Iarnród Éireann
Irish Rail

Rosslare ORE Hub

EIAR Technical Appendices

Technical Appendix 12:

Fish, Shellfish and Turtle Ecology

venterra | GDG GAVIN & DOHERTY GEOSOLUTIONS | NICHOLAS O'DWYER an RSK company

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12 FISH, SHELLFISH AND TURTLE ECOLOGY

12.1 INTRODUCTION

This Fish, Shellfish and Turtle Ecology Technical Appendix supports **Volume 2: Chapter 12: Biodiversity - Fish, Shellfish and Turtle Ecology** of the Rosslare Europort ORE Hub (hereafter the 'Proposed Development') Environmental Impact Assessment Report (EIAR).

The Proposed Development is located at Rosslare Europort in southeast Ireland and comprises a range of marine infrastructure works, including land reclamation, dredging, and quay construction. This Technical Appendix provides a detailed baseline characterisation of fish, shellfish and marine turtle ecology within the Proposed Development Boundary (PDB) and surrounding waters.

This Technical Appendix has been informed by a comprehensive desk-based assessment undertaken by Gavin and Doherty Geosolutions Limited (GDG), drawing on publicly available datasets and published literature relevant to fish, shellfish and turtle ecology within the region. While no site-specific ecological surveys were conducted solely for fish, shellfish or turtles, relevant ecological and habitat information was derived from the results of benthic ecology surveys reported in Chapter 11: Benthic Ecology and Technical Appendix 11.

These data were used to characterise subtidal and intertidal habitats, sediment types, and infaunal communities present within the marine zone of influence. In addition, vantage point (VP) surveys for marine mammal (as detailed in Technical Appendix 13: Marine Mammals) and birds (as detailed in Technical Appendix 14: Ornithology) were reviewed for any incidental observations of large pelagic fish species (e.g. basking shark *Cetorhinus maximus*) and marine turtles occurring in proximity to the PDB.

The aim of this Technical Appendix is to inform the ecological baseline and subsequent impact assessment by identifying key species and ecological groups of interest. These are considered within the EIA as Key Ecological Receptors (KERs), based on their conservation status, ecological function, and/or commercial importance.

This technical report has been prepared by Maggie Starr BSc (Hons) Marine Sciences. Maggie is an Ecologist and Ornithologist with experience in terrestrial, aquatic and marine/coastal ecology and is a trained Marine Mammal Observer (MMO). Her expertise includes specialised mammal, bird (land based and aerial) and habitat surveys, as well as freshwater surveys such as assessments for white-clawed crayfish, pearl mussels, and Biotic Indices (Q-values) Surveys. Her current work includes ecological and environmental desktop studies for terrestrial, aquatic and marine environments, specialised mammal surveys, ornithological surveys, map preparation and reporting (AA/NIS, PEAR, EcIA, EIAR).

This report has been reviewed by Joey O'Connor (BSc (Hons) Marine Science, MSc. Engineering in the Coastal Environment). Joey is an Environmental Impact Assessment practitioner and Principal Marine Scientist with coastal engineering expertise. Joey has had an overview role in this project as EIAR co-ordinator.

12.1.1 SCOPE OF REPORT

The scope of Technical Appendix 12 is to summarise the methodology and findings of the desk-based assessment undertaken to inform Chapter 12: Fish, Shellfish and Turtle Ecology of the EIAR for the Proposed Development.

Technical Appendix 12 presents the baseline information used to describe the presence and distribution of fish, shellfish and turtle species within and surrounding the PDB, including a review of potential spawning and nursery habitats. The assessment is based entirely on a desk study completed by GDG in 2025, with no site-specific ecological surveys undertaken for these receptors.

Supporting information has been drawn from:

- Benthic habitat and faunal data obtained through site-specific surveys, as reported in Chapter 11: Benthic Ecology and Technical Appendix 11.
- Incidental observations (if any) of large fish and turtle species recorded during marine mammal vantage point (VP) surveys (Technical Appendix 13: Marine Mammals) and ornithological VP surveys (Technical Appendix 14: Ornithology).
- Publicly available ecological datasets and published literature sources relevant to marine ecology.

Technical Appendix 12 provides the technical evidence base for the impact assessment presented in Chapter 12, including the identification of Key Ecological Receptors (KERs) and the evaluation of potential construction-phase effects such as underwater noise, habitat disturbance, sedimentation, and water quality changes.

12.1.2 STUDY AREA

The Study Area for Technical Appendix 12 is defined as the geographical area within which a clear source–pathway–receptor link may exist between the Proposed Development and marine ecological receptors, namely fish, shellfish, sea turtles, and basking sharks. It includes all areas that may be directly or indirectly affected by the Proposed Development during the construction or operational phases, including potential effects arising from underwater noise, sediment dispersal, habitat disturbance, and barrier or displacement impacts.

To address both localised and wider ecological processes, two nested spatial units are defined (as shown in Figure 2-1):

- **Fish, Shellfish and Turtle Ecology Study Area**: This encompasses the footprint of the Proposed Development, including the 24.5 ha reclamation area and the 48.37 ha dredging area extending to -12 mCD. It also includes the surrounding nearshore marine environment potentially affected by tidal dispersion and construction activities. This area was delineated based on hydrodynamic plume modelling and reflects the maximum predicted extent of sediment dispersion. Suspended sediment concentrations above background levels are predicted to extend approximately 1.5 km west and 2.5 km southeast along the shoreline from the Proposed Development Boundary.

- **Wider Contextual Study Area**: To interpret local impacts in a broader ecological and conservation context, a larger marine area is considered, covering the nearshore and offshore waters along southeastern Ireland. This encompasses key migratory corridors and feeding areas used by anadromous and catadromous fish species, sea turtles, and basking sharks within the western Irish Sea region. It provides context for assessing the regional ecological role of the site and its connectivity to designated conservation sites and wider fishery resources.

This approach ensures the desk study is spatially appropriate for both site-level impacts and broader ecological considerations, particularly for highly mobile or migratory species.

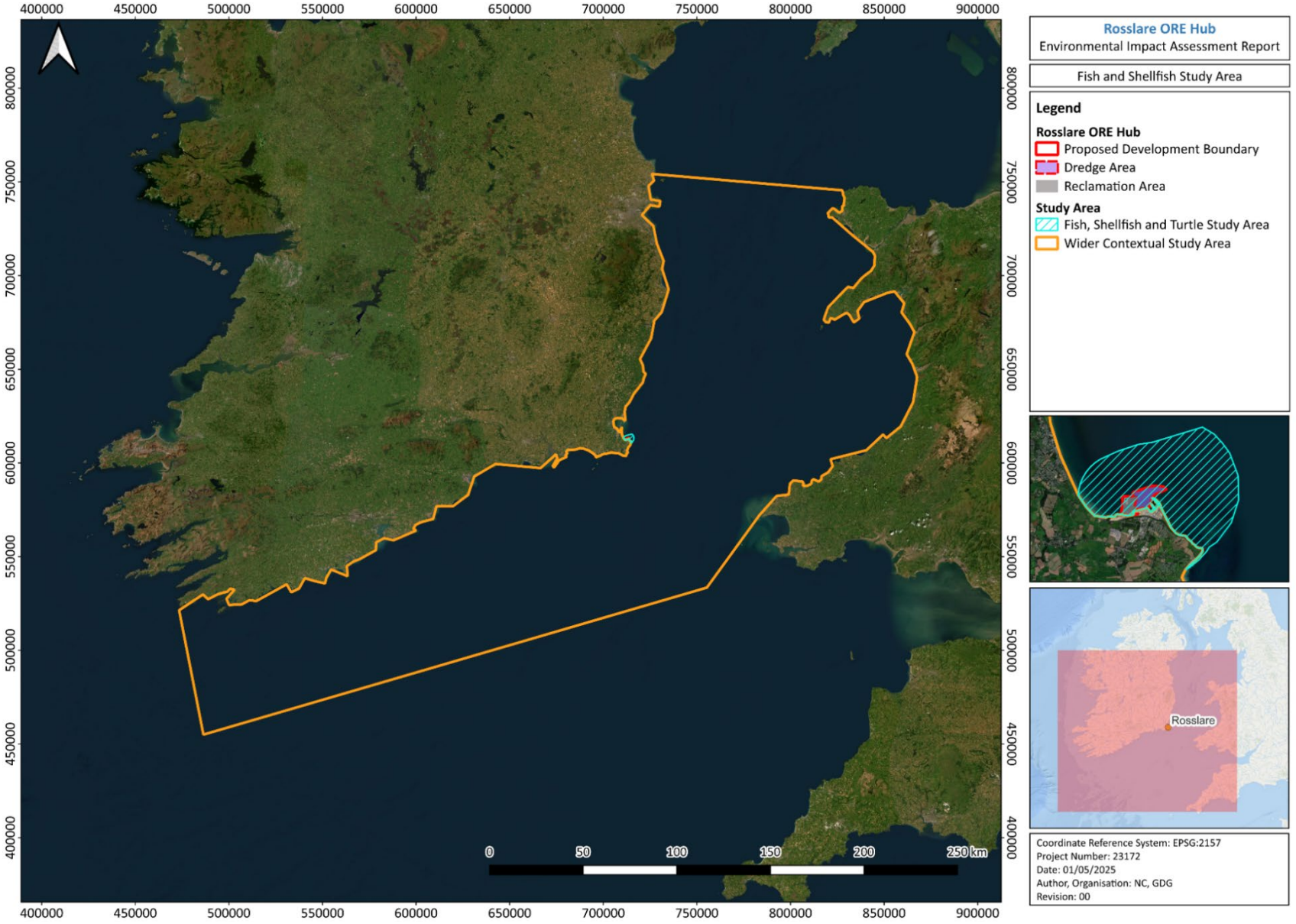

Figure 2-1 Fish, Shellfish and Turtle Ecology Study Area and the Wider Contextual Study Area

12.2 METHODOLOGY

The fish, shellfish and turtle ecology data presented in this Technical Appendix are based entirely on a desk-based review. The methodology comprised:

- Review of publicly available ecological datasets relevant to fish, shellfish and turtle species in Irish coastal and estuarine waters
- Review of peer-reviewed literature on species ecology, sensitivity, and responses to marine development pressures
- Analysis of habitat and faunal data derived from benthic ecological surveys undertaken within the PDB
- Review of incidental records (if any) of large fish and turtle species recorded during marine mammal and ornithological vantage point (VP) surveys.

12.2.1 DESK STUDY REVIEW

A desk-based review was undertaken to compile existing ecological information relevant to fish, shellfish and turtle species within and surrounding the PDB, located on the southeast coast of Ireland. The purpose of the review was to collate baseline information on the distribution, habitat use, and seasonal presence of marine species of interest, including any notable or protected species known to occur in the area.

The review incorporated publicly available ecological datasets, published scientific literature, and relevant survey data from other disciplines completed for the Proposed Development. Benthic habitat and faunal data were sourced from subtidal and intertidal surveys undertaken in 2023, as reported in Chapter 11 and Technical Appendix 11: Benthic Ecology. These surveys provided direct observations of sediment characteristics, habitat types and invertebrate communities that inform the ecological context for fish and shellfish.

In addition, incidental records of large fish and turtle species were reviewed using:

- Marine mammal vantage point (VP) surveys (Technical Appendix 13), which involved systematic observations conducted from onshore locations during 2023 and 2024.
- Ornithological VP surveys (Technical Appendix 14), which contributed additional observation effort across the same marine area.

No marine turtles or basking sharks were observed during these VP surveys.

Designated site documentation was also reviewed to identify any Special Areas of Conservation (SACs) supporting marine or diadromous fish species as Qualifying Interests (QIs). The spatial extent of mapped spawning and nursery areas for commercially important fish and shellfish species was examined using GIS layers provided by the Marine Institute.

The findings of this desk study are presented in Section 3 of this Technical Appendix to describe the species and habitats known or likely to occur within the Study Area.

12.2.2 DATA SOURCES

Key sources for the desk study included national marine data portals, peer-reviewed scientific literature, and existing environmental datasets provided by statutory bodies and marine research organisations. These resources provided baseline information on marine species distributions, benthic habitat types, spawning and nursery grounds, and historical sightings of large fish and turtle species within the PDB and surrounding area.

The following key sources and organisations were consulted:

- Marine Institute. Ireland's Marine Atlas; accessed at https://atlas.marine.ie/ [accessed March 2025]
- National Parks and Wildlife Service (NPWS). NPWS Map Viewer; accessed at https://www.npws.ie/maps-and-data [accessed March 2025]
- Article 17 Reports (NPWS, 2019)
- Article 17 GIS Spatial Data. Article 17 GIS and Metadata Downloads | National Parks & Wildlife Service (www.npws.ie)
- Irish Whale and Dolphin Group (IWDG). Sightings database for large marine vertebrates; https://iwdg.ie [accessed March 2025]
- EPA Maps. Maps and environmental datasets; accessed at https://gis.epa.ie/EPAMaps/ [accessed March 2025].

The guidelines and literature listed below were consulted to inform the scope, structure and content of this Technical Appendix:

Information on fish, shellfish and turtle ecology within the study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 2-1.

Table 12-1 Summary of key desktop reports and datasets

Data Source	Type of Data	Temporal and Spatial Coverage
Published survey data covering the wider region		
ObSERVE Phase I Aerial surveys (Rogan *et al.,* 2018)	Published Report	Aerial surveys from 2015 to 2017, providing year-round temporal coverage of fish and turtle populations off Ireland's coast. Spatially, the surveys encompassed key offshore regions, including the Celtic Sea, Irish Sea, and deep waters of the Porcupine Basin and Rockall Trough, focusing on monitoring cetaceans, large fishes and other marine megafauna including turtles to support conservation efforts. This report was used to provide recent context for the wider Irish Sea, including abundance estimates where possible.
ObSERVE Phase II Aerial surveys	Published Report	Aerial surveys from 2021 to 2023, providing updated seasonal and spatial coverage of fish and turtle populations within Ireland's

Data Source	Type of Data	Temporal and Spatial Coverage
(Giralt Paradell *et al*., 2024)		Exclusive Economic Zone. Spatially, the surveys encompassed coastal and offshore regions, including the Irish Sea, Celtic Sea, and Atlantic Margin. These surveys focused on refining abundance and distribution estimates for cetaceans, seabirds, large fishes and other marine megafauna including turtles, while addressing previously under-surveyed areas. This report provided population data and trends, providing contemporary context for the Irish Sea and adjacent regions, including density and abundance estimates where possible.
National Biodiversity Database Centre	Online fish and turtle datasets for Ireland https://maps.biodiversityireland.ie/Species	Online database of historic and recent fish and turtle records from national atlases and other datasets. Information was used to provide details of fish and turtle species recorded in the vicinity of the Proposed Development.

12.3 WILDLIFE RECORDS

12.3.1 NATIONAL BIODIVERSITY DATA CENTRE (NBDC)

The National Biodiversity Data Centre (NBDC) is an Irish organisation responsible for collecting, managing, analysing, and sharing data on the country's biodiversity. It is funded by the Heritage Council and supported by the Department of Housing, Local Government and Heritage. The NBDC makes all validated biodiversity data available through Biodiversity Maps, an online data portal.

Users can view and examine biodiversity records and detailed species information through the interactive Biodiversity Maps portal (http://maps.biodiversityireland.ie/#/Home). This tool is useful for conducting a preliminary assessment of biodiversity considerations for specific proposed development sites.

For this purpose, the NBDC search tool was tailored to include all records within the 10 km^2 grid containing the PDB. The main goal of this exercise is to identify any records of protected species or species of natural heritage significance near the PDB.

The NBDC database was searched for all relevant species within the marine environment within the 10 km^2 grid T11 covering the spatial footprint of the PDB.

12.3.2 IRISH WHALE AND DOLPHIN GROUP (IWDG)

A data request submitted to the Irish Whale and Dolphin Group (IWDG) returned sighting records for basking sharks and other large marine species within the vicinity of the Proposed Development over the past 10 years (March 2015 to March 2025).

Over the ten-year period reviewed, a single confirmed sighting of a basking shark (*Cetorhinus maximus*) was recorded near Tuskar Rock, located outside the immediate Proposed Development

Boundary. No other sightings of basking sharks, sea turtles (e.g. *Dermochelys coriacea*), or large pelagic fish species (e.g. tuna, sunfish) were recorded within Rosslare Europort or the adjacent coastal waters during this time. The IWDG noted that their database primarily focuses on cetaceans and basking sharks and does not include systematic records of other large fish species.

12.3.3 ObSERVE Aerial Survey Strata (Phase I And Phase II)

The most recent broad-scale dataset on the distribution of large fish and marine turtles in Irish waters was provided by Giralt Paradell *et al*. (2024) as part of Phase II of the ObSERVE aerial survey programme, which built upon the baseline established during Phase I by Rogan *et al*. (2018). Surveys were conducted across the Irish Exclusive Economic Zone (EEZ) using a Partenavia P-68 fixed-wing aircraft, flying at an altitude of 600 feet (183 m) and a groundspeed of 90–100 knots (167–185 km/hr).

Figure 2-1 and Figure 2-2, presented below, illustrate the survey strata and transect designs used during the ObSERVE Aerial Phase I and Phase II projects. These aerial surveys provided key baseline data on the occurrence, distribution, and abundance of large fish and marine turtle species - alongside cetaceans and seabirds - across Irish waters, including areas relevant to the Proposed Development.

In Phase I, survey blocks (Strata 1 to 5) were predetermined by the Department of Culture, Heritage and the Gaeltacht (DCHG) and the Department of Communications, Climate Action and Environment (DCCAE) to reflect national conservation and marine spatial planning priorities. Additional inshore strata (Strata 6 to 8) were surveyed in 2016–2017 to address data gaps during and after the SCANS-III survey (Hammond *et al*., 2017). Transects were designed using equally spaced zig-zag patterns, with randomised start points across survey years to reduce bias and improve seasonal representativeness.

Phase II (Giralt Paradell *et al*., 2024) comprised four seasonal aerial surveys (Summer 2021, Summer 2022, Winter 2022–2023, with Winter 2021–2022 cancelled due to a forced aircraft landing). The design included both offshore strata (1–4) and coastal strata: Stratum 5 (Irish Sea) and Strata 6A to 6C (north, west, and south coasts). Transect layouts varied by stratum, with zig-zag designs applied to most areas (Strata 1–5 and 6B), and parallel transects used in Strata 6A and 6C. Unlike Phase I, the same transect lines were repeated in each year to enable temporal comparisons.

This stratified and standardised design ensured broad spatial coverage and robust data collection critical for assessing offshore development impacts on marine megafauna, including fish and turtle species.

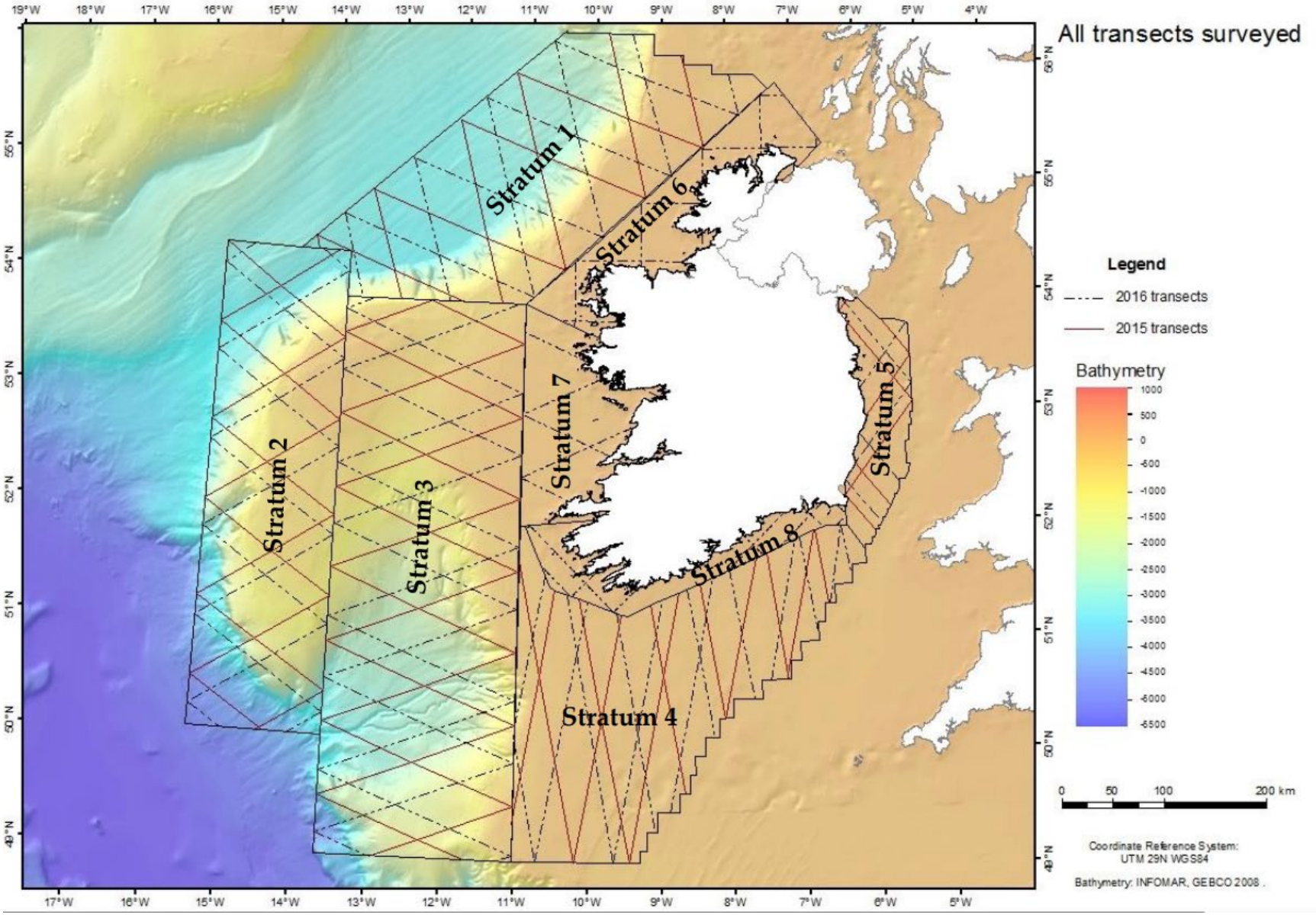

Figure 2-2 ObSERVE Aerial Phase I transect lines flown in summer and winter 2015 and 2016 in relation to bathymetry (from Rogan et al., 2018)

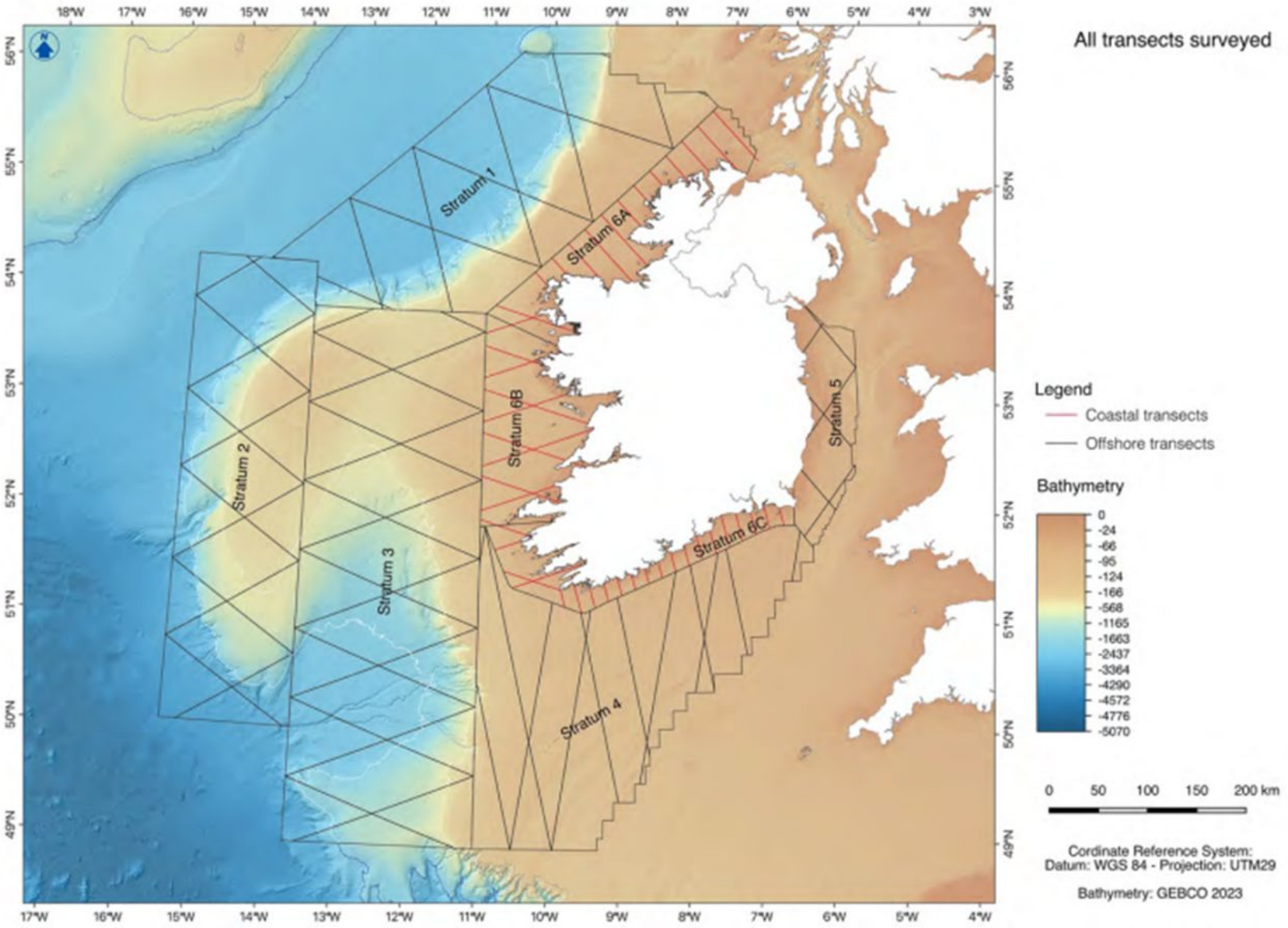

Figure 2-3 ObSERVE Aerial Phase II transect lines flown in summer 2021 and 2022 and winter 2022-2023 in relation to bathymetry. Black lines show the transect lines in offshore strata and red lines the transect lines in coastal strata (from Giralt Paradell *et al*., 2024)

12.4 SITE SPECIFIC SURVEYS

The project-specific benthic ecology surveys undertaken are described in detail in Technical Appendix 13: Benthic Ecology in Volume 3: Technical Appendices of this report. A summary of the site-specific surveys used to inform the fish and shellfish ecology baseline for the Proposed Development is outlined in Table 2-2. While a comprehensive desktop study was deemed sufficient to characterise the fish and shellfish ecology of the area, no dedicated fish or shellfish surveys were undertaken specifically for this chapter (Chapter 12: Fish, Shellfish and Turtle Ecology). However, data collected through other site-specific surveys provide additional and relevant information on the presence and potential use of the area by fish, shellfish and turtle species. A summary of the site-specific surveys informing the fish, shellfish and turtle ecology baseline is presented in Table 2-2.

Benthic subtidal and intertidal surveys, undertaken to inform the Benthic Ecology chapter (refer to Chapter 11: Benthic Ecology), included subtidal grab sampling for macrofauna and sediment characterisation, high-definition drop-down video transects, intertidal walkover surveys, and water sampling. Although primarily designed to classify benthic habitats and biotopes, these surveys provided incidental records of demersal and benthopelagic species and helped define substrate types and habitat structures relevant to fish and shellfish ecology.

Marine mammal VP surveys (Chapter 13: Marine Mammals and Technical Appendix 13) were also capable of detecting large pelagic fish species, such as basking shark (*Cetorhinus maximus*), although no such species were recorded during the survey period. The absence of observations supports the conclusion that large pelagic fish species are infrequent within the Proposed Development site and surrounding waters during the monitoring period.

Given the absence of high-sensitivity spawning or nursery grounds within the immediate footprint of the Proposed Development, and the heavily modified nature of the port environment, the available site-specific data - in combination with the desktop study completed for this chapter (Chapter 12: Fish, Shellfish and Turtle Ecology) - were considered appropriate to inform a robust ecological baseline for fish and shellfish receptors.

Table 2-2 Summary of Site-Specific Surveys Informing the Fish, Shellfish and Turtle Ecology Baseline

Survey Type	Date(s)	Method Summary	Relevance to Fish, Shellfish and Turtle Ecology
Subtidal Grab Sampling	13th–15th February 2024	40 stations using 0.1 m² Day and mini-Hamon grabs; macrofauna, PSA, TOC	Provides incidental records of demersal and benthic-associated fish/shellfish species; informs sediment characteristics relevant to habitat preferences
Subtidal Drop-Down Video Survey	18th–19th May 2024	HD video and stills of sediment and cobble reef areas	Identifies substrate and biotope types; cobble reef and macroalgae presence informs habitat suitability for epifaunal and mobile fish species
Intertidal Walkover Surveys	10th October 2023, 27th May 2024	Meandering transects, SACFOR scoring, habitat/biotope mapping	Characterises intertidal habitats potentially used by juvenile or estuarine fish species
Water Quality Sampling	15th February 2024	CTD profiling and water samples at 15 stations	Assesses parameters relevant to fish/shellfish physiology (salinity, DO, etc.)
Marine Mammal VP Surveys	July 2022–August 2024	Fortnightly land-based surveys from west of Rosslare Europort	Capable of detecting large fish (e.g. *Cetorhinus maximus*); no large fish observed.
Ornithological VP Surveys	May 2022 – April 2023	Monthly 6-hour surveys across two VP locations	Provides supplementary information on large pelagic species; no basking sharks or marine turtles

12.5 IDENTIFICATION OF DESIGNATED SITES

Designated sites were identified through a desk-based review of spatial datasets and conservation site documentation. The review focused on Special Areas of Conservation (SACs) designated under the EU Habitats Directive for Annex II fish species with a known or potential marine component to their life cycle. These include diadromous species as outlined in Section 3.4 below, which utilise both marine and freshwater environments during different life stages.

In tandem with salmonid hosts, freshwater pearl mussel (*Margaritifera margaritifera*) was also considered where it occurs as a qualifying feature. Although not a fish species, it has an obligate parasitic larval stage on salmonids, primarily Atlantic salmon and brown trout (*Salmo trutta*), and is therefore ecologically linked to anadromous fish. As such, it may be indirectly sensitive to marine-phase pressures that affect host fish populations or migratory pathways.

Spatial data on site boundaries and qualifying interests were sourced from:

- The National Parks and Wildlife Service (NPWS) online mapping system and Site Synopsis reports
- The European Environment Agency (EEA) Natura 2000 database
- Ireland's Marine Atlas (https://atlas.marine.ie).

Only SACs located within the Wider Contextual Study Area (refer to Section 1.2 above) extending were considered (Figure 2-1). Sites were screened for relevance based on Qualifying Features (QIs), and potential source–pathway–receptor (S-P-R) linkages.

Designated sites containing exclusively freshwater species or habitats with no plausible connectivity to the marine environment were excluded from further consideration.

12.6 TOPIC-SPECIFIC CONSULTATION

Stakeholder consultation has been an integral component of the EIA process for the Proposed Development and has informed the baseline characterisation for fish, shellfish, and turtle ecological receptors.

As detailed in Chapter 4: Scoping and Consultation of the EIAR, the EIA Scoping Report was issued in February 2023 to key topic-specific stakeholders, including:

- Bord Iascaigh Mhara (BIM)
- Inland Fisheries Ireland (IFI)
- Marine Institute
- National Parks and Wildlife Service (NPWS)
- Sea Fisheries Protection Authority (SFPA).

Subsequent consultation meetings were held with stakeholders, including a phone meeting with NPWS on 4 September 2023. During this meeting, NPWS advised that sufficient coverage and replication of grab samples be incorporated into the benthic survey design to robustly characterise

benthic infaunal communities relevant to shellfish ecology. In response, the survey design was revised in October 2023 to increase sampling from 20 to 40 stations, each with four replicate grabs, and to include seabed imagery transects and water quality sampling.

Further engagement took place during the pre-application consultation phase between December 2023 and December 2024, involving:

- An Bord Pleanála
- NPWS
- Wexford County Council Biodiversity Officer
- Irish Whale and Dolphin Group (IWDG).

While no specific concerns were raised in relation to fish or marine turtle receptors, the input received supported the inclusion of relevant desktop data sources and impact categories in this assessment. Notably, IWDG provided access to marine megafauna sighting records, which contributed to the baseline characterisation of large pelagic species (e.g. *Cetorhinus maximus*).

In addition, the Rosslare Harbour Fisheries Consultative Group was established in February 2024, as described in Chapter 12b: Commercial Fisheries and Aquaculture. The Group includes local and regional representatives from the commercial fisheries, aquaculture, and charter boat sectors. It has functioned as the primary platform for engagement between the Project Team and marine resource users throughout the project's development.

Meetings were held both online and in person, with members of the Group providing valuable qualitative data on local fish and shellfish distribution, which has further informed the ecological baseline presented in this appendix.

12.7 RESULTS

12.7.1 EXISTING ENVIRONMENTAL CONDITIONS

The Proposed Development is characterised by a shallow, gently sloping coastal shelf with water depths typically ranging from 0 to 20 m below Chart Datum (CD). The marine environment is dynamic, influenced by tidal currents and wave action driven by prevailing south-westerly winds and exposure to the Celtic Sea.

The Proposed Development is situated in a relatively shallow nearshore zone, with the seabed gently shelving seaward from the intertidal shoreline. The project footprint spans an area of modified seabed within Rosslare Harbour and adjacent waters to the east and southeast. Bathymetric data from marine geophysical surveys indicate that water depths within the PDB) range from intertidal (0 m CD) to approximately 15 m CD in the deeper dredge areas. The area is exposed to bidirectional tidal currents, generally flowing north-northeast during flood and south-southwest during ebb, facilitating sediment transport and the dispersion of fine particles.

12.7.2 BENTHIC SURVEYS

Benthic surveys conducted for the Proposed Development identified a predominance of mixed sediments, including muddy sands, coarse sands, and gravel substrates. Subtidal habitats within the PDB and surrounding area were classified according to EUNIS and biotope codes, with dominant communities including:

- SS.SSa.CMuSa.AalbNuc: *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand, and
- SS.SMx.IMx.MedCirr: Medium to coarse sediments with polychaete assemblages.

Sediment chemistry and particle size analyses from grab samples confirmed the presence of fine to medium sands, interspersed with gravel and shell fragments, particularly near the dredge channel and in areas of high-energy hydrodynamic conditions. Intertidal areas include mixed sediment shores with epifaunal and infaunal assemblages typical of estuarine and harbour environments.

Notably, no sensitive benthic habitats (e.g. maerl beds, seagrass, Sabellaria spp.) were recorded within or immediately adjacent to the PDB. The surrounding environment is heavily modified by existing port infrastructure and vessel activity, contributing to a relatively low ecological sensitivity.

12.7.3 FISH AND SHELLFISH HABITAT SUITABILITY

The sedimentary and hydrodynamic conditions at Rosslare support a range of demersal and benthic fish species, as well as commercially targeted shellfish. The seabed provides potential foraging habitat for species such as plaice (*Pleuronectes platessa*), dab (*Limanda limanda*), and whiting (*Merlangius merlangus*), and supports infaunal prey species (e.g. polychaetes, small bivalves). Shellfish species such as brown crab (*Cancer pagurus*), whelk (*Buccinum undatum*), and Nephrops (*Nephrops norvegicus*) are known to occur in wider Wexford Bay, although their preferred muddy habitats are more common further offshore in the southern Irish Sea.

The shallow, dynamic sedimentary environment within the immediate footprint of the Proposed Development is not considered to provide significant nursery or spawning habitat for key fish or shellfish species. However, broader Wexford Bay may support seasonal nursery functions for pelagic species such as sprat (*Sprattus sprattus*) and herring (*Clupea harengus*).

12.8 DESIGNATED SITES

The Proposed Development does not directly overlap with the boundary of any marine Special Area of Conservation (SAC). However, several SACs occur within the marine environment surrounding the PDB, including sites designated for marine habitats and species of relevance to fish, shellfish and turtle ecology.

Only designated sites with QI features that utilise the marine environment during any stage of their life cycle are considered here (i.e. excluding species that are wholly freshwater in distribution and ecology). Designated sites meeting these criteria within the Study Area are presented in Table 3-1. Designated sites supporting Annex II fish species with a marine phase within the wider Fish, Shellfish and Turtle Ecology Study Area are illustrated in Figure 3-1.

Table 3-3 SACs in the vicinity of the Proposed Development relevant to fish, shellfish and turtle ecology

Site name & code	Closest Distance from PDB (km) via the marine environment	Relevant marine QI
Slaney River Valley SAC [0781]	6.6 km via estuary	• Twaite shad (*Alosa fallax fallax*) [1103] • Atlantic salmon (*Salmo salar*) [1106] • River Lamprey (*Lampetra fluviatilis*) [1099] • Sea Lamprey (*Petromyzon marinus*) [1095] • Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]
River Barrow and River Nore SAC [2162]	52 km	• Twaite shad (*Alosa fallax fallax*) [1103] • Atlantic salmon (*Salmo salar*) [1106] • River Lamprey (*Lampetra fluviatilis*) [1099] • Sea Lamprey (*Petromyzon marinus*) [1095] • Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]
Lower River Suir SAC [2137]	69 km	• Twaite shad (*Alosa fallax fallax*) [1103] • Atlantic salmon (*Salmo salar*) [1106] • River Lamprey (*Lampetra fluviatilis*) [1099] • Sea Lamprey (*Petromyzon marinus*) [1095] • Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]
Blackwater River (Cork/Waterford) SAC [2170]	116 km	• Twaite shad (*Alosa fallax fallax*) [1103] • Atlantic salmon (*Salmo salar*) [1106] • River Lamprey (*Lampetra fluviatilis*) [1099] • Sea Lamprey (*Petromyzon marinus*) [1095] • Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]

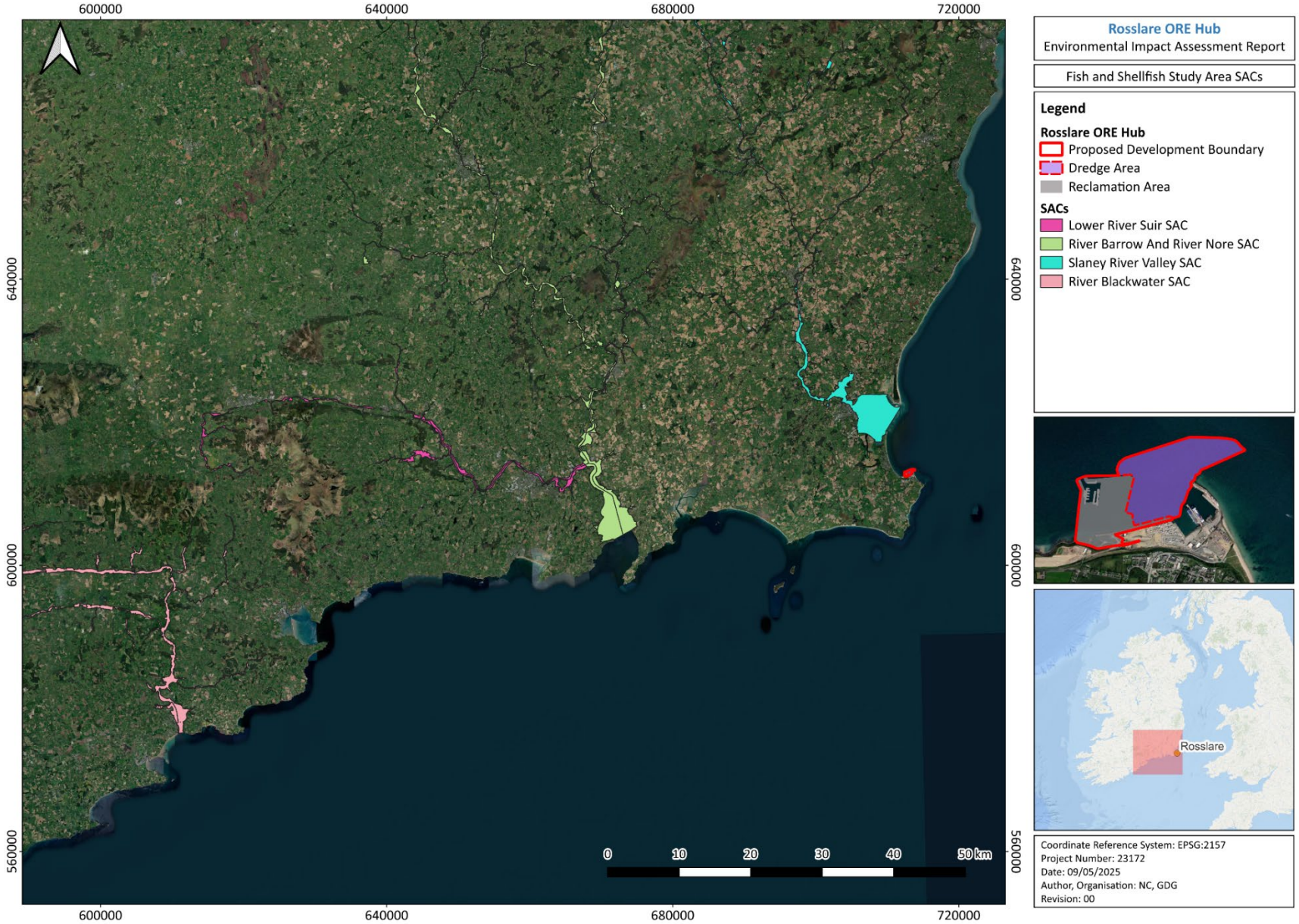

Figure 3-4 SACs designated for Annex II migratory fish species within the Wider Contextual Study Area

12.9 MARINE TELEOSTS

Marine teleost species, or bony fish, represent a diverse and ecologically significant group within the Fish, Shellfish and Turtle Ecology Study Area. This group includes both demersal species, which inhabit and interact with the seabed, and pelagic species, which utilise the water column. Teleost fish may occur year-round or on a seasonal basis, and are functionally important as forage species, ecological indicators, and, in some cases, commercially targeted resources.

This section presents a characterisation of marine teleost species potentially occurring within or near the PDB, informed by a desk-based review of aerial survey data, fisheries literature, and incidental records from benthic surveys. It focuses on the expected ecological presence, habitat use, and seasonal patterns of occurrence of representative species and functional groups. Where relevant, known distributions and abundance data from the ObSERVE Aerial Survey Programmes and other sources are included to provide regional context.

12.9.1 OCEAN SUNFISH (*MOLA MOLA*)

The ocean sunfish (*Mola mola*) is a large epipelagic teleost species and the heaviest bony fish in the world. It is broadly distributed across temperate and tropical ocean basins and is recognised by its unique flattened morphology, truncated tail fin, and surface-associated behaviour. Although *M. mola* is not considered migratory in the traditional sense, it exhibits distinct seasonal movements linked to sea temperature, prey availability, and surface productivity (Pope et al., 2010). The diet of the ocean sunfish is dominated by gelatinous zooplankton such as jellyfish, salps, and ctenophores.

In Irish waters, *M. mola* is considered a seasonal visitor, with sightings largely restricted to summer months. It typically favours shelf-edge and oceanic waters, but individuals are occasionally recorded closer to shore, especially in areas of high surface productivity. Observations are mostly of solitary individuals, though small aggregations have been recorded. The species is often seen near the surface, likely for a combination of thermoregulation, ectoparasite removal, and foraging. Despite its generally sluggish movement at the surface, tagging studies (e.g. Hays et al., 2009) have shown that *M. mola* is capable of vertical movements to several hundred metres, particularly outside the summer surface-foraging period.

Although *M. mola* is not currently listed under Irish or EU conservation legislation, it is considered vulnerable to pelagic fisheries bycatch. The species is classified as Data Deficient on the IUCN Red List due to insufficient information on population size, life history traits, and trends.

Presence in Irish Waters – Aerial Survey Data

ObSERVE Phase II (2021–2023)

During the ObSERVE Phase II aerial survey programme (Giralt Paradell *et al*., 2024), ocean sunfish was the most frequently sighted marine megafauna species after cetaceans and seabirds, with 386 sightings comprising 434 individuals, all during the summer months (). The highest concentrations occurred over the continental shelf, particularly the southern Porcupine Bank and Porcupine Seabight. Sightings in the Irish Sea and adjacent coastal areas were sporadic, with few records in eastern strata such as Stratum 5 (Irish Sea) and coastal strata such as 6C (refer to Figure 2-2).

No individuals were recorded during winter 2022–2023, precluding the calculation of abundance estimates for that season. However, model-based estimates indicated seasonal presence during the summer, with a declining density trend between survey years. In summer 2021, estimated density was 0.033 individuals per km², corresponding to an abundance estimate of 7,512 individuals (95% confidence interval: 6,200–9,102). In summer 2022, estimated density fell to 0.0023 individuals per km², with an estimated abundance of 9,111 individuals (95% CI: 7,064–11,751). Figure 3-2 illustrates the spatial distribution of ocean sunfish sightings recorded during the ObSERVE Phase II surveys.

ObSERVE Phase I (2015–2017)

In Phase I of the ObSERVE aerial survey programme (Rogan *et al.*, 2018), ocean sunfish was also recorded during both summer and winter surveys. The species showed broad habitat use in summer, ranging across coastal, neritic, and offshore waters. However, winter sightings declined between years, with 68 sightings recorded during winter 2015–2016 and 26 sightings during winter 2016–2017. No ocean sunfish were recorded in the Irish Sea (Stratum 5) during winter in either year, and no sightings occurred in coastal strata (Strata 6–8).

Model-based estimates for summer also showed declining densities over time. In summer 2015, estimated density was 0.068 individuals per km², dropping to 0.023 individuals per km² in summer 2016. Due to the limited number of winter sightings, density and abundance estimates were not generated for the winter periods in Phase I. Due to low winter sightings, density and abundance estimates were not calculated for winter periods in Phase I. Figure 3-3 presents the distribution of ocean sunfish sightings recorded during the ObSERVE Phase I aerial survey programme.

These findings suggest that while ocean sunfish can occasionally occur in nearshore areas, including the Irish Sea, its core habitat in Irish waters lies offshore, and its presence within the PDB or surrounding waters is likely rare and seasonal.

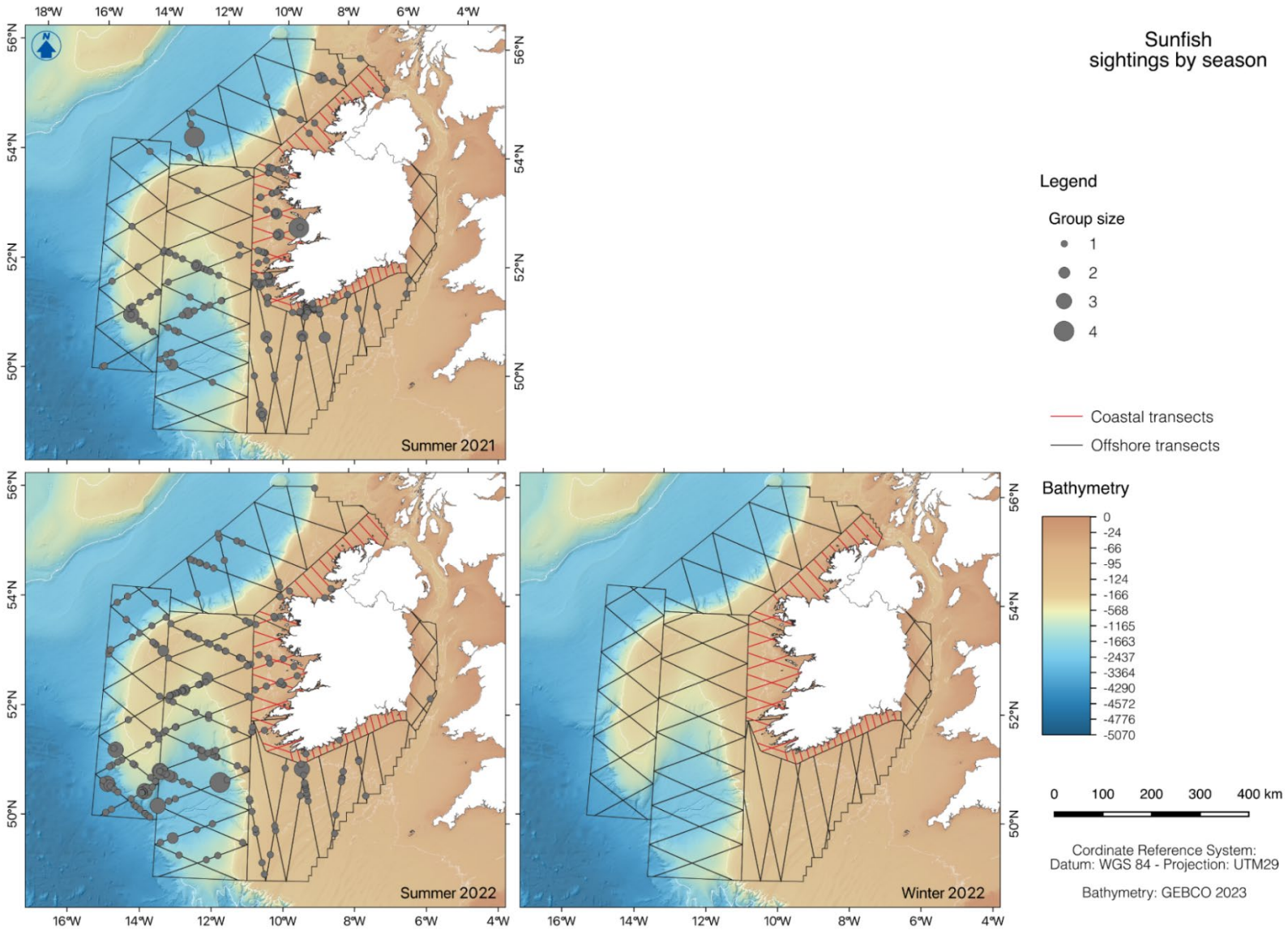

Figure 3-5 Ocean sunfish (*Mola mola*) sightings during Phase II of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey track lines in the offshore strata and red lines indicate the track lines in the coastal strata. Circles are proportional to the number of sunfish in each sighting (Giralt Paradell *et al.*, 2024).

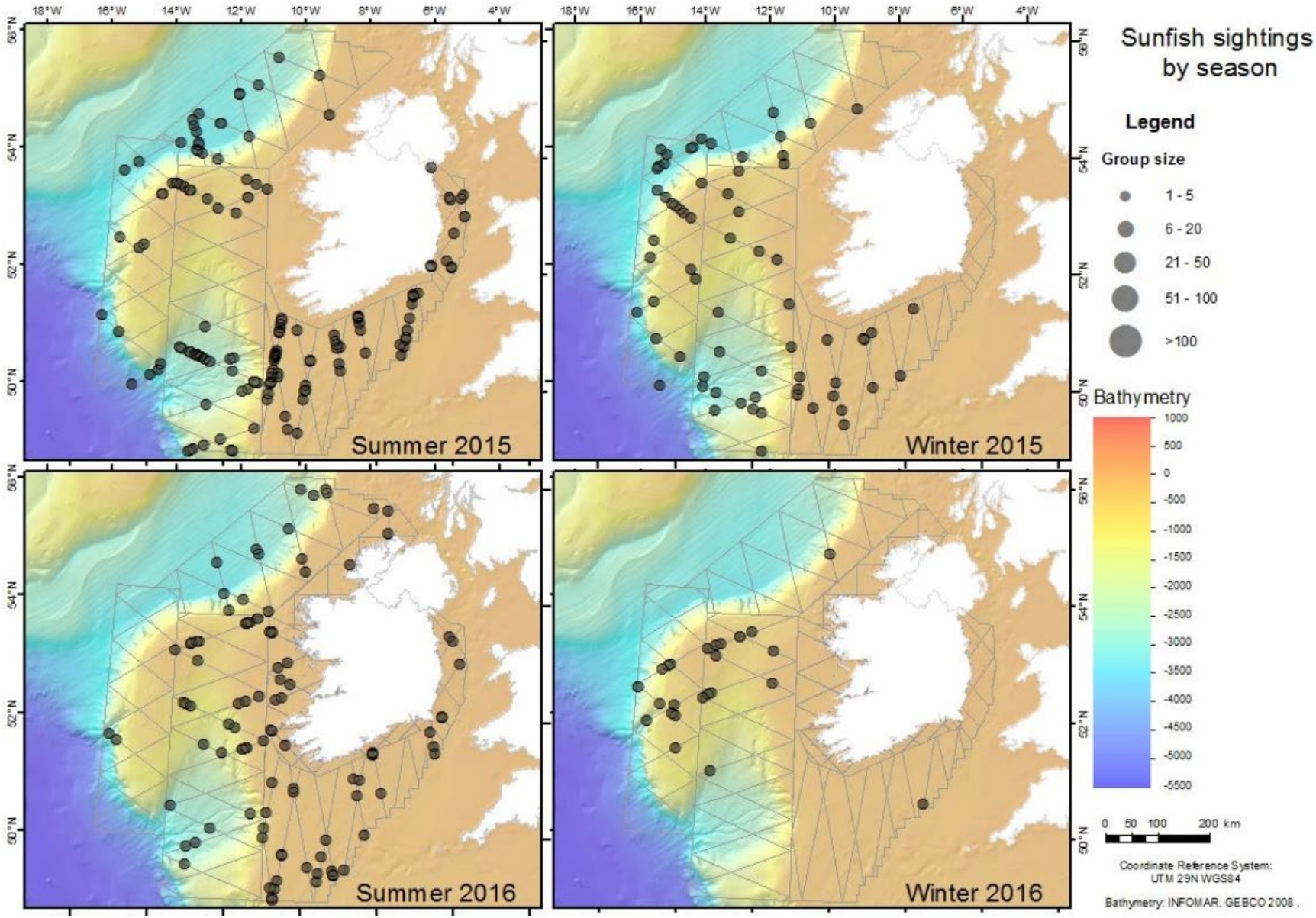

Figure 3-6 Ocean Sunfish (*Mola mola*) sightings during the Phase I of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey tracklines along which sightings were made. Circles are proportional to the number of individuals in each sighting (Rogan *et al.*, 2018).

12.9.2 DEMERSAL AND PELAGIC TELEOST FISH

The marine environment within and surrounding the PDB supports a variety of teleost (bony) fish species, including both demersal species associated with seabed habitats and pelagic species that utilise the water column. These fish may occur year-round or seasonally, using the area for foraging, shelter, or as a movement corridor.

While no dedicated fish surveys were undertaken for this assessment, the presence and likely distribution of teleost species were informed by:

- Benthic drop-down video and grab sampling surveys (see Technical Appendix 11: Benthic Ecology)
- National and regional data sources (e.g. NPWS, OSPAR, IFI)
- Existing environmental literature, including the Arklow Bank Wind Park 2 EIAR

12.9.2.1 DEMERSAL TELEOSTS

Demersal species expected to occur within or near the PDB include:

- Common goby (*Pomatoschistus microps*) – A small-bodied coastal fish tolerant of soft substrates and estuarine salinity fluctuations.
- Sand goby (*Pomatoschistus minutus*) – Commonly associated with sandy or mixed sediment substrates in shallow waters.
- Dragonet (*Callionymus lyra*) – Prefers shallow, sandy subtidal areas with low turbidity.
- Hooknose (*Agonus cataphractus*) – A gravel-associated benthic species found in nearshore environments.
- Two-spotted goby (*Gobiusculus flavescens*) – Occurs in reef mosaