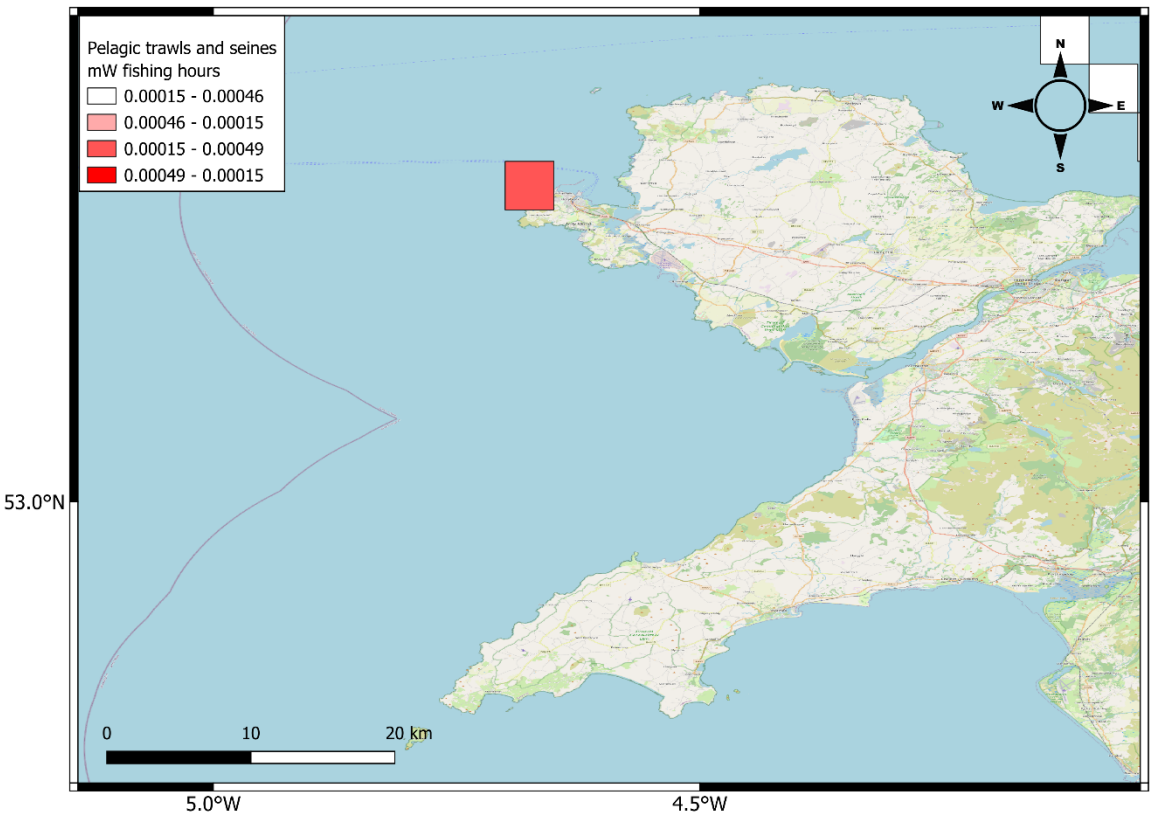


Fig 11. Fishing effort by pelagic trawlers within Caernarfon Bay, 2018-2021

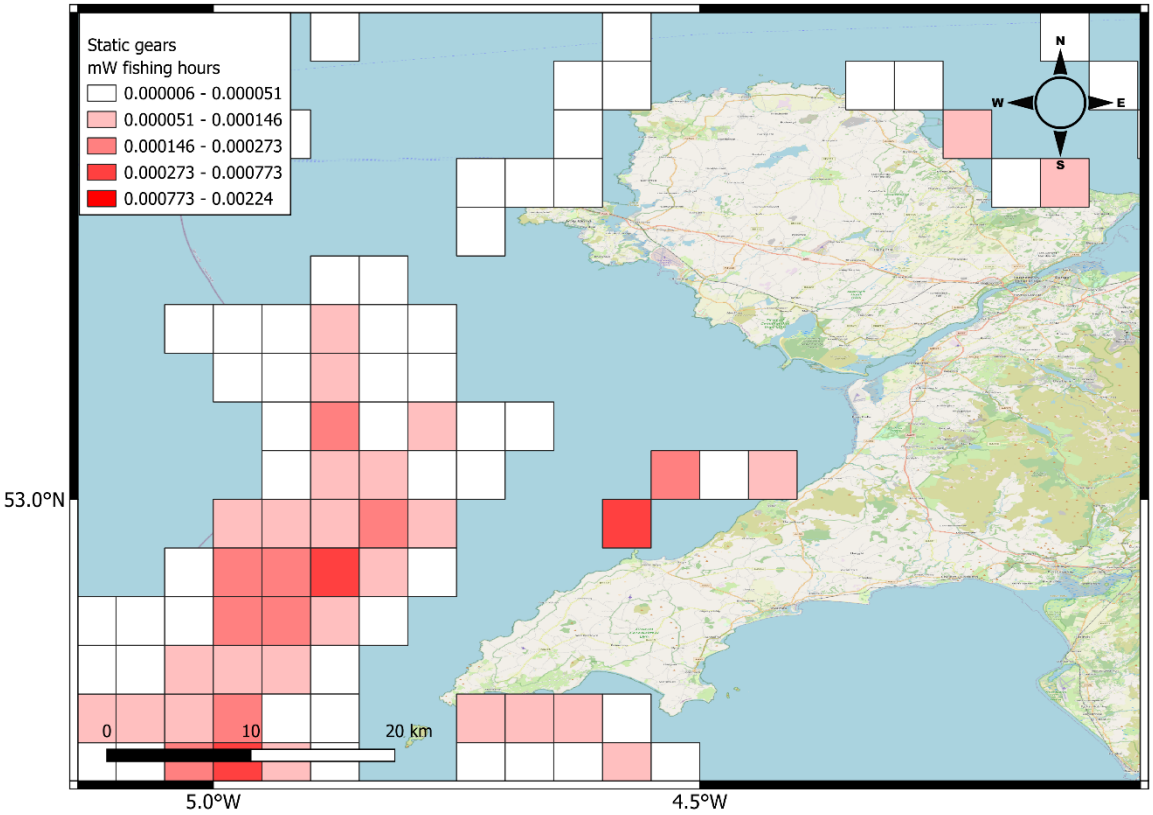


Fig 12. Fishing effort using static gear (lobster and whelk pots) within Caernarfon Bay, 2018-2021

Static gears do occur within Caernarfon Bay but more fishing effort is observed further away from the coast, although some relatively high-density static gear fishing occurs along the North coast of the Llyn Peninsula (Fig 12). No bottom seines, pelagic trawls, pelagic seines or bottom otter trawls were identified from the area, and thus no maps were created. However, there is some fishing effort from these gears just beyond the extent of Caernarfon Bay.

In summary, fishing effort from larger vessels does occur within Caernarfon Bay but it is static gears and dredges that show the highest distribution of effort within the area relative to the other fishing gear types. In order to provide a fuller understanding of current fishing effort within Caernarfon Bay, information on smaller vessels will be researched and effort relating to hand line and inshore potting effort reviewed.

7a. Monitoring work

Marine Mammals

One of the primary focuses of the work of the Sea Watch Foundation at Bodorgan is to carry out surveys for cetaceans throughout Caernarfon Bay and along the SW coastline of Anglesey. This is facilitated by the thirty or so interns, who are hosted on the Bodorgan Estate between April and November, each year. Surveys are conducted by boat and from land, and the data from these surveys provides us with a better understanding of the distribution and seasonality of the different species observed. Using photo identification techniques, we can also follow the movements of specific individual bottlenose dolphins between Cardigan Bay and Caernarfon Bay as well as North Anglesey and beyond, allowing us to understand the range of these individuals, birth rates, survival rates, and how these individuals use different areas for different purposes or at different times of the year. These studies will allow us to identify important areas for cetaceans including feeding, socialising and breeding areas. This type of data will be used to guide work on the management of areas and relevant levels of protection.

Land-based marine mammal surveys

Surveying marine mammals from land is accessible, inclusive and low cost. We have used trained volunteers, interns and staff to carry out over 120 hours of survey since April 2023 at locations around Anglesey, with primary focus on sites neighbouring the Bodorgan Estate. Key vantage points around Anglesey are shown in Fig 13. Pen y Parc is the closest vantage point to the Sea Watch office at Bodorgan. Here, we carry out surveys for both seabirds and marine mammals, with regular sightings of feeding activity by some of the larger seabird species and amongst marine mammals, by bottlenose dolphins in particular. Land watches typically last for three hours and usually involve 2-3 people, allowing the group of interns to cover more than one site during the same day. Interested volunteers and members of the public are encouraged to join these surveys, and training sessions have been delivered to numerous community groups or have been open to the public.

Fig 13. Land watch sites for marine mammal data collection. ★ Sites of primary interest where effort is concentrated. ★ Sites of secondary interest used for public outreach events.

Figures 14 and 15 show the amount of survey effort in hours per site and per month since 2023 with highest coverage during the months when interns are resident at Bodorgan, April – November.

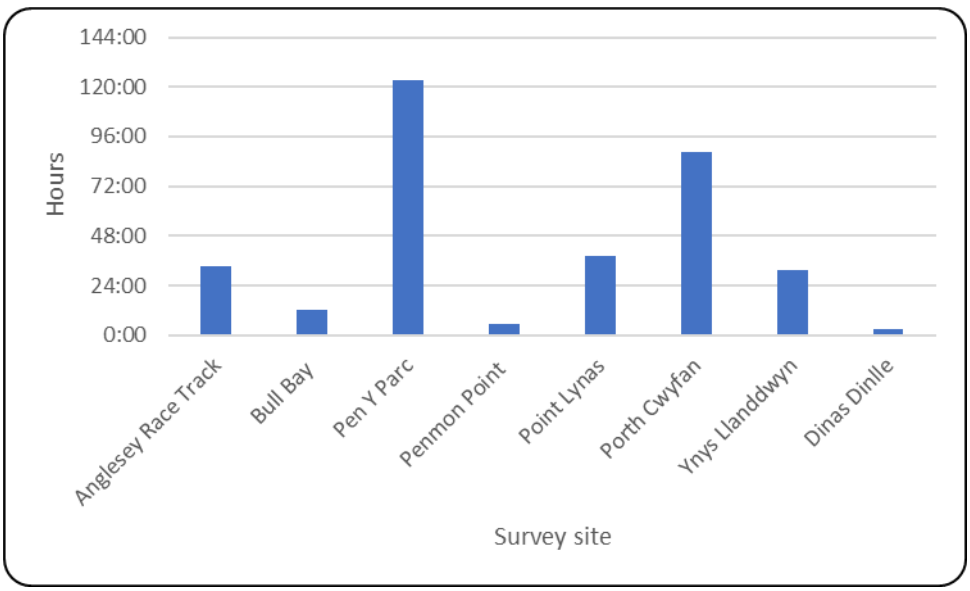


Fig 14. Total survey effort per site April 2023 – March 2025

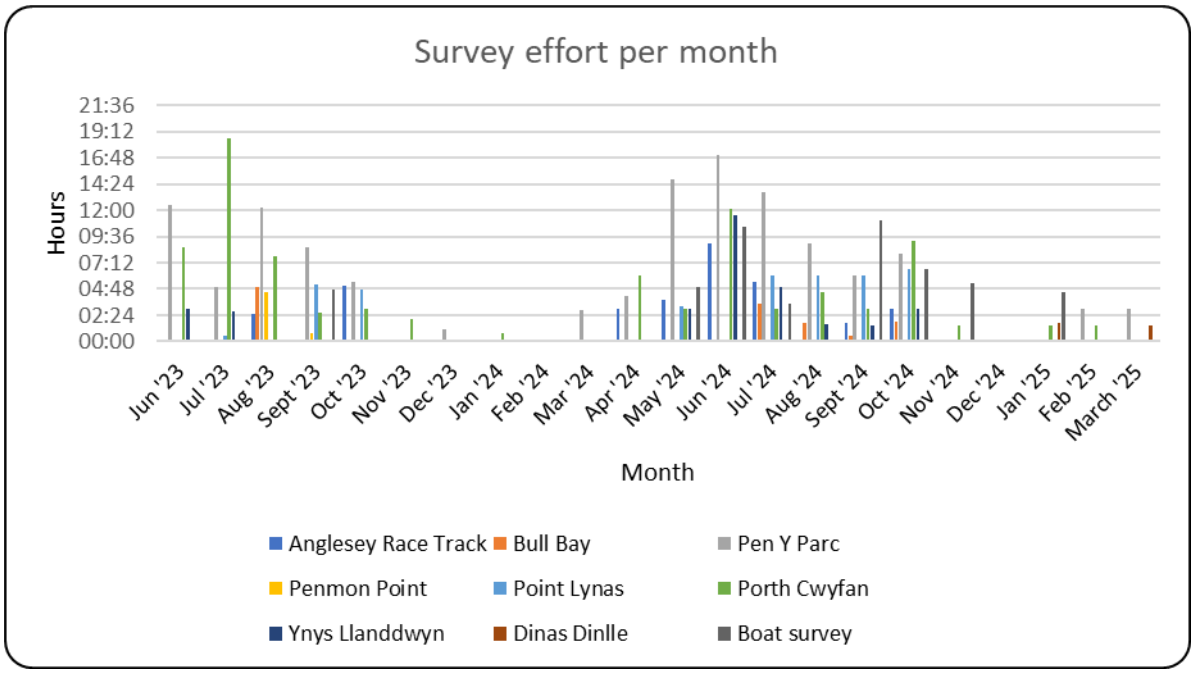


Fig 15. Survey effort per site and month between April 2023 to March 2025

In total, six species of marine mammal have been observed during land-based surveys: harbour porpoise, bottlenose dolphin, common dolphin, Risso's dolphin, grey seal and Eurasian otter. Risso's dolphins were seen only from vantage points in the north of Anglesey, rather than sites in the southwest of the island. Grey seal was the most commonly encountered marine mammal species followed by bottlenose dolphin, harbour porpoise, Risso's dolphin, and common dolphin (Fig 16). One otter was seen and photographed from Pen y Parc in June 2023.

Plate 12. Eurasian otter photographed from Pen y Parc 2023. (Photo Chloe Higgins)

The average group size of bottlenose dolphin sightings was four, with a maximum number of seventeen individuals sighted. On several occasions, we were able to obtain photographs of the dorsal fin of bottlenose dolphins, which were used in photo ID analysis (see page 34).

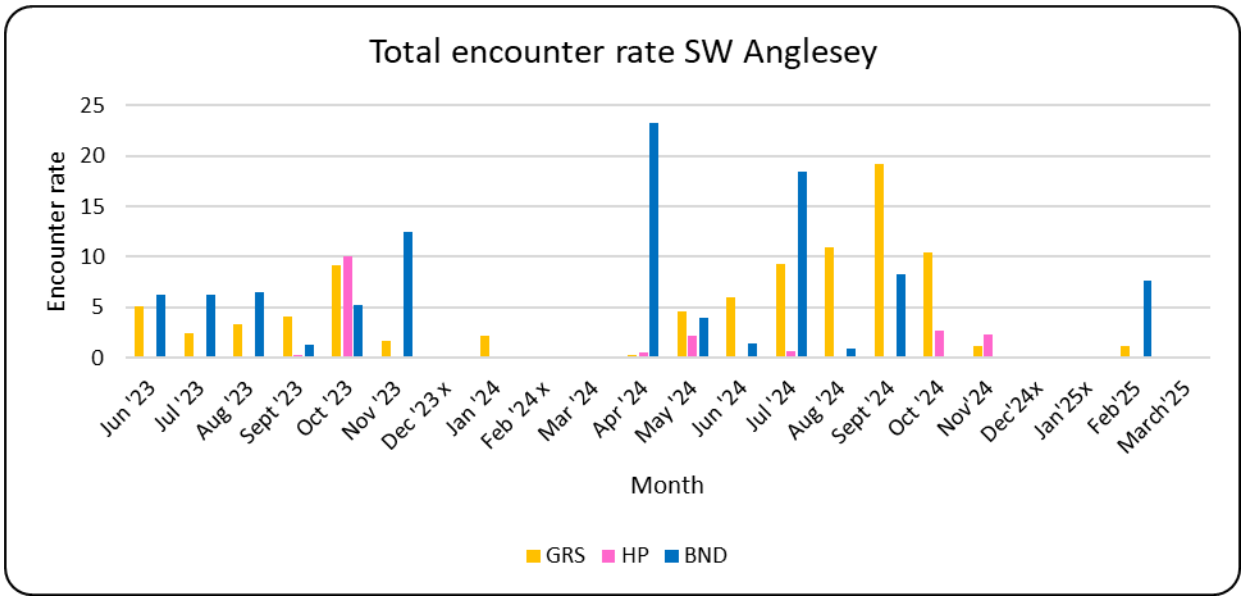


Fig 16. Encounter rate of bottlenose dolphin, harbour porpoise and grey seal at land based survey sites in Caernarfon Bay combined: Ynys Llanddwyn, Pen y Parc, Porth Cwyfan, and Trac Môn. Months with 'x' denotes 0hrs effort.

Vessel-based marine mammal surveys

The project staff and interns carried out 55 hours of survey on the vessel *Luke Oliver* between August 2023 and March 2025, and 135 hours of survey on *Highlander* in northern Cardigan Bay. This data collection contributed to the Cardigan Bay bottlenose dolphin monitoring project, and began the vessel-based data collection for marine mammals in Caernarfon Bay on the *Luke Oliver.*

The *Luke Oliver* is a 7m Cheetah Marine catamaran moored in the Cefni Estuary where tides influence access for surveys and their duration. Typically, tide times allow for a 3-4 hr survey. On days when there are two high tides during daylight hours, surveys of up to 8 hours can be completed. In order to achieve even survey coverage across the study area, a systematic survey design was developed, where line transects, which form a grid pattern, are followed (Fig 17).

During surveys, trained observers scan the sea for signs of marine mammals and when animals are seen, the species, numbers, presence of calves, location, behaviours, and environmental data are recorded, and in the case of bottlenose dolphins, photographs are taken of the dorsal fin for individual identification purposes. Using this approach, we can build an understanding of the seasonal distribution of different species and areas of importance within the study area. Fig 18 presents a summary of the sightings data from these surveys. In total, four species of marine mammal were sighted within Caernarfon Bay: grey seal, bottlenose dolphin, harbour porpoise and common dolphin, in descending order of occurrence. Grey seals were seen throughout Caernarfon Bay, usually as single individuals, whereas common dolphins were seen only on one occasion forming a group of c. 50 offshore from Trac Môn. Bottlenose dolphins were seen generally in the northern and eastern parts of Caernarfon Bay, particularly around Caernarfon Bar and the entrance to the Cefni Estuary. Harbour porpoises were seen along the central and

northern areas of Caernarfon Bay between Ynys Llanddwyn and Rhosneigr, and further offshore in the southwest parts of the bay.

Plate 13. Interns and staff carrying out a boat-based survey in Caernarfon Bay including photo ID on bottlenose dolphins. Photo J Bond.

Bottlenose dolphins were seen feeding around Caernarfon Bar, Ynys Llanddwyn, and near Aberffraw. Reports from fishers also support these observations, the dolphins being seen feeding in the vicinity of mackerel shoals during the summer months, suggesting these are important feeding areas for this dolphin species.

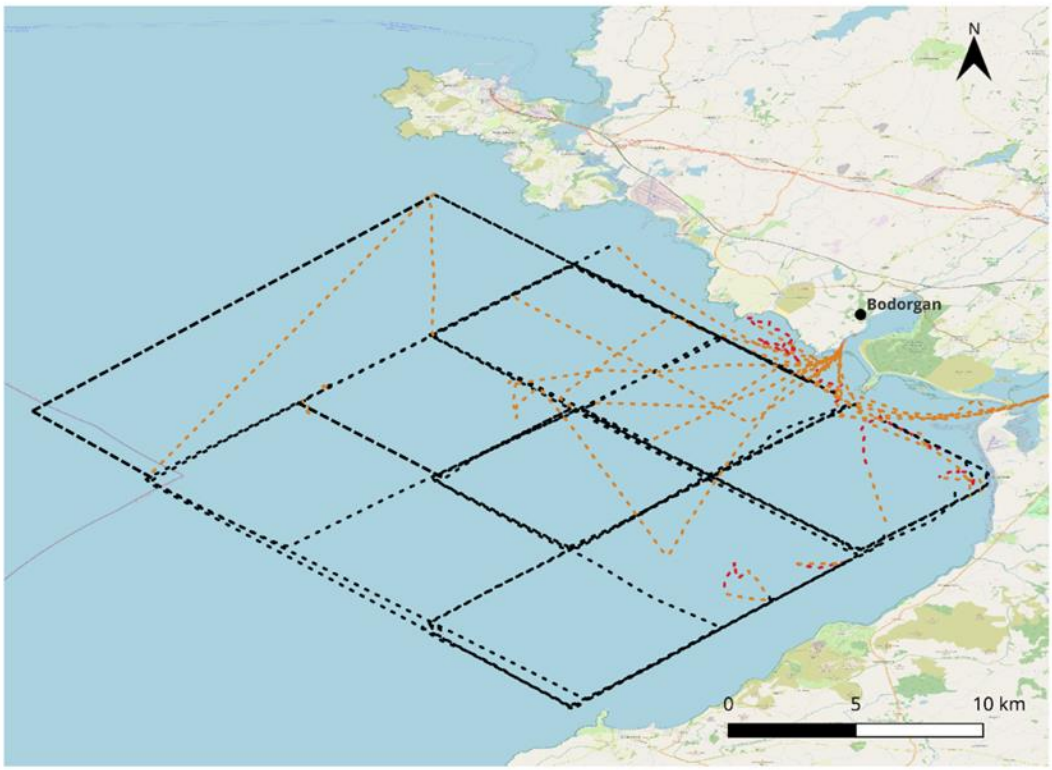


Fig 17. All survey tracks carried out on Luke Oliver Aug 2023-March 2025, different effort types indicated by colour. Yellow – Dedicated search; Black - Line transect; Red – photo ID.

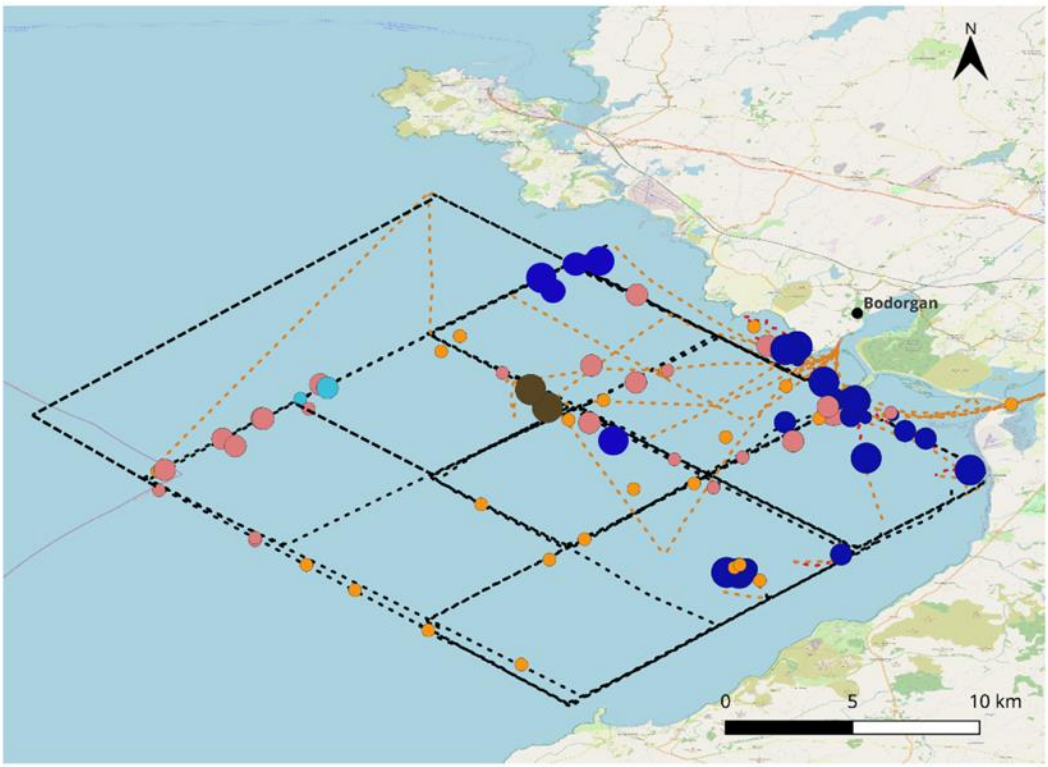


Fig 18. All sightings of marine mammals from Luke Oliver surveys Aug 2023-March 2025. Species colours – Dark blue = bottlenose dolphin; Pink – harbour porpoise; Orange – grey seal; Light blue – unidentified dolphin; Brown – common dolphin.

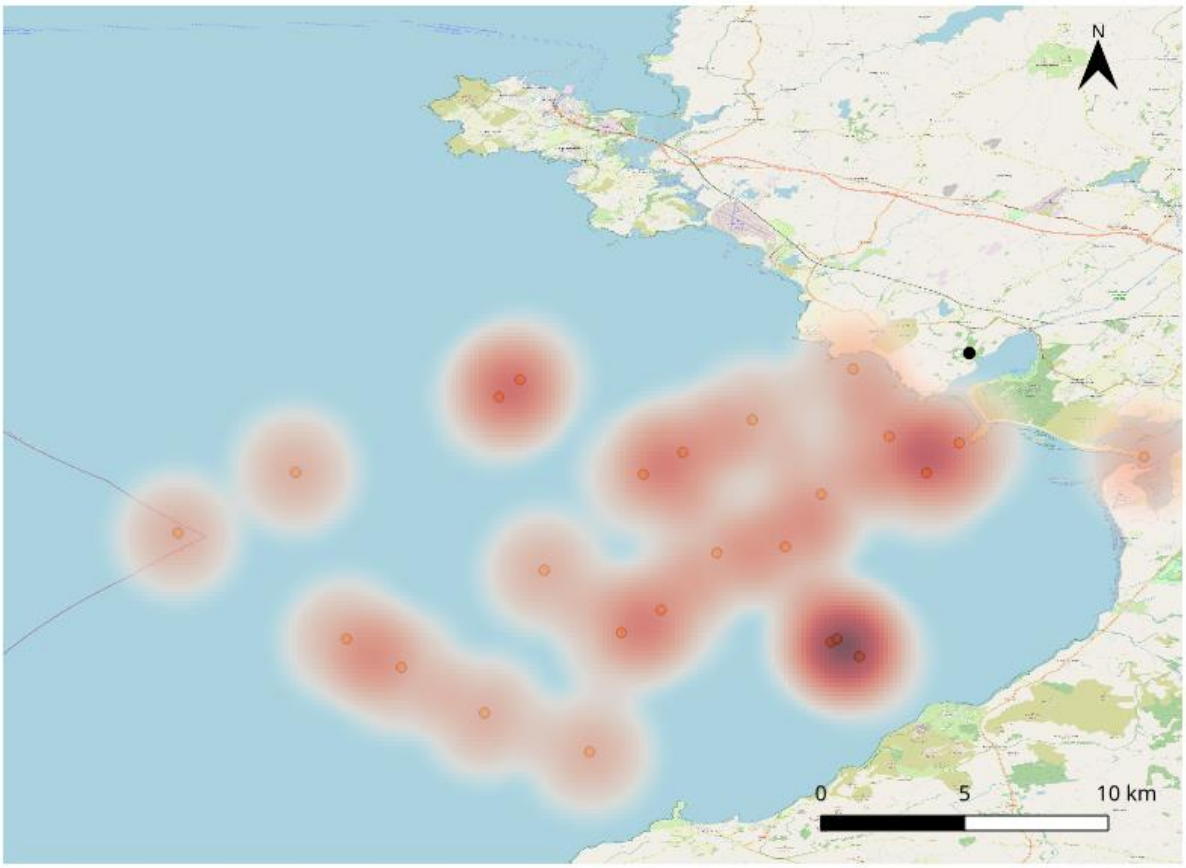


Fig 19. Heat map of sightings of grey seals throughout Caernarfon Bay from Luke Oliver.

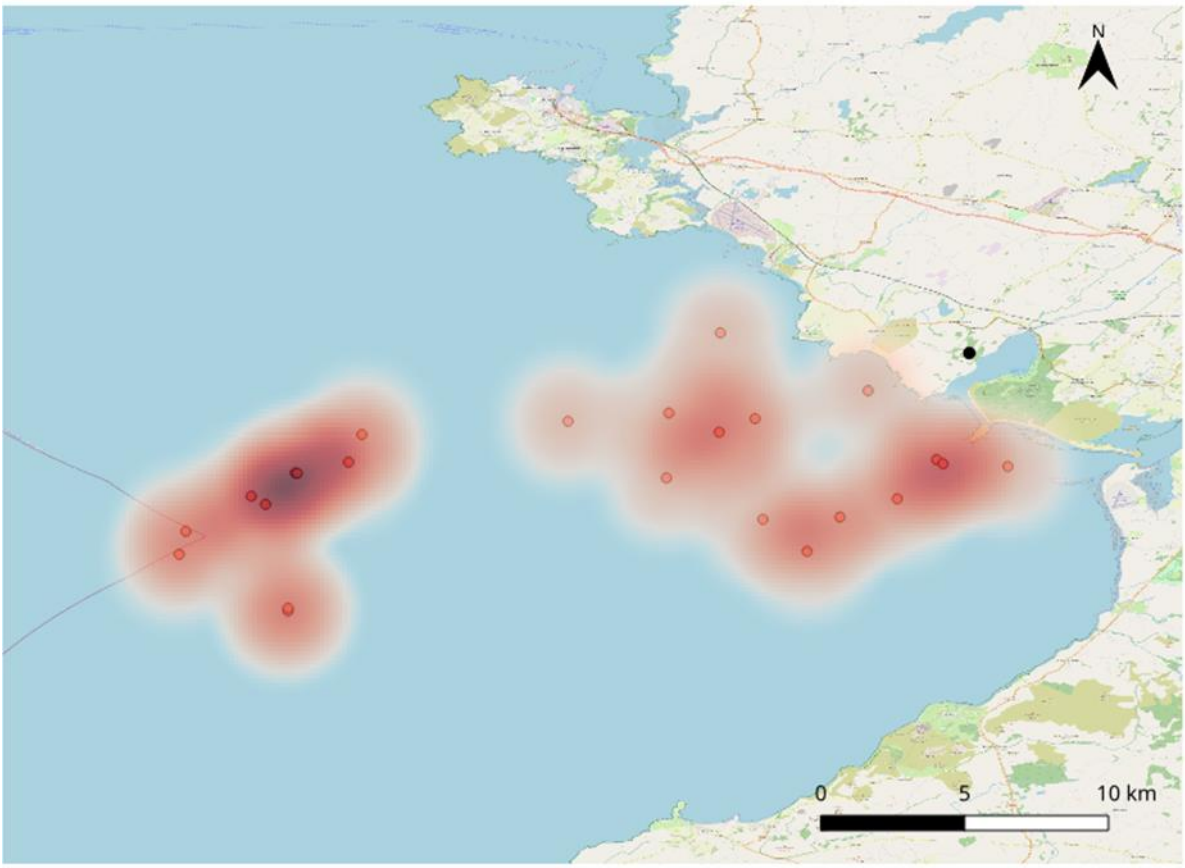


Fig 20. Heat map of sightings of harbour porpoise throughout Caernarfon Bay from Luke Oliver.

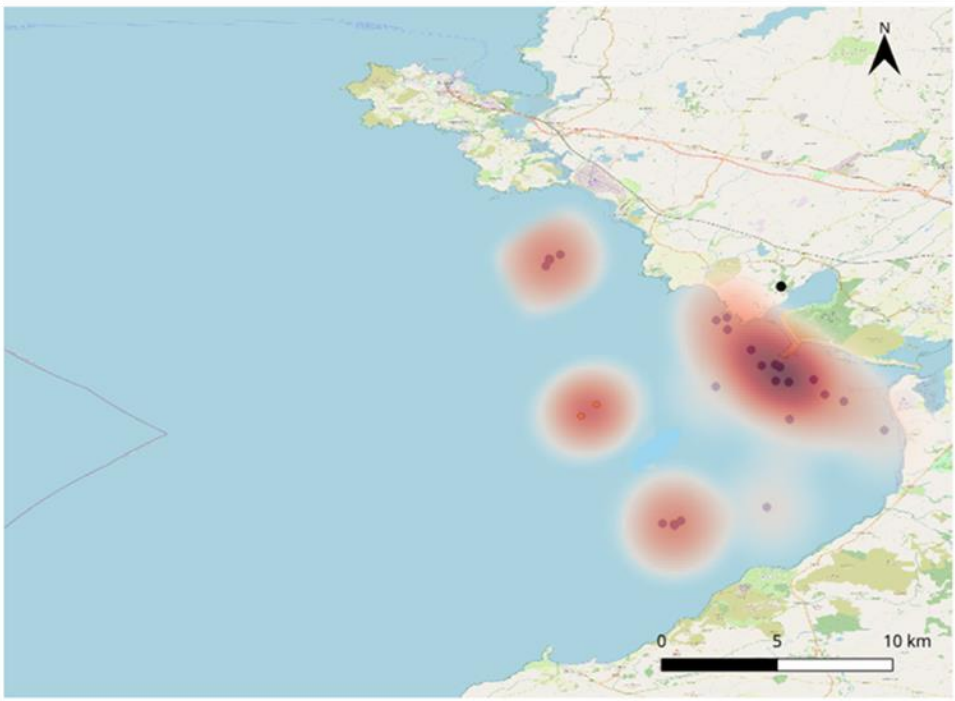


Fig 21. Heat map of sightings of bottlenose dolphins throughout Caernarfon Bay from Luke Oliver.

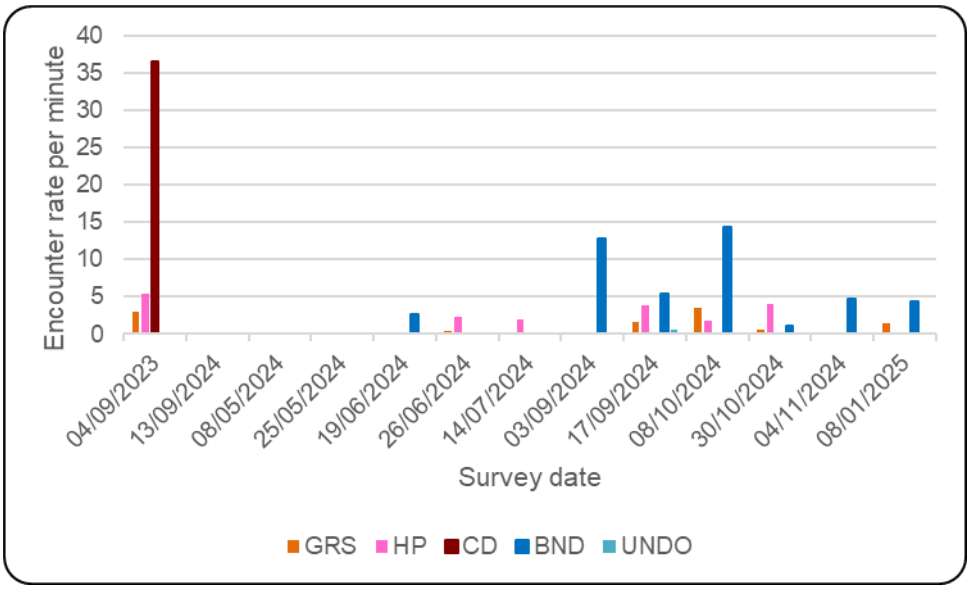


Fig 22. Encounter rate of marine mammals during surveys in Caernarfon Bay on *Luke Oliver*. Grey seal (GRS); harbour porpoise (HP); common dolphin (CD); bottlenose dolphin (BND); Unidentified dolphin (UNDO).

Following analysis of photographs of bottlenose dolphins, 12 individuals were matched to our photo ID catalogue. Plates 14 & 15 present these individuals. A number of bottlenose dolphin calves were also observed. Future photographic analysis will assist in confirming local movements, survival and birth rates among these individuals.

Photo-identification of Individuals

During boat surveys, photographs of bottlenose dolphins are taken in order to identify individuals from the marks on their dorsal fin. Over the past three decades, Sea Watch Foundation has grown a catalogue of photographs of the different individuals that are observed in Cardigan Bay. This catalogue has been used to match 12 individual dolphins from our surveys in Caernarfon Bay since 2023. These matches include individuals with calves, individuals who have not been photographed since 2015 and individuals who have been photographed around the North coast of Anglesey, Caernarfon Bay and Cardigan Bay, indicating that some individuals range significantly within the Irish Sea.

Plate 14. Bottlenose dolphin fin photographs of individuals matched to the SWF catalogue from sightings in Caernarfon Bay

Plate 15. Bottlenose dolphin fin photographs of individuals matched to the SWF catalogue from sightings in Caernarfon Bay

7b. Seabirds

Tern species are particularly abundant in Caernarfon Bay, featuring the largest tern colony in Wales (NRW MCA 11). There currently exists an SPA for terns around Anglesey (Figure 1) classified in 1992 for the common tern, arctic tern, roseate tern, and sandwich tern. This originally focused upon Ynys Feurig, Cemlyn Bay, and The Skerries. However, it is proposed that this area should be increased to include part of Caernarfon Bay and be renamed 'Anglesey Terns'. Since all these breeding tern species are listed as 'rare and vulnerable' by the EU Birds Directive, this SPA highlights the importance of the area for the conservation of several species of tern (NRW, 2015). All the tern species are migratory, with the arctic tern in particular travelling from summer breeding grounds in North Wales, to the Antarctic where they spend the winter months, making their time in Caernarfon Bay a crucial period in their life history (Egevang et al., 2010). The abundant food supply, calm waters, and safe nesting locations allow migrating birds to safely complete their journey with no additional refuelling stress.

Breeding seasons vary between species; however, in Wales most breed between March and July (Rees 1994; Evans & Waggitt, 2023). The overlap between the influx of summer tourists to the area, and the timing of seabird breeding highlights the importance for effective conservation management, particularly in and around key breeding areas. Public access should be restricted to reduce any unnecessary stress to both the parents and hatchlings in the area. The summer months also see dense aggregations of Manx shearwater (*Puffinus puffinus*), which despite being listed as 'Least Concern' in terms of conservation status, the need to protect important breeding and feeding areas should still be considered. Additionally, fishing effort needs to be consistently monitored in the bay to ensure there are sufficient food sources available to support the diverse array on seabirds throughout the year. Projects to protect and monitor the seabirds present in Caernarfon Bay are crucial for maintaining high numbers and protecting delicate species, which rely on the area as a haven. Tourism and recreational bird watching should be conducted in an educational and protective way, to further not only the biological importance but also the socio-economic value of the area.

The Bodorgan headland is a private area of land, with no public access, allowing seabirds to breed without disturbance and has breeding pairs of various seabird species. The nearby Cefni estuary is important for overwintering birds such as curlew, lapwing and various wading bird species. In order to understand the importance of the Bodorgan headland to seabirds, land- based surveys were regularly conducted to assess fine scale habitat use and behaviours such as feeding. Fig 23 indicates the segmentation of the survey site in order to give even coverage to the area, and ensure fine scale occupancy could be assessed for all seabird and marine mammal species. Figs 24-27 provide the data on the different seabird groups and their use of the scan area.

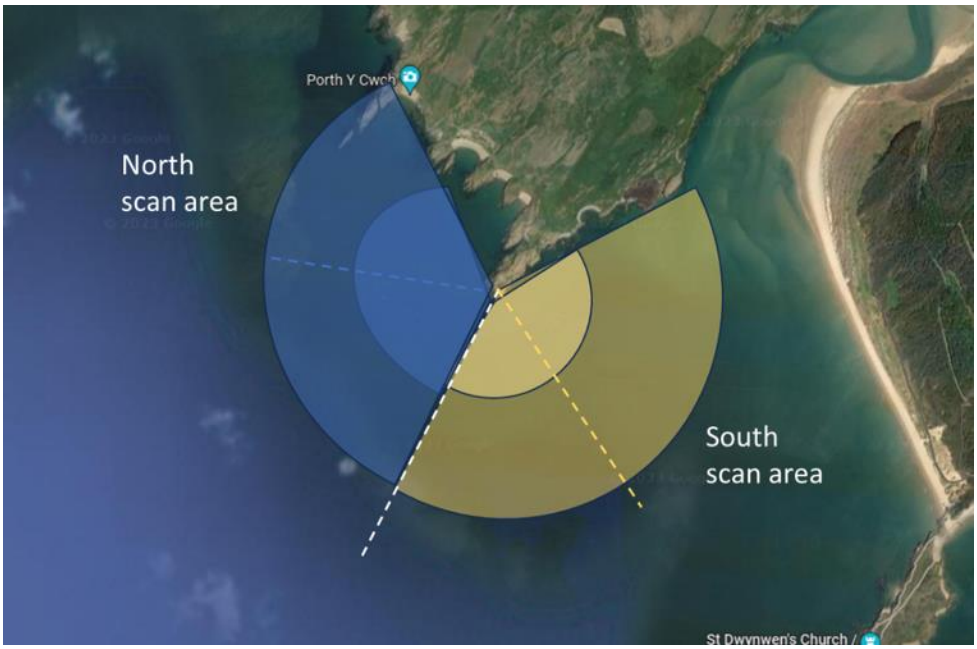


Fig 23. Pen y Parc land-watch site, divided into two scan areas allowing thorough coverage for data collection of seabirds and marine mammals.

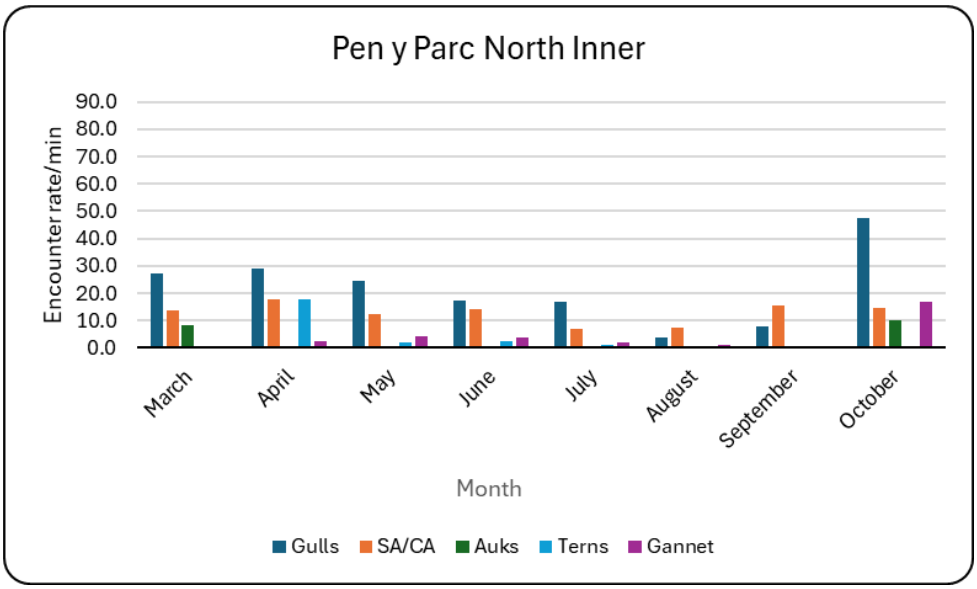


Fig 24. Encounter rates of Gulls, Shag/Cormorants, Auks, Terns and Gannets in Pen y Parc North Inner

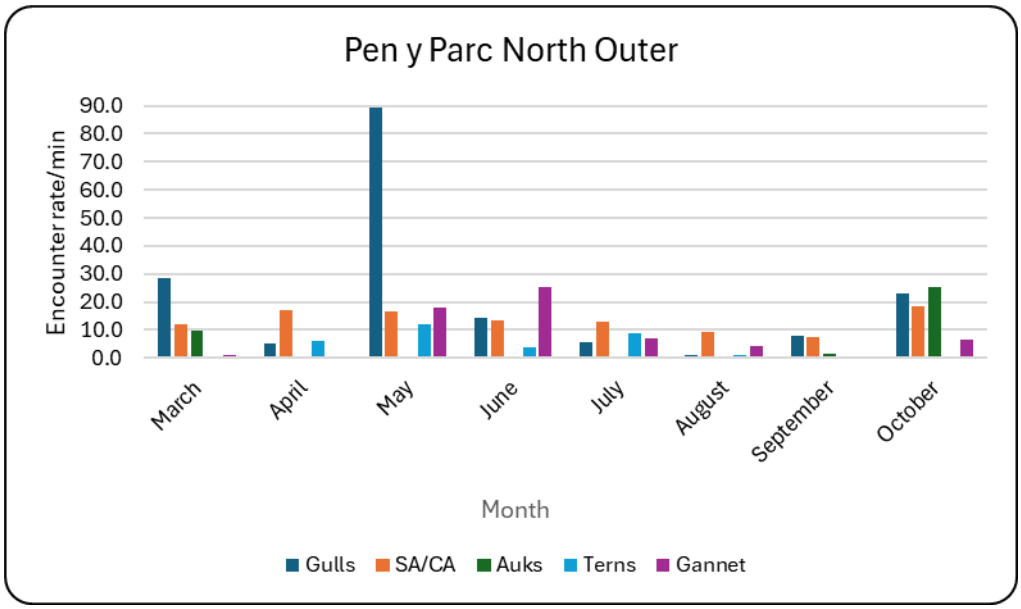


Fig 25. Encounter rates of Gulls, Shag/Cormorants, Auks, Terns and Gannets in Pen y Parc North Outer

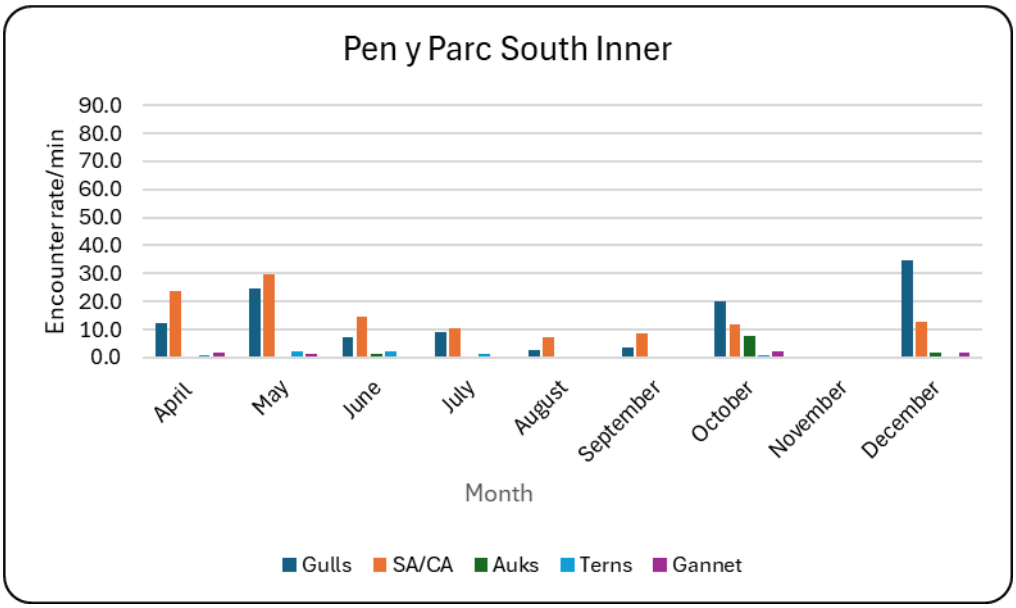


Fig 26. Encounter rates of Gulls, Shag/Cormorants, Auks, Terns and Gannets in Pen y Parc South Inner

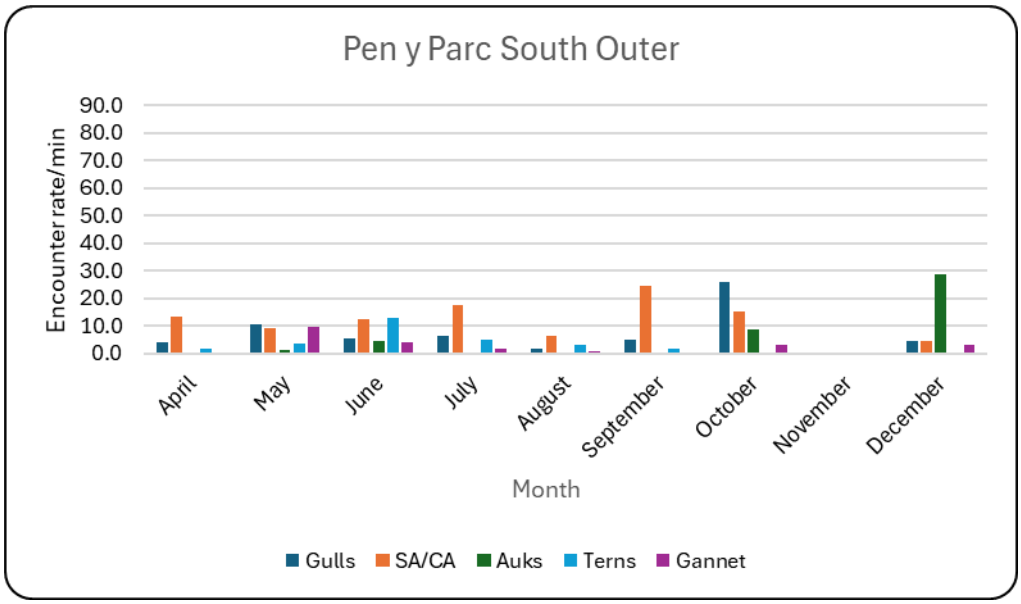


Fig 27. Encounter rates of Gulls, Shag/Cormorants, Auks, Terns and Gannets in Pen y Parc South Outer

7c. Intertidal Habitat Surveys

Rocky Shore

Working with the North Wales Wildlife Trust, we have been trained in their Shore Search methodology, which forms part of a national citizen science survey of the intertidal shore. Since our session with Shore Search, we have developed a simplified line transect survey methodology to collect data on rocky shore species in the estuary using the following procedure:

1. Find two points of interest as the starting location (A) and ending location (B).
2. Write down date, time, time of low tide, and GPS coordinates for the starting location.
3. Travel in a straight line parallel to the shoreline from Point A to Point B, noting every species one finds in a 1 metre buffer zone on either side of the transect line.
4. When finishing the transect line, mark the end time and end GPS coordinates.

At present, surveys have noted only the absence or presence of a species. The purpose of these surveys has been to draw baseline data of the species presence in the estuary. For the upcoming season, we will redesign the survey method so that we have counts of the abundance of each species found.

In 2024, we have conducted 12 line transect surveys on the following dates:

Date
11/06/24
11/06/24
11/06/24
11/06/24
11/06/24
11/06/24
23/08/24
28/08/24
28/08/24
12/09/24
02/10/24
17/02/24

Fig 28 presents the number of times that different species of various taxonomic groups occurred within the 12 line transects. The most common species in each group are: *Miscellaneous Invertebrates*: sand hoppers; *Algae*: egg wrack; *Crustaceans*: green shore crab; and *Molluscs*: common periwinkle.

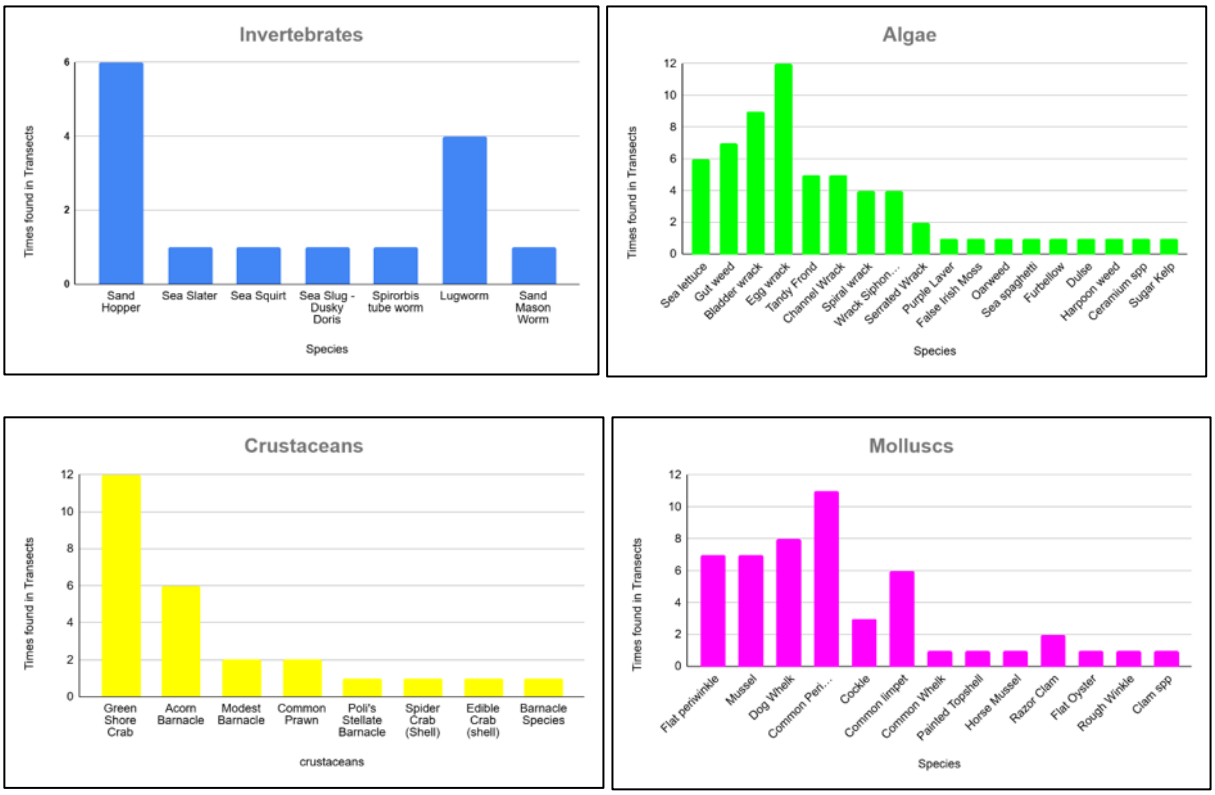


Fig 28. Histograms showing the occurrence of different species of Invertebrates (top left), Algae (top right), Crustaceans (bottom left), and Molluscs (bottom right) in 12 line transect surveys

7.d Seagrass

The species of seagrass that is located in the Cefni Estuary is dwarf eelgrass (*Zostera noltei*). It is widely distributed across Atlantic European coasts including around the British Isles. The dwarf eelgrass is an intertidal species that is found growing on muddy or sandy substrates. They grow in scattered clumps, dense beds or meadows. In the Cefni estuary, they are growing in small, scattered clumps that are near to each other. In spring, new leaves will appear and the growth will develop over the summer. In September/October, the leaves are shed naturally as well as the result of wave action and grazing from waterfowl. Over winter, the plant is reduced to its rhizomes within the sediment.

Plate 16. Dwarf eelgrass in the Cefni Estuary (Photo Jenny Bond)

Compared to common eelgrass, *Zostera marina* (the other type of *Zostera* species that is found around the British Isles), dwarf eelgrass is found higher up the intertidal zone but their ranges overlap. The rhizomes of dwarf eelgrass are thinner than those of the common eelgrass but its growth is rapid and ephemeral, taking advantage of the increasing light and nutrients with the summer season rather than the metabolites stored in the rhizome.

Why is dwarf eelgrass important?

Dwarf eelgrass is a food source for migrating waterfowl, especially wigeon and brent geese. There is an established saltmarsh located in the Cefni estuary (roughly 1.5 km for our surveyed seagrass beds). This seagrass creates underwater meadows that support diverse species of fauna and flora. This is important for migration, spawning and nursery grounds for garfish (*Belone belone),* and other fish species.

Seagrass is also a significant contributor of blue carbon. Although it only occupies 0.1% of the ocean's surface, it accounts for 10-18% of organic carbon buried in the global ocean, thus constituting an important sink in the global carbon cycle. It can also help mitigate climate change by reducing erosion and filtering nutrient run-off from local sources.

On the IUCN website, dwarf eelgrass is listed as 'Least Concern', due to its widespread distribution. However, its abundance has been declining in recent decades. In the UK, it is estimated that 44% of seagrass has been lost since 1936 (Green *et al.,* 2021).

What are the threats to dwarf eelgrass?

Nutrient enrichment from urban and industrial pollution has been estimated to be the biggest factor leading to seagrass loss in the UK. Nitrogen in this wastewater feeds phytoplankton/microalgae, causing them to bloom rapidly on the surface of the water and on the plant itself, shading the seagrass and depriving them of the sunlight they need for photosynthesis.

Climate change in the form of severe storms, exposure to the air for extended periods of time, decreased salinity, warming sea temperatures and low sunlight levels, may all cause stress to the plants, leading to large losses. Although some of these factors may take many years to have an effect, erosion, disturbance from cockle fishing and changing bathymetry in intertidal areas can be more of a sudden threat to seagrass habitats.

Locations of dwarf eelgrass in Cefni estuary

Rice *et al.* (2022) plotted known mapped areas of seagrass meadows around the United Kingdom that had been surveyed between 1998 and 2021. They show a collection of *Zostera noltei* clumps in the Cefni estuary (Fig 29).

Fig 29. Locations of dwarf eelgrass patches in the Cefni Estuary. Green = 2024, yellow =2022, based on historic data from NRW.

The locations of the 2024 sites are around 150 metres northwest of the 2022 sites, with two exceptions that are within the 2024 area and close proximity to three sites.

Habitat Restoration

We have identified opportunities for habitat restoration within the Cefni estuary, through the reseeding of seagrass beds as well as native oyster cultivation. Further investigation is required into the conditions and areas suitable for restoration works, collaborations with Bangor University are ongoing with a focus in 2025 to identify areas suitable for restoration of seagrass species within the Cefni Estuary. Native oysters are growing at Ynys Llanddwyn (Jenny Bond, personal observation) providing potential opportunities for the collection of wild seed. Future funding bids will be developed with habitat restoration work at the centre.

8. Outreach and Engagement

One of the key elements of our work on Anglesey is to engage with local people, through schools, community groups and public events to encourage everyone to take part in marine mammal surveys and learn more about the marine habitats and species of Anglesey. The ultimate aim is to raise awareness and understanding amongst local communities of the marine environment and wildlife in the area. Table 2 presents a summary of the number and type of different events that we held in 2023 and 2024. In September 2023, our Outreach Officer started their role working three days a week. This has allowed us to increase our reach by almost quadrupling the number of events compared with the previous year, as can be seen below.

Table 2. Numbers and types of outreach event delivered during 2023 and 2024.

Type of event	2023	2024
School, college, and university visits	6	2
Stall-holding events	1	10
Training sessions	0	3
Community and group events	1	7
Public land watches	2	13
Public beach cleans	0	2
Public rock pooling	0	1
Marine code events	1	6
Art/crafty Events	1	2
Total	**12**	**46**

School, College, and University Events

For school visits, the focus has been to engage the children with their marine environment. We gave interactive presentations about the different marine habitats that occur on their doorstep as well as the animals that inhabit them. Since September 2023, we have visited five local primary schools: Ysgol y Borth (~60 children), Ysgol Pencarnisiog (27), Ysgol Llandegfan (~40), Ysgol Santes Dwynwen (~40), and Ysgol Gynradd Rhosneigr (25). We are currently strengthening our relationship with Ysgol Santes Dwynwen in particular, with the end goal of getting every single child in the school onto the beach for activities such as rock pooling, beach cleans, and of course, marine mammal surveys. We have sent them options of different packages of activities that the children can choose from, making it a more personalised experience for the children.

We have visited Coleg Glynllifon twice in the past two years to promote the internship programme to their Animal Management students, as well as to inform them about our work. We have also hosted a talk to Bangor University's Ocean Sciences and Zoology Societies and taken them out on two land watches over the past two years. We are also constantly directly involved in different events that Bangor University holds, such as career fairs, workshops, and lectures.

Stall-holding Events

We have attended many events across Anglesey, Gwynedd and Conwy, which has allowed us to share information about our work with a wide variety of audiences. These events included Eco Days, Beach Safety events, protests, conservation festivals, and local festivals. At these events we promoted our work by talking with the public about the marine code and wildlife disturbance, training opportunities, the Sea Watcher app, and arts/crafts activities. These events also allowed us to network with other organisations and groups who were also in attendance.

Marine Code Events

We hosted seven marine code events, including four 'Operation Seabird' events with the North Wales Police, and three leaflet drops. 'Operation Seabird' is an initiative established by the Police force to address and reduce wildlife disturbance around our coasts. At these events, we have set up a stall with the police, near popular boat and jet ski launching sites, where we are able to talk to recreational watercraft users about the marine code and how to have safe, yet memorable, encounters with marine wildlife. We also went to popular tourist towns and villages around the coast of Ynys Môn, such as Trearddur Bay and Rhosneigr, and visited local shops to drop off marine code leaflets (Fig 30). Overall, people have had a very positive reaction towards this work and recognized that it is a very serious issue. We are building on this work by establishing training sessions with instructors at Plas Menai, the National Watersports Centre, to ensure that wildlife disturbance reduction is taught as part of every watercraft course and is introduced to school groups visiting their centre. We will also work with their apprentices to train them in championing marine life and reducing disturbance by watercraft users.

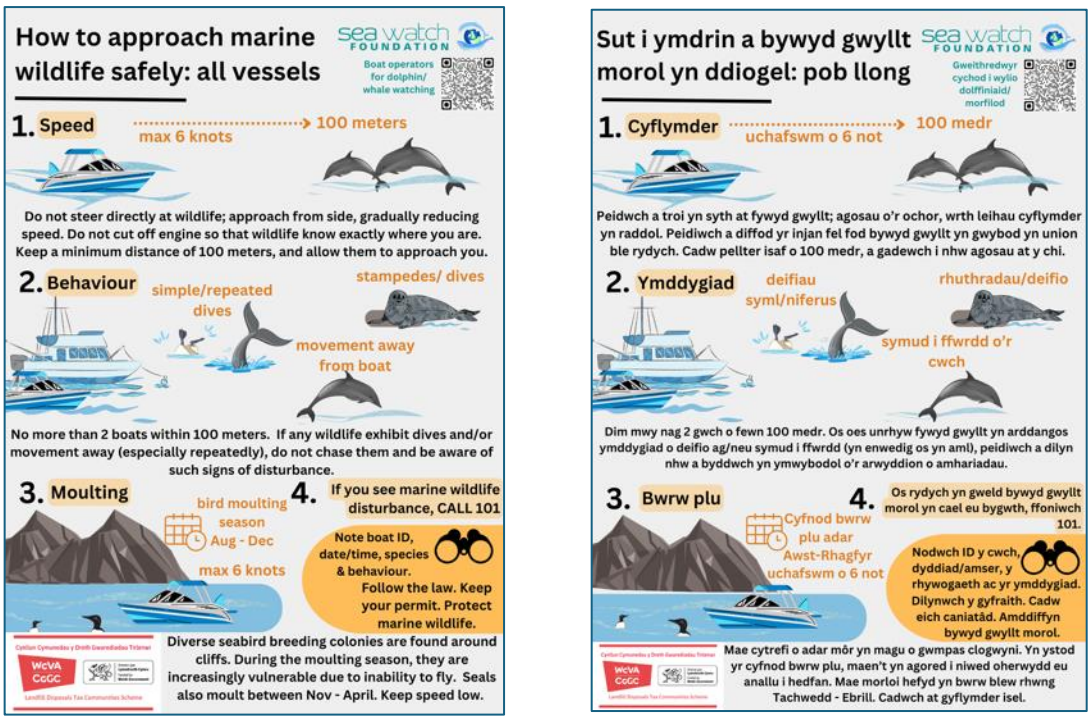


Fig 30. Marine code leaflets developed to reduce wildlife disturbance and circulated to the general public.

Training Sessions

Using funding from WCVA, we were able to allocate money towards venue hire. We have used these funds to host three free public training sessions in Newborough, Llangefni, and Rhosneigr, respectively. At these training events, we went through marine mammal species ID, general Sea Watch and project information, and how to survey using standardised recording forms and the Sea Watcher app. We then invited the attendees to our public land watches which four attendees from different training sessions have since joined, and were able to implement their training and receive further guidance from us. We have since sent out a questionnaire to all of the attendees to gauge their opinions about the session, whether they would benefit from any further support and training, any factors that limit their ability to apply the training, and if they would like to be part of our volunteering network.

Community and Group Events

We have worked with several communities and groups across Anglesey, Gwynedd, and Conwy. We have worked with the U3A, Women's Institutes, over 50's Clubs, and Summer Clubs and are in talks with Rotary groups and more about future sessions. At these meetings, we inform the members about our work, and give them a brief overview of marine mammal ID. After the session we also invite them to our public land watches. Several people were very keen and joined us, which again allowed them to implement their ID skills from the meeting. For the younger groups, we took them rock pooling, and when the weather did not allow, we ran a session on intertidal species with some interactive and crafty activities.

Public Land Watches

Since April 2024, we have been hosting monthly public land watches on the last Sunday of each month (weather permitting). Since then, we have held a total of seven monthly public surveys, most of which had good sightings and attendance where ~140 people have joined in on surveys throughout the last two years. These surveys also gave us a chance to talk to people who were passing by and were curious about what we were doing.

Activity Days (rock pooling, art/crafts)

We have held a total of four different activity days, including two sand sculpture events on Aberffraw beach where members of the public joined us in creating life-sized sand sculptures of marine mammals as a part of the National Whale and Dolphin Watch Event. We also hosted a public rock-pooling session at Rhosneigr. Using funding from WCVA, we hired Llanfaelog Village Hall and invited members of the public to join us in creating a life-sized sculpture of a harbour porpoise made of beach litter collected the day before from our public beach clean in Porth Trecastell, as well as other beaches on the Bodorgan Estate, collected by Sea Watch staff and interns.

Estimated Reach

Facebook and Instagram numbers have been built up using the reach facility. These metrics cover reach from the organic distribution of one's social media content, including posts, stories, and ads. It also includes reach from other sources, such as tags, check-ins and page or profile visits, and from posts and stories that were boosted. Reach is only counted once it occurs from both organic and paid distributions. This metric is therefore an approximate estimate. Numbers from X (formerly Twitter) were obtained through impressions, which represent the number of times a given Tweet has been viewed on the platform in an organic context. TikTok numbers were obtained from post views, which is the number of times a post was viewed over a certain period.

Because the numbers from each social media platform are obtained using different metrics, the numbers in tables 3 & 4 are estimates, but they give an idea of the overall reach in the past two years.

Table 3. *Number of people reached through events in person and online social media accounts from year 1 (April 2023 – March 2024). Records start from July 2023 when social media accounts were made and events started, numbers are as of 12/12/24. **TikTok account was created later in August 2024*

Month	In person	Facebook	Instagram	Twitter/X	TikTok**	Total per month
July	55	NA	NA	6,700	NA	6,755
August	10	NA	NA	9,400	NA	9,410
September	127	2,859	262	3,000	NA	6,248
October	130	1,329	675	3,600	NA	5,734
November	10	12,201	366	3,900	NA	16,477
December	18	7,377	592	1,200	NA	9,187
January	47	1,603	765	2,300	NA	4,715
February	35	1,310	162	616	NA	2,123
March	30	2,937	307	597	NA	3,871
Total	**462**	**29,616**	**3,129**	**31,313**	**NA**	**64,520**

Table 4 *Number of people reached through events in person and online social media accounts from year 2 (April 24 – December 2024). Numbers are as of 12/12/24. *Insights and analytics for Twitter/X are only available by paying a premi.um subscription from April 2024 onwards. **TikTok account was created later in August 2024.*

Month	In person	Facebook	Instagram	Twitter/X*	TikTok**	Total per month
April	41	5,261	33	NA*	NA	5,335
May	115	2,560	1,844	NA*	NA	4,519
June	175	1,034	965	NA*	NA	2,174
July	159	5,640	930	NA*	NA	6,729
August	115	573	386	NA*	7,988	9,062
September	30	4,962	1,018	NA*	7,753	13,763
October	33	5,630	763	NA*	4,616	11,042
November	25	5,361	730	NA*	68	6,184
December	50	171	162	NA*	27	410
Total	**743**	**31,192**	**6,831**	**NA***	**20,452**	**59,218**

Plate 17. Public land watch event at Point Lynas; visit to Clwb Sparci (M-Sparc); public rock pooling event; Operation Seabird awareness day with North Wales Police; visit to Ysgol Santes Dwynwen; talk given to the Endeavour Society, Bangor University.

Beach Litter

Since the start of the project in April 2023, we have conducted several beach cleans both on and beyond the Bodorgan Estate. We hosted two public beach cleans, one in collaboration with Anglesey's AONB Team and the other as a part of NWDW. The litter for the latter was used the next day in an outreach event where we invited the public to help us build a life-sized sculpture of a porpoise. The shape of the porpoise was constructed beforehand using chicken wire, then at the event, the sculpture was filled with the litter collected.

Plate 18. Beaches cleaned are marked by a yellow star. Rubbish collected, weighed and ready for recycling. Seawatch foundation interns and Bodorgan Estate staff worked together to clear beaches and transfport the rubbish.

The tables below show a summary of the different types of items found, as well as their quantities and weights (where applicable). As can be seen, a vast majority of what was collected was common gear used on boats and for fishing such as rope, fish boxes, lobster pots, and buckets. Other single miscellaneous items were also found, such as: a bike seat, hoover base, chair seat, traffic cone, car tyre, marine flare, life ring, and a blow-up beach ball. For some beach cleans, we were supported by Leo Willis, Bodorgan Estate Ranger, but despite our best efforts, there remains a large amount of rope buried beneath the sand on one beach – this will require a digger to remove.

Table 5. Weight of beach litter collected between 2023 and 2025 from beaches around the Bodorgan area

Item	Quantity	Weight (kg)
Rope	NA	256.9
Hard plastic	NA	55.3
Fishing boxes	11	33
Lobster pots	NA	3
Shoes	28	NA
Plastic container	16	16
Plastic bottles	NA	12
Mixed plastics	NA	80
Buckets	6	5
Soft plastics	NA	4
Total	**61**	**466.2**

9. The Sea Watch Map Viewer

A key element in the engagement of members of the public in our citizen science efforts is feedback. Our network of volunteer observers continues to grow resulting in over 300,000 sighting records in our database from 10,500 observers. However, our set-up only allowed for a limited number of recent sightings to be posted on our website, and there was no mapping facility. A high priority was therefore to develop a map viewer linked to our database management system. When a specialist programmer joined the School of Ocean Sciences in Bangor University, we were anxious to seize the opportunity to contract him to help us develop the map viewer.

The main aim was to enable volunteer observers, coastal communities and the general public to view their own sightings and those of others, and to better understand the relationships different species have with their environment, and the various human pressures they face. The maps show these clearly, and help the observer to learn more about the sightings they have submitted and how it fits into the bigger picture. The maps are not only important feedback to the volunteer network of observers but serves as a wider educational and research tool. We are making some final tests to ensure it works smoothly and hope to go live with it on our website sometime in April.

Figures 31a-d display the distributions of sightings around Anglesey of the four main cetacean species – harbour porpoise, bottlenose dolphin, common dolphin, and Risso's dolphin. On the map viewer. If one clicks on a symbol, the details of the sighting appear in a box (species, time, date, group size and observer).

Figures 32a-e show the distribution around NW Wales of various environmental parameters known to affect the distribution of different cetacean species: water depth, sea surface temperature, chlorophyll (a measure of primary productivity), current strength, and water column mixing. The substrate type and seabed habitat also can influence where cetaceans may occur and different substrates (mud, sand, gravel, rock) favour different species of fish,

cephalopods, molluscs and crustaceans. Two maps from the map viewer showing these features in relation to bottlenose dolphin sightings are presented also on page 49.

Figure 33a-b show the areas of high density of shipping of all types and fishing effort using static nets, which are well known to accidentally entangle marine life such as cetaceans. These are just examples from the map viewer which also displays the activities of different types of vessels, fishing effort with different gears, licensed areas for oil & gas exploration, offshore wind farms, underwater noise levels, and marine areas designated for protection.

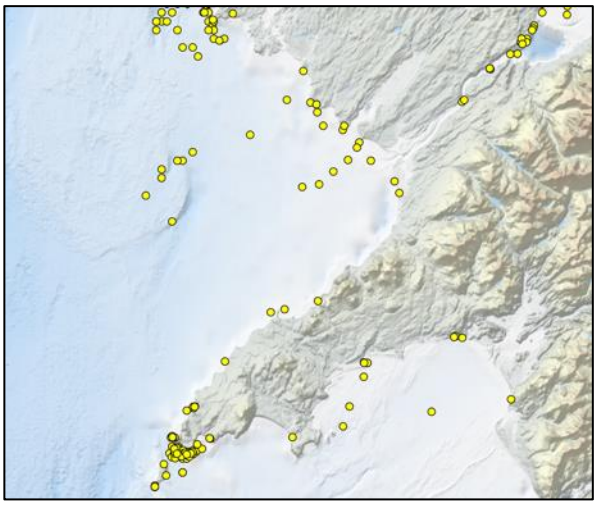


Figure 31a. Harbour Porpoise Sightings

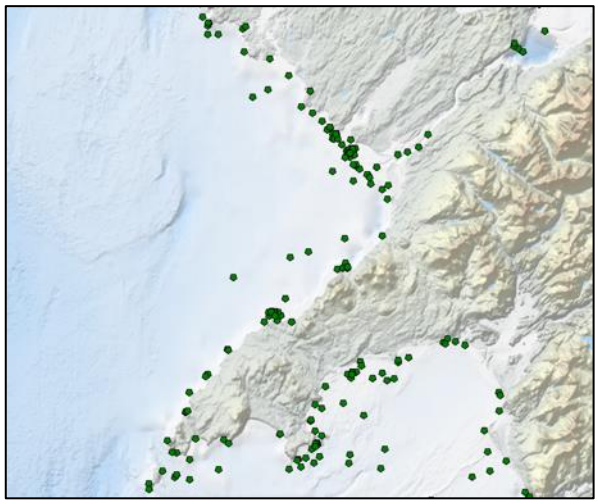


Figure 31b. Bottlenose Dolphin Sightings

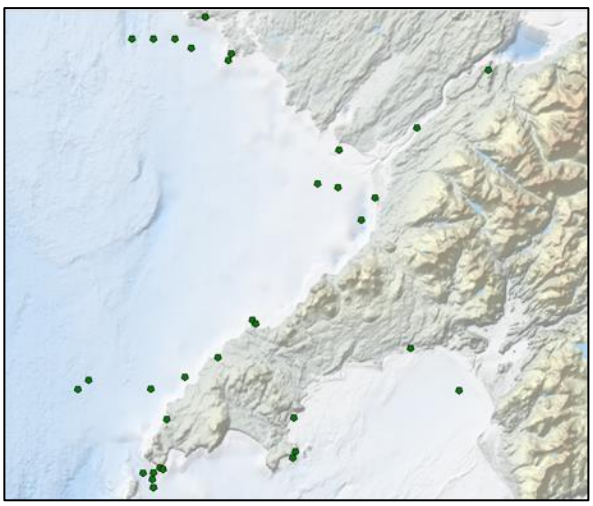


Figure 31c. Common Dolphin Sightings

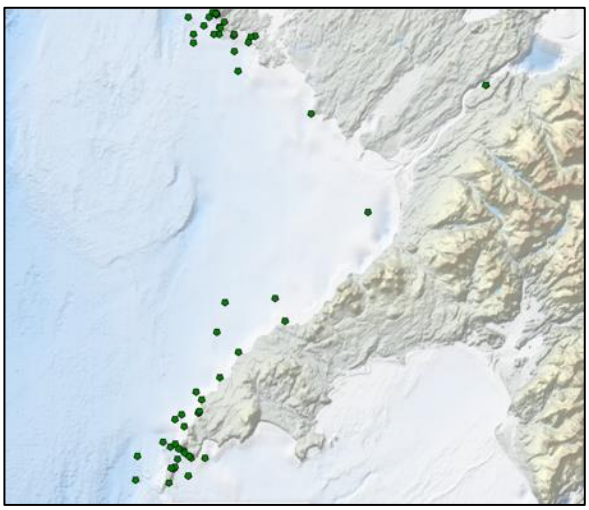


Figure 31d. Risso's Dolphin Sightings

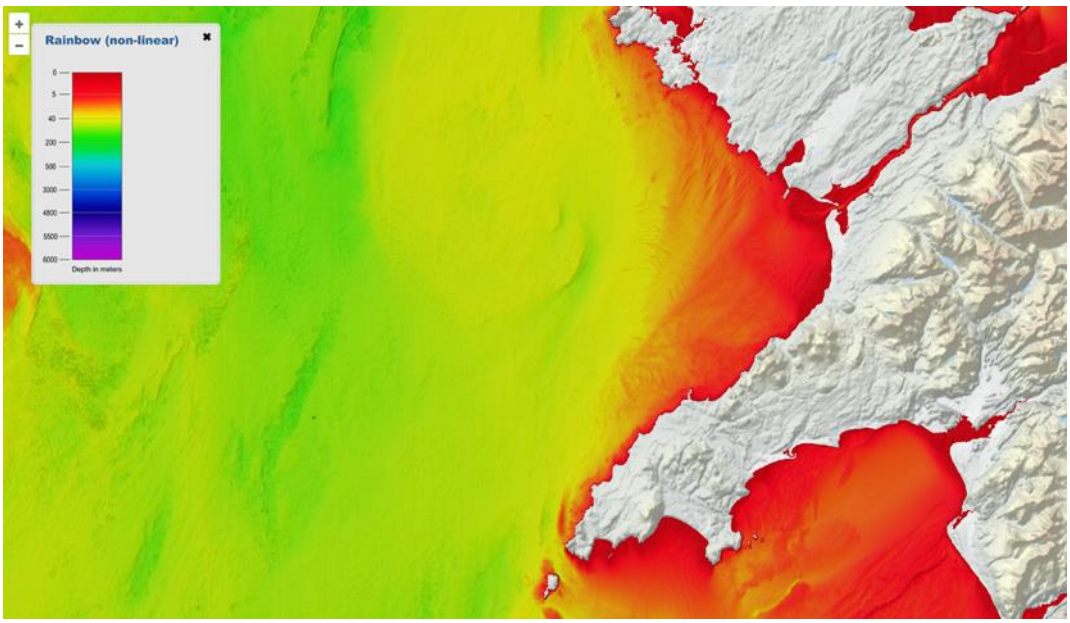


Figure 32a. Map showing water depths around Anglesey and the Llyn Peninsula

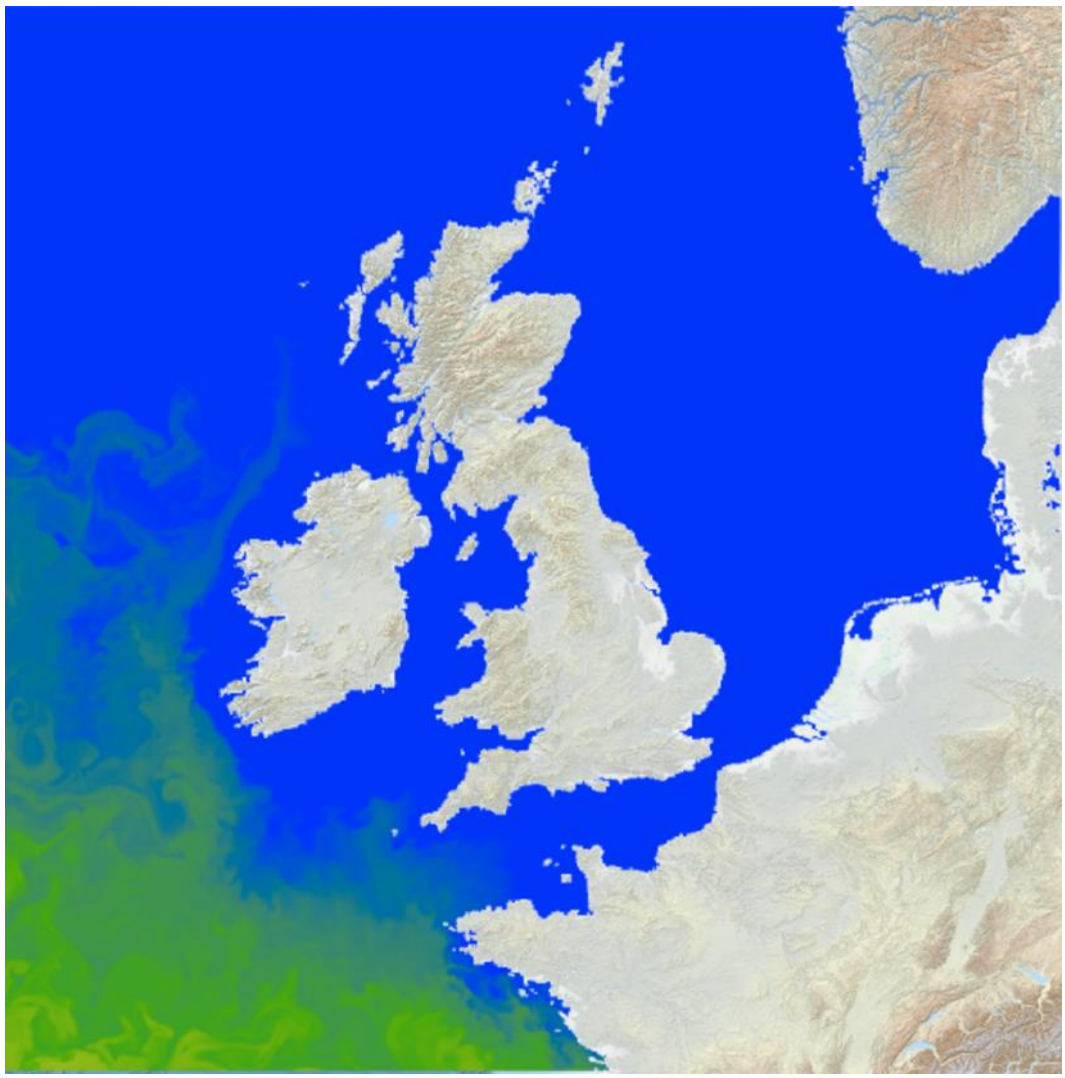


Figure 32b. Map showing Sea Surface Temperatures, January 2025

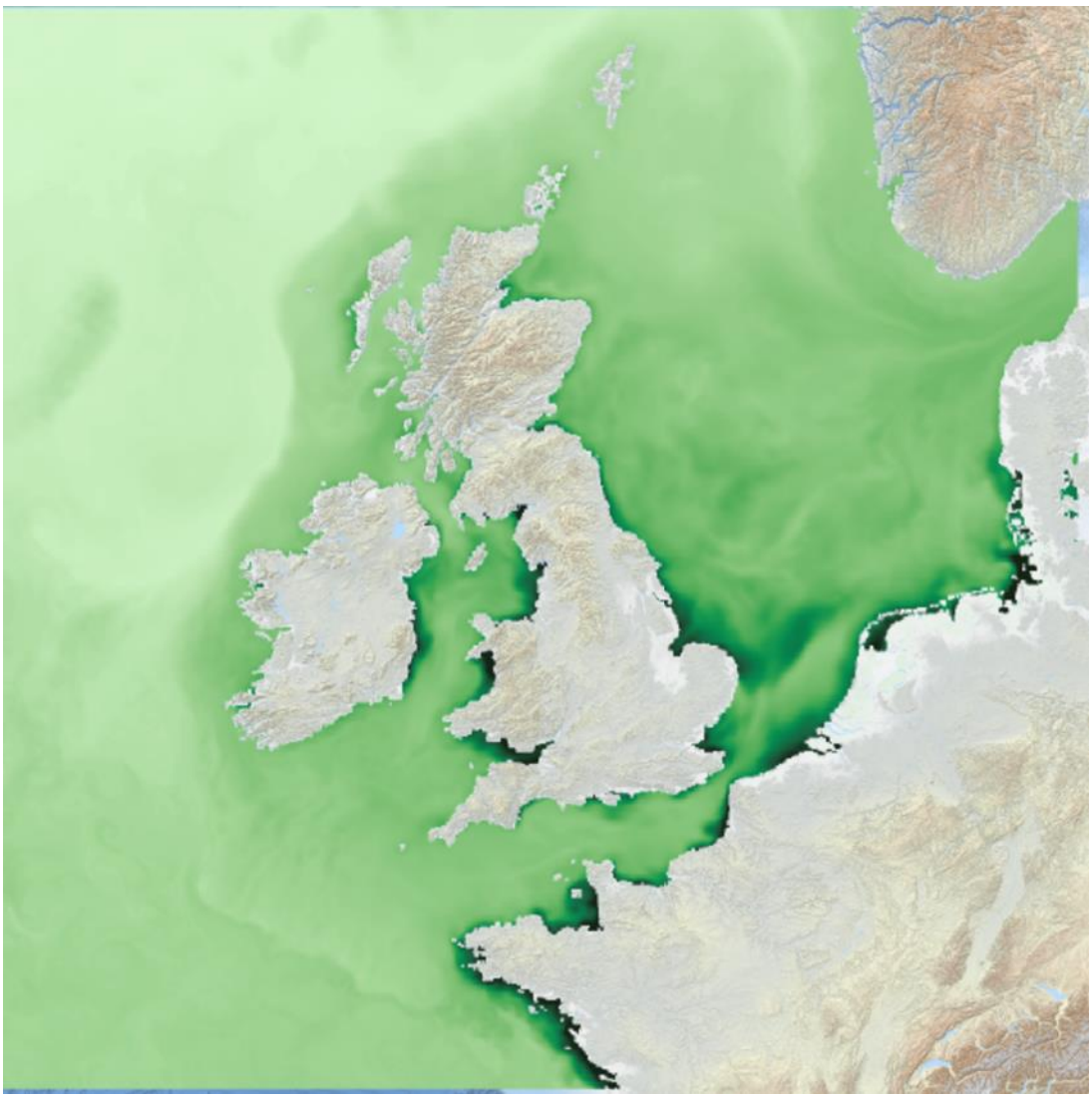


Figure 32c. Map showing Chorophyll Concentrations, July 2024

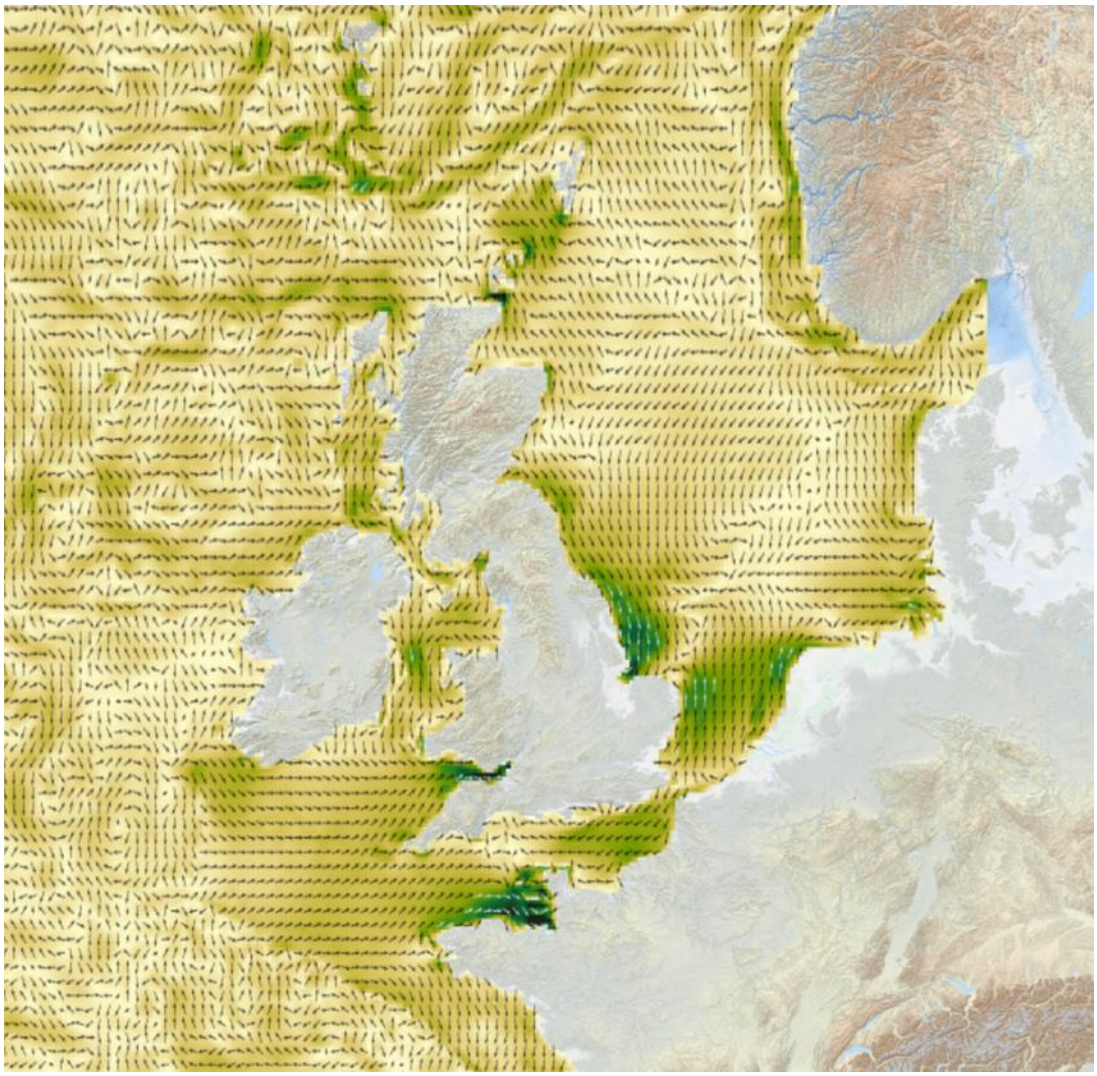


Figure 32d. Map showing Current Strengths, Mar 2025

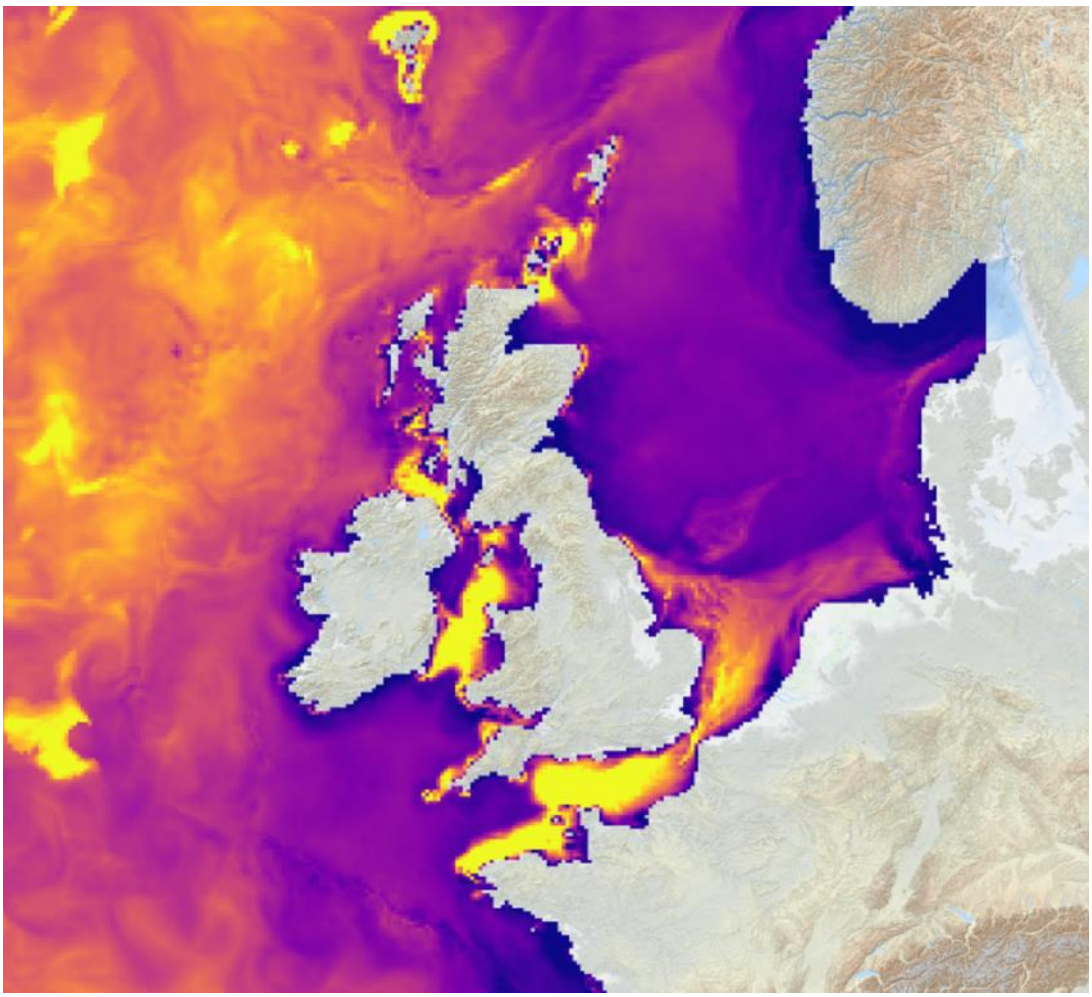


Figure 32e. Map showing Water Column Mixing, Mar 2025

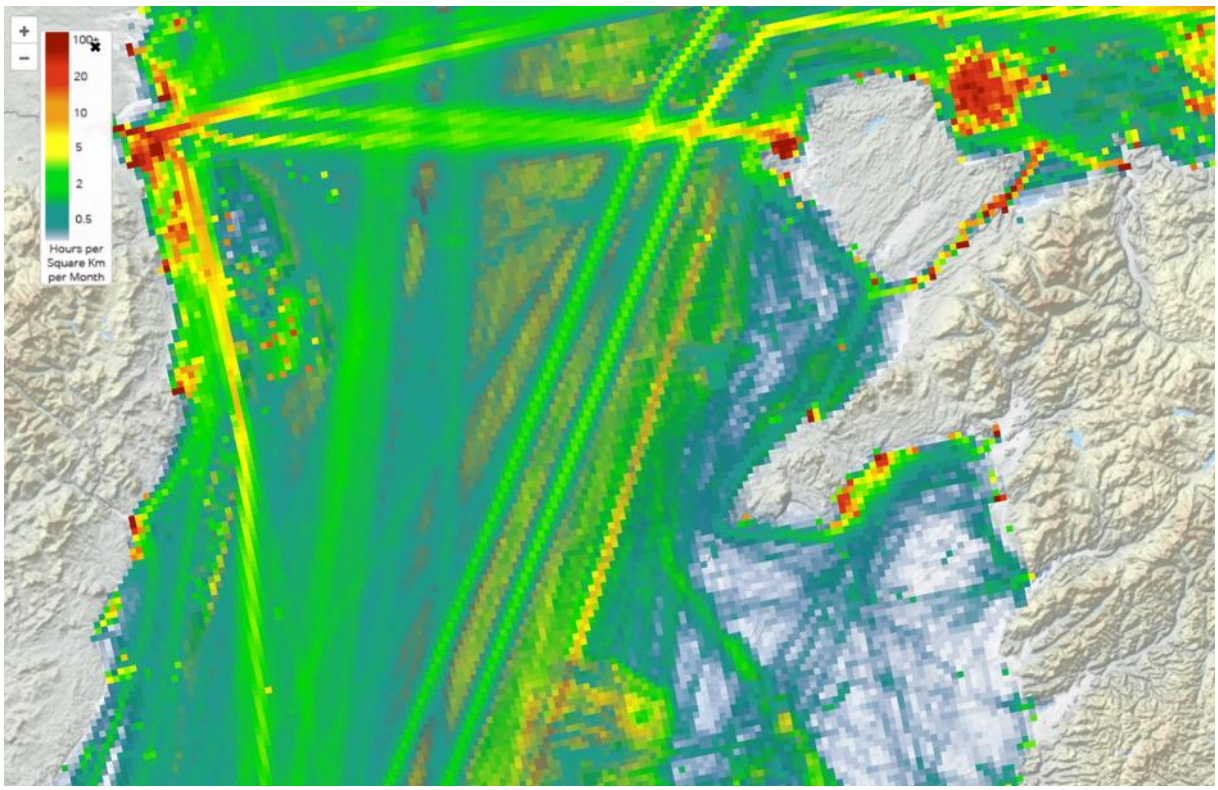


Figure 33a. Density of all vessels recorded by AIS in the Irish Sea between Northwest Wales and Ireland

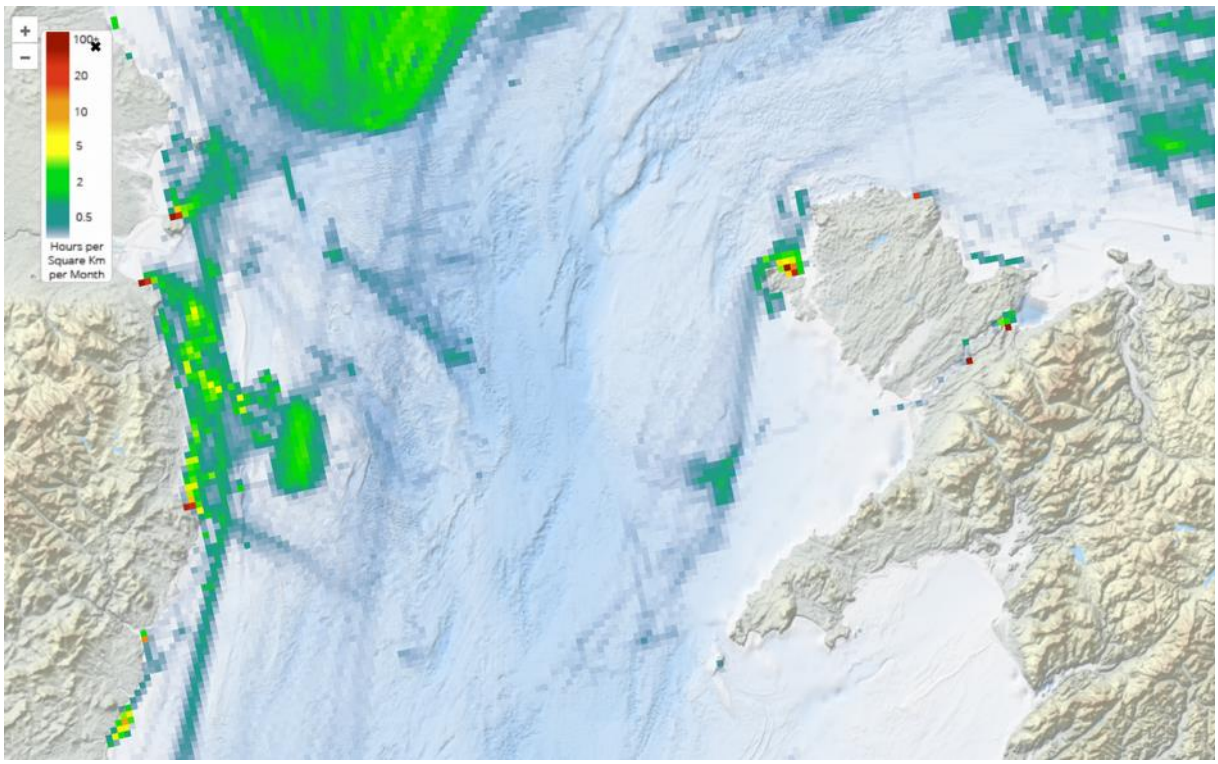


Figure 33a. Distribution of Fishing Effort using Static Nets in the Irish Sea between Northwest Wales and Ireland

10. Engagement with Fishers

Fisher Engagement

With aspirations to create a community-led marine management programme, engagement with stakeholders such as fishers, managers and community members is key in building relationships and understanding the issues faced by individuals and groups. The first phase in engagement is face-to-face meetings with key individuals from organisations involved in activities within the project area as well as individuals active in the area. The three fishers currently operating around the coast of the Bodorgan Estate have all been engaged, along with one retired fisher, and the following gives a brief profile of each and their perspective on the status of fish or invertebrate stocks and the pressures currently faced.

Fisher1

Fishes for: Sea Bass

Is aware of numerous individuals carrying out illegal and unlicensed bass fishing including landing more than the legal limit and fishing with illegal gear.

The lack of enforcement allows these illegal activities to continue; patrol vessels are not present in the area, so activities continue, regardless.

He would be happy to indicate individuals and locations in order for policing to be carried out.

Herring and bass numbers have increased in recent years.

More frequently, seeing Risso's dolphins now, whilst common dolphins are being seen closer to the shore in recent years

Ynys Llanddwyn is a bass nursery area

Albacore tuna seen in Caernarfon Bay and at Porth Colmon

More seals and cormorants observed in the Menai Strait in recent years

Fisher 2

Fishes for: Sea Bass, lobster. Years of fishing: 35.

Respects legal seasons for bass fishing, considers the bass stocks to have increased since catch limits were introduced.

Has noticed more dolphins in Caernarfon Bay in the last few years than in the past.

Has observed more sea bream present during 2024 than previous years

Feels pressured to get pots out early to ensure grounds are secured before potters from Holyhead lay their pots.

Uses scraps from Mermaid Seafood in Llandudno for bait rather than collecting own bait.

Sees dolphins mostly one hour before high water

Fisher 3

Fishes for: Lobster, crab.

Has noticed mackerel are around for longer but are more patchy in distribution

More spider crabs present than in previous years – they were previously here in the spring months only, now they are present for longer

Catches own bait

Finds one other local pot fisher to be uncooperative and will place pots in the same place and may take catch out of others' pots

Sees dolphins mostly two hours before high water

Fisher 4. Retired.

Fishes for: Lobster, crab.

More spider crabs present than previously

Mackerel are around the area between April and September – they are more patchy than previously, but are around for longer.

Finds one other local pot fisher to be uncooperative and will place pots in the same place and may take catch out of others' pots

Through interviews with local fishers, general trends and changes in certain species were reported with species such as bass and herring reportedly on the increase, whereas blue mussels were reported as having significantly decreased specifically within the Cefni estuary. The period of time during which certain species were present in Cearnarfon Bay was also reported as having changed over recent years, specifically fishers reported mackerel and spider crabs being present for longer periods during the year.

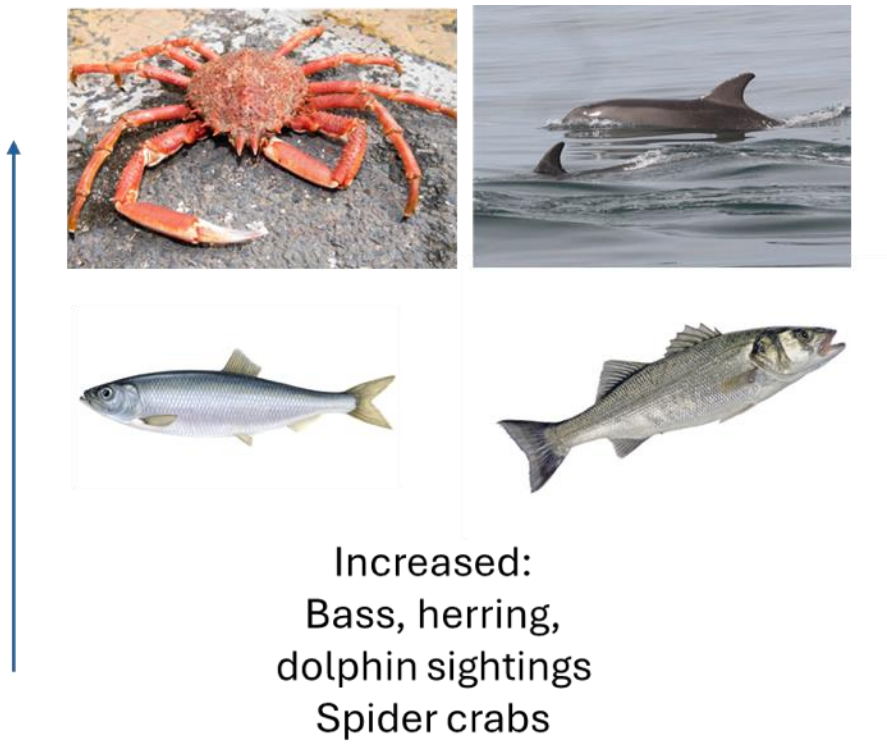


Fig 34. An increase in bass, herring, dolphin sightings and spider crabs was reported by a number of local fishers over the last 10years.

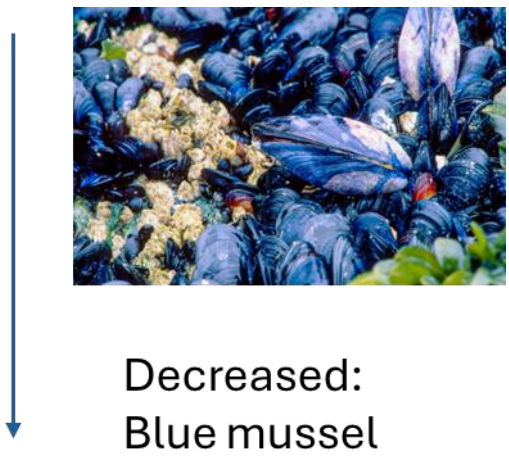
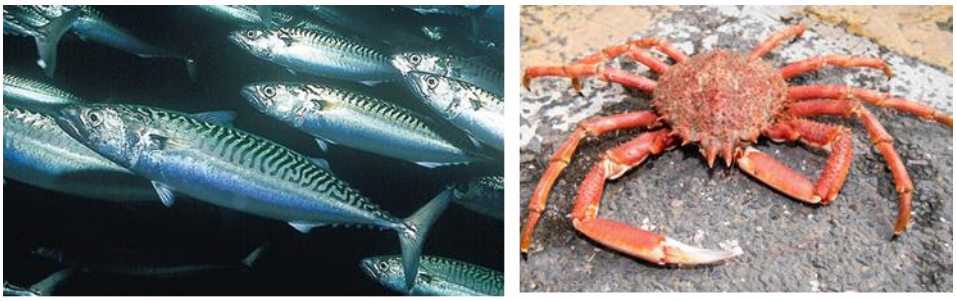


Fig 35. A decrease in blue mussels has been observed by local residents of the Cefni Estuary in recent years.



Here for longer:
Spider crab,
mackerel

Fig 36. Fishers reported spider crabs and mackerel being present in Caernarfon Bay for longer periods over the year compared to previous years.

11. Community led marine management

Setting up a community-led marine management group involves a thoughtful, collaborative process that begins with engaging local stakeholders. One of the initial steps will be to form a diverse group that represents the interests of all community members, including fishers, local residents, environmental organizations and businesses. The group will then work to establish clear objectives that reflect both the local community's needs and broader environmental goals. Facilitating open discussions to define priorities—such as protecting biodiversity, sustaining fisheries, or improving water quality—will allow a collective vision to be developed. The group will need clear governance structures, with defined roles and responsibilities, which is crucial for effective decision-making and ensuring that leadership is both accountable and transparent. Additionally, it is important to create mechanisms for ongoing communication and feedback among all members to maintain trust and unity.

When setting up the group we will also need to address capacity-building and sustainability, ensuring that members have the necessary skills, knowledge, and resources to manage marine resources effectively going forward. This may involve training in aspects such as sustainable fishing practices, habitat restoration, or marine monitoring techniques. Legal and regulatory considerations must also be taken into account to ensure the group has the authority to take action and implement management strategies. Securing funding will be another significant consideration, as the group will require financial resources for operational costs, monitoring programmes, and outreach initiatives. Partnerships with governmental bodies, NGOs, and/or academic institutions will provide invaluable support. Input from groups such as the Coastal Communities Network will also be essential, building on the experiences of others around the country. Finally, continuous monitoring, data collection, and adaptive management practices will be essential to assess the effectiveness of the group's efforts and make necessary adjustments to ensure the long-term viability of the programme.

We have begun engaging with stakeholders and developing relationships with local fishers, organisations and businesses. Fig 37 presents the stakeholders initially identified who will be key in the development of such a programme, and the two years of work reported on here has laid the foundations for this to move forward, beginning the process of engagement and evidence gathering in order to inform this work into the future. Our work will now focus on enabling full participation by local stakeholders and the establishment of a community-led marine management plan to allow the habitats, species and communities of Caernarfon Bay and SW Anglesey flourish.

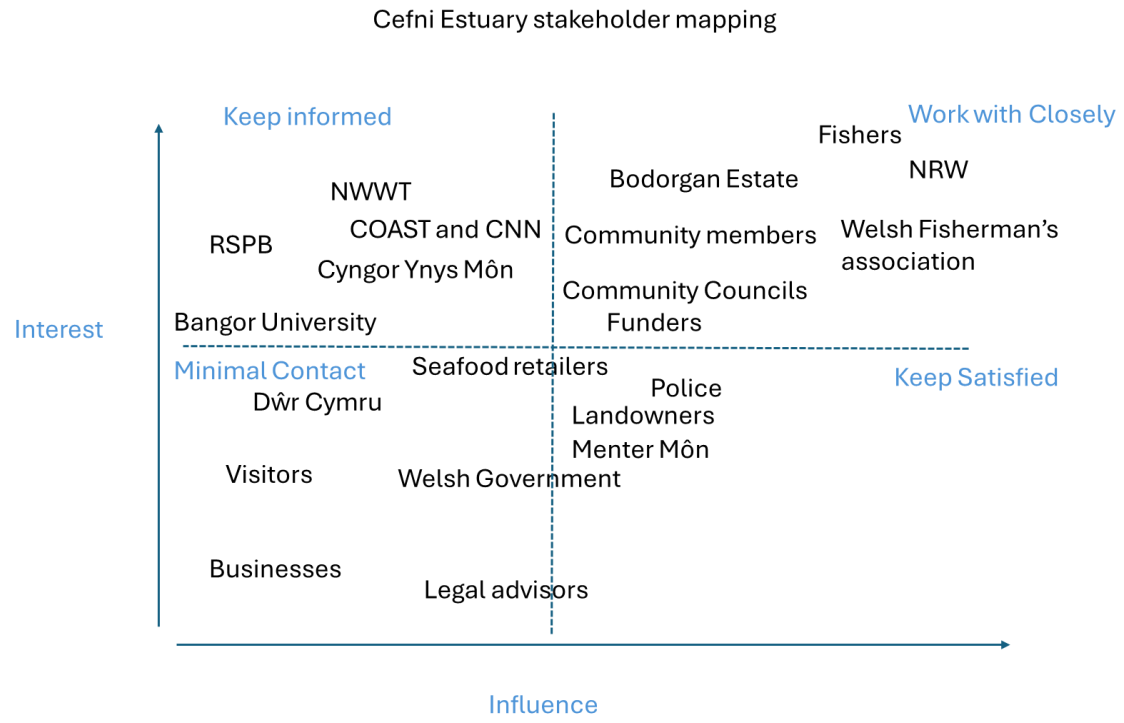


Fig 37. Map of stakeholders identified for engagement in the development of the community led marine management programme

This work is supported by new funding from the Landfill Tax Fund which will allow the employment of a part-time Community Engagement Officer and consultation with professional facilitators. In 2025, a series of community workshops will be held with the aim of:

- Gathering information on the uses of the Cefni catchment and coastline by visitors and local people
- Collating areas/issues of concern from workshop participants
- Identifying action areas for conservation and restoration along the catchment
- Strengthening existing relationships and forming new ones
- Engaging local stakeholders in the design of a community forum to spearhead community-led action and management

Outcomes will include:

- Stakeholder- and activity-use maps for the Cefni catchment and coastline
- Formation of a Community Forum group

- Action plan for the Cefni catchment and coastline including a programme of volunteer participation

In 2025, we will also be working with SeaSearch and local divers to collect underwater footage in order to produce a film reel which can be used as an educational and inspirational tool to enthuse audiences about our marine habitats.

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Appendix

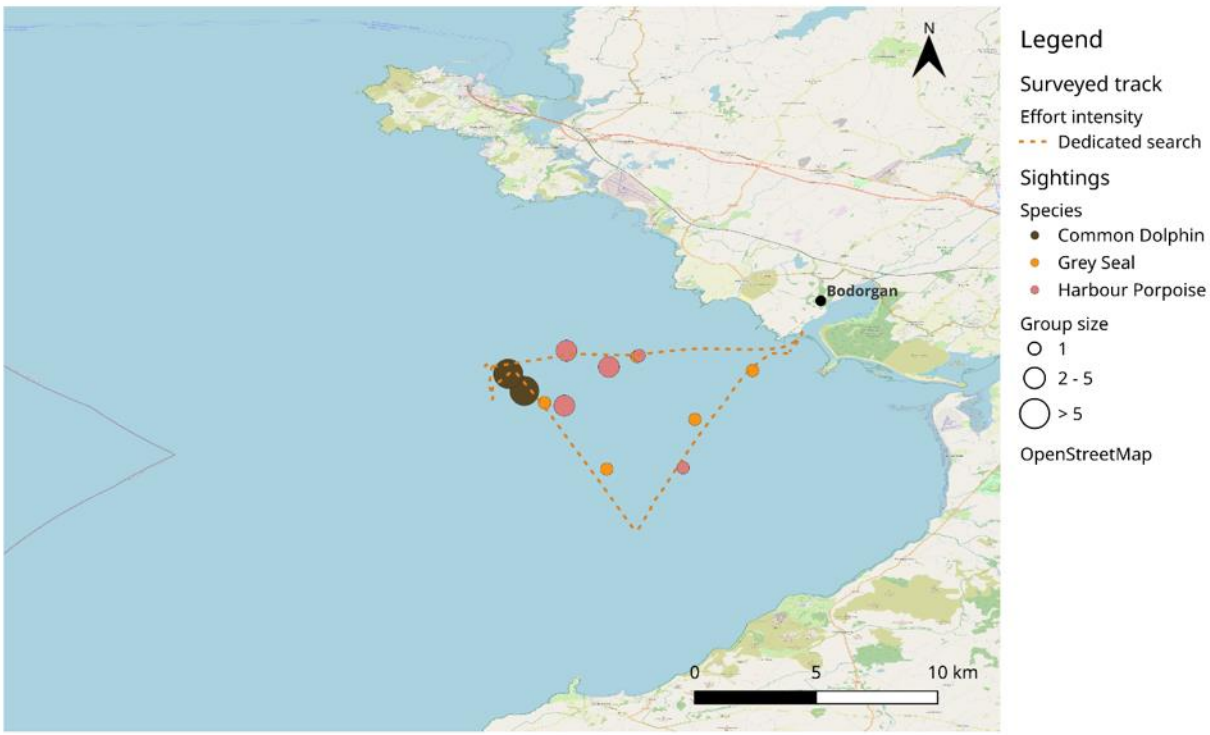

Figure A1. Sightings of common dolphin, grey seal and harbour porpoise 04/09/2023.

Figure A2. No marine mammal sightings during the survey on 13/09/2023.

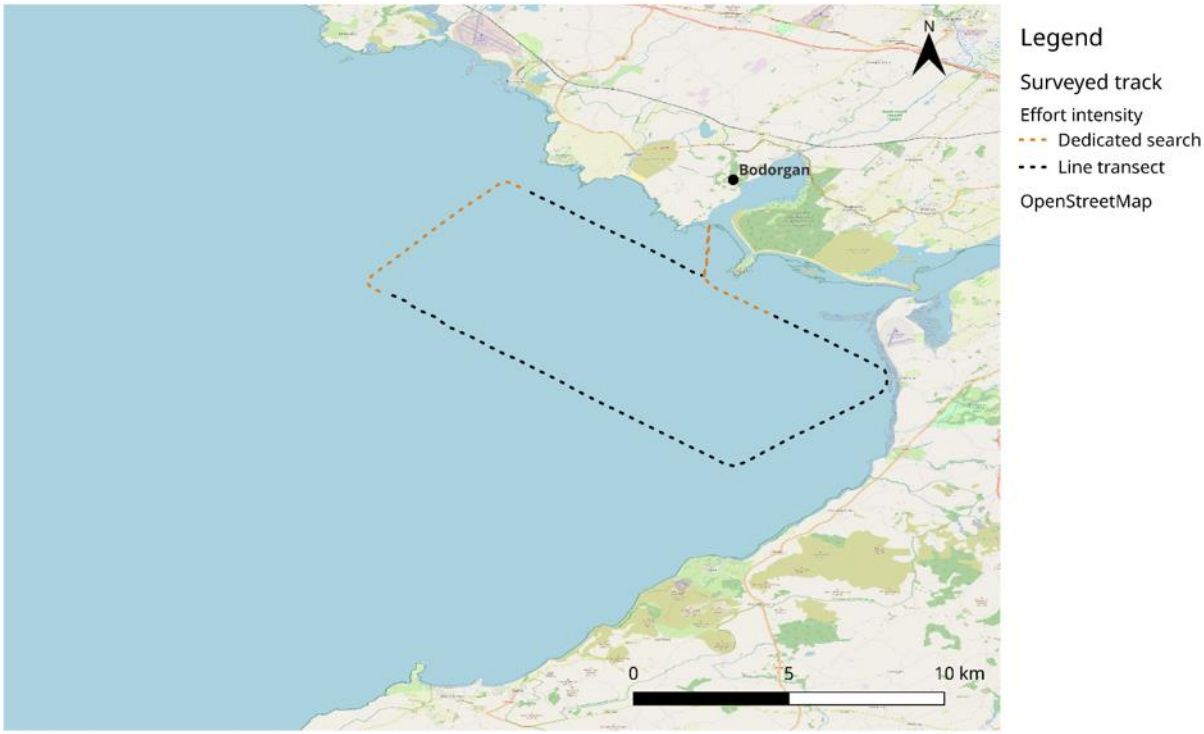

Figure A3. No marine mammal sightings during the survey on 8/05/2024.

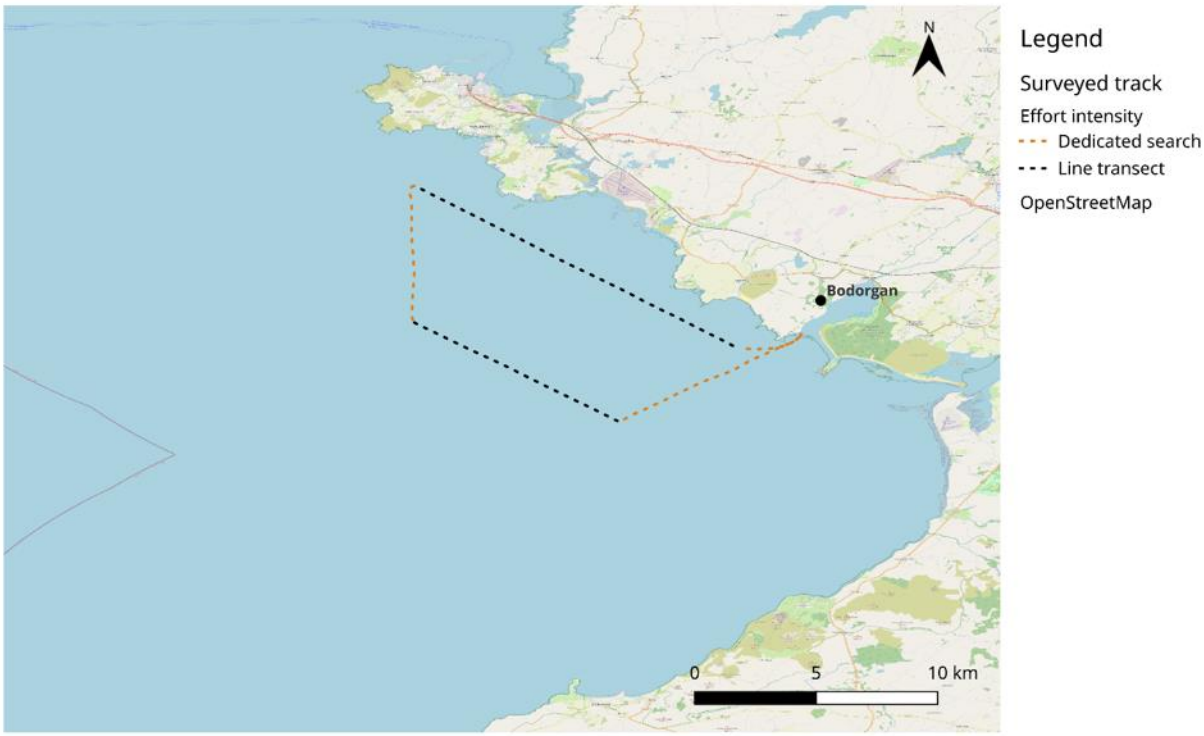

Figure A4. No marine mammal sightings during the survey on 25/05/2024.

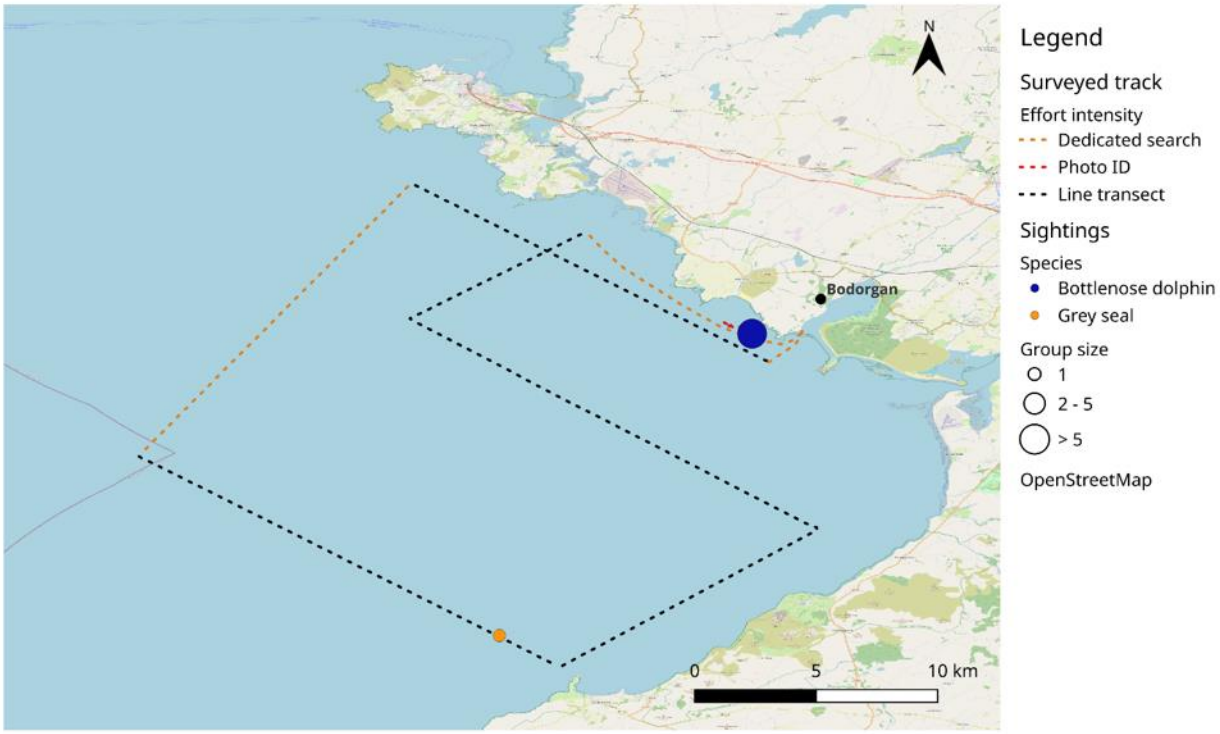

Figure A5. Bottlenose dolphins and grey seal sighted during the survey on 19/06/2024.

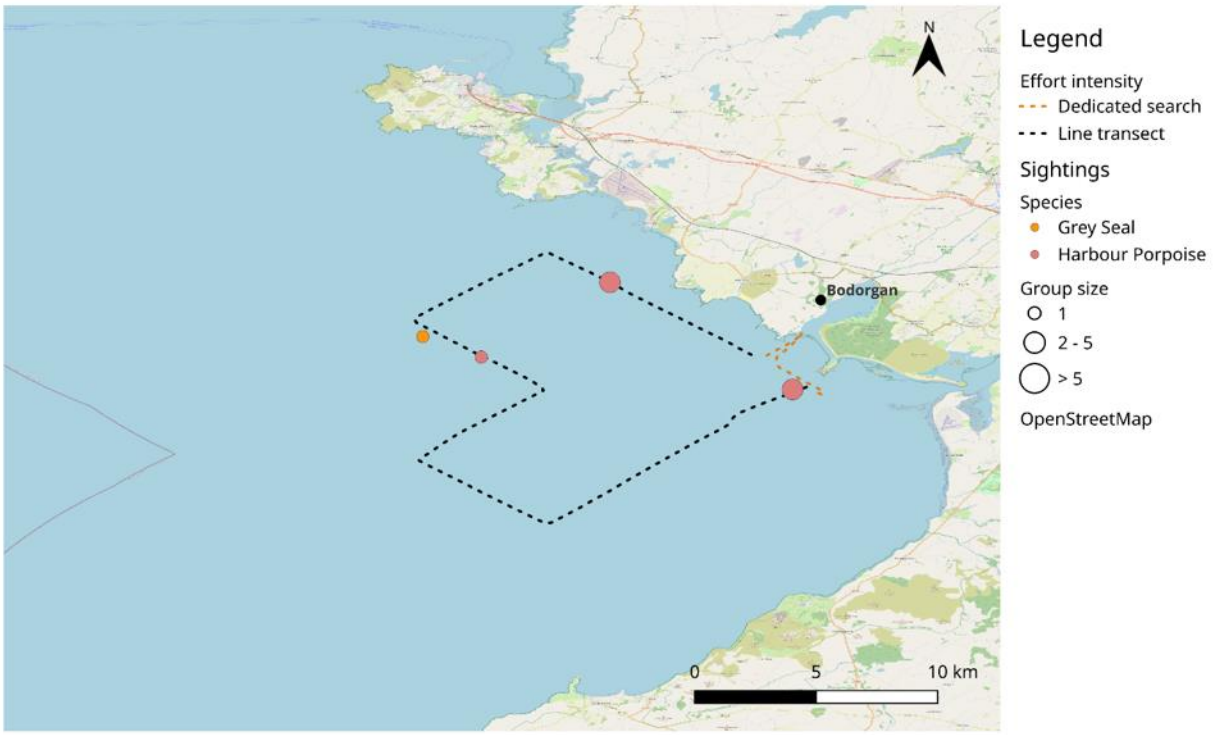

Figure A6. Grey seals and harbour porpoises sighted during the survey on 26/06/2024.

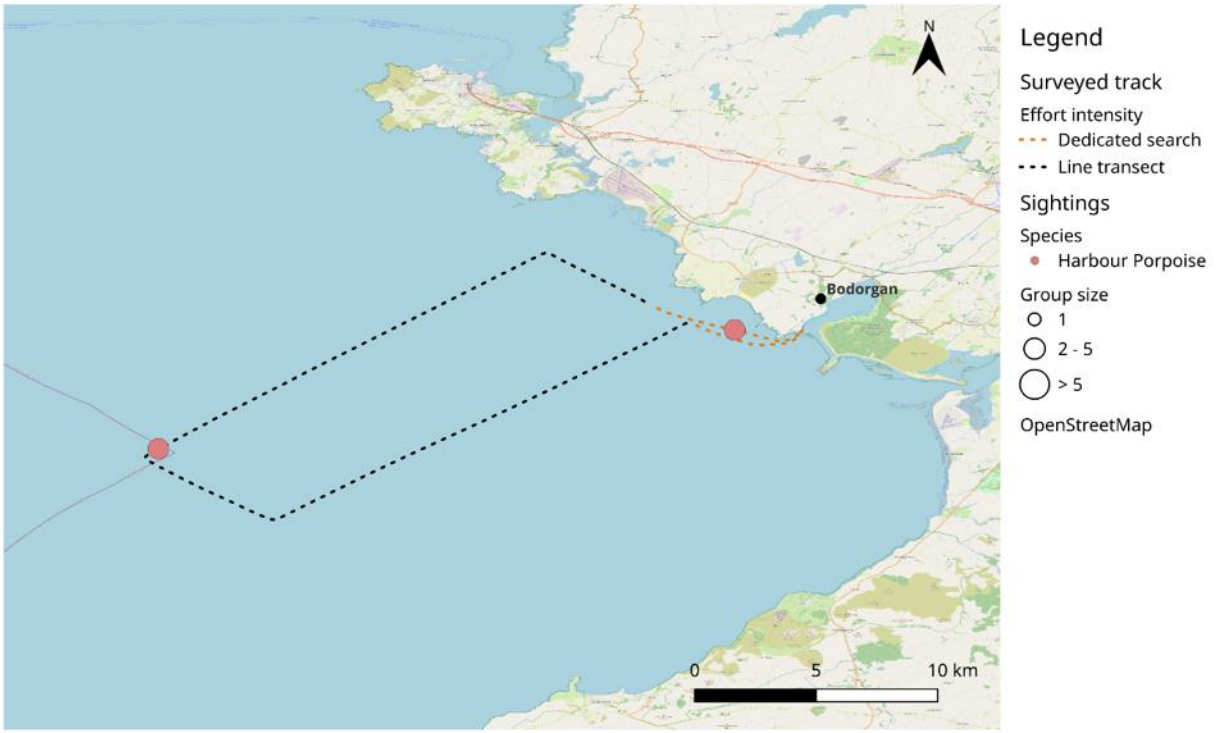

Figure A7. Harbour porpoises sighted during the survey on 14/07/2024.

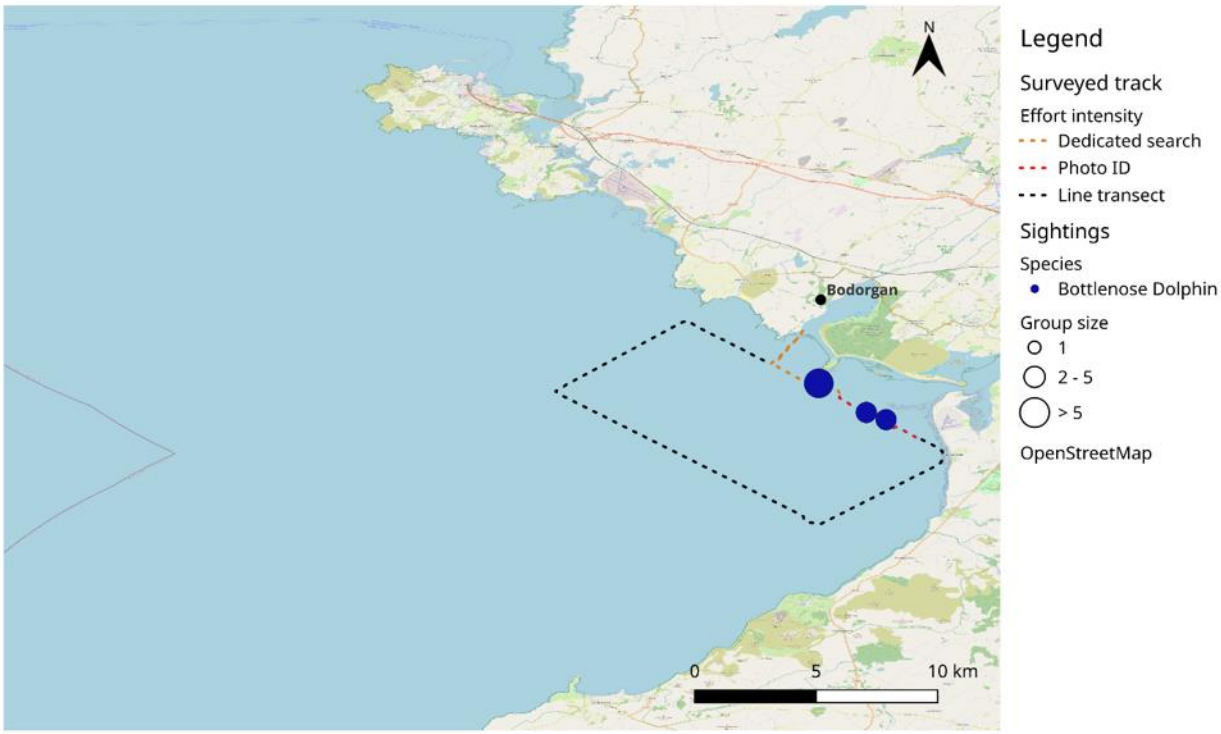

Figure A8. Bottlenose dolphins sighted and photographed during the survey on 3/09/2024.

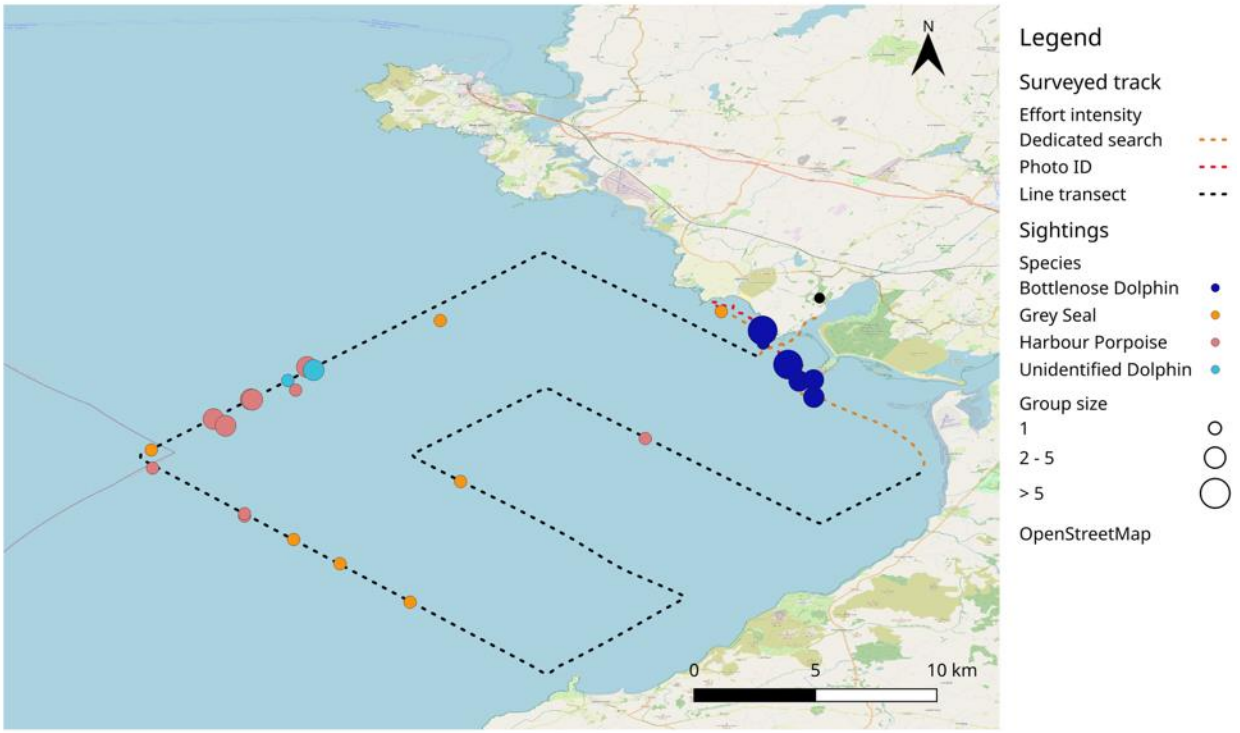

Figure A9. Bottlenose dolphins sighted and photographed as well as harbour porpoise, grey seal and unidentified dolphins during the survey on 17/09/2024.

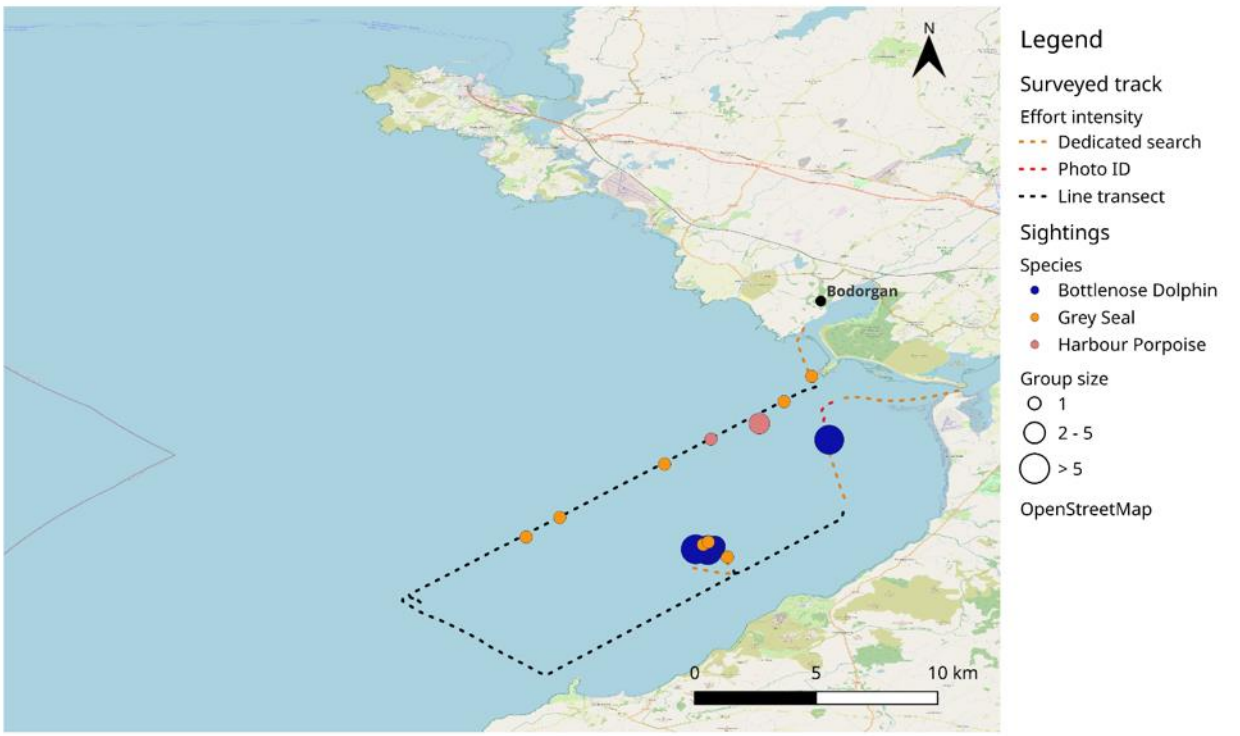

Figure A10. Bottlenose dolphins sighted and photographed as well as harbour porpoise and grey seal during the survey on 8/10/2024.

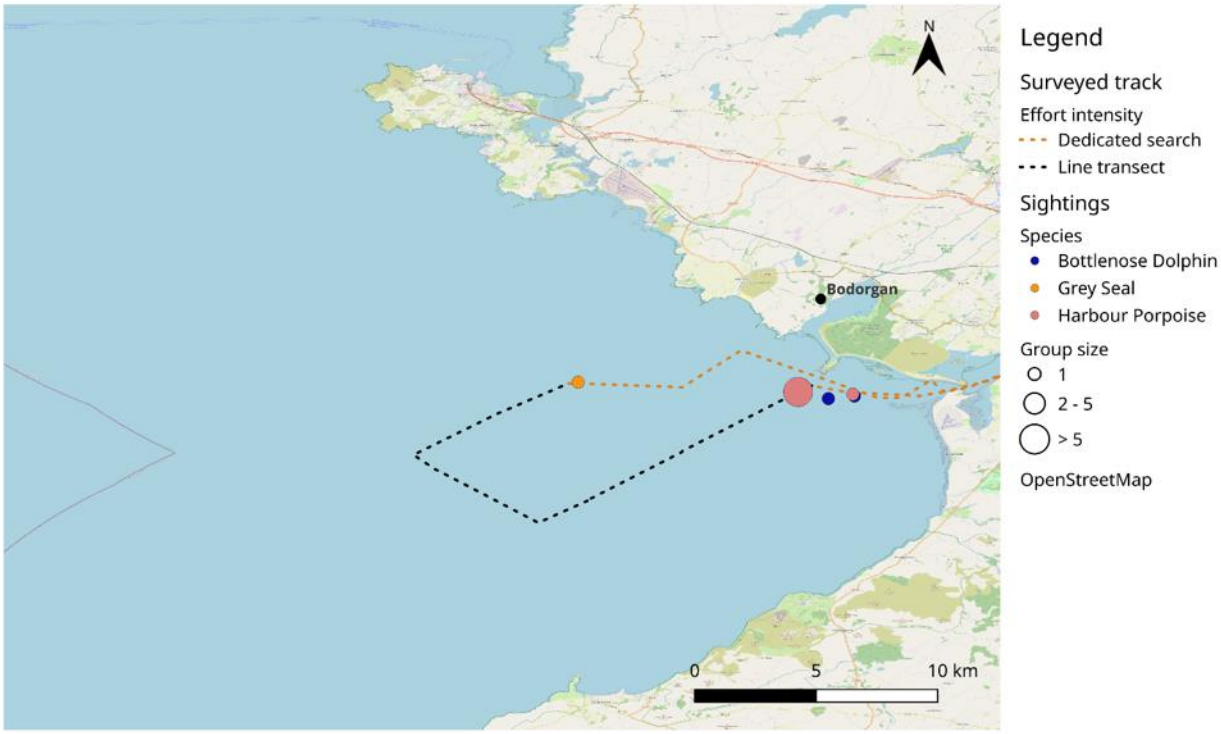

Figure A11. Bottlenose dolphins sighted and photographed as well as harbour porpoise and grey seal during the survey on 30/10/2024.

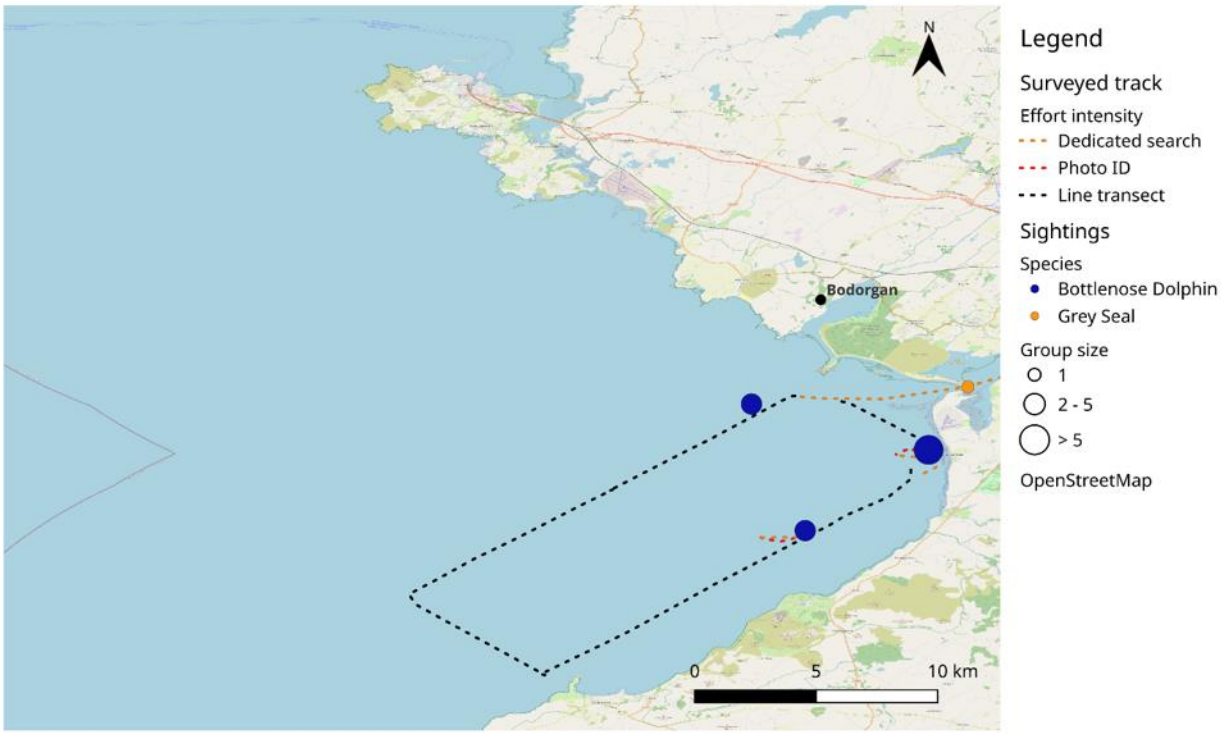

Figure A12. Bottlenose dolphins sighted and photographed as well as grey seal during the survey on 4/11//2024.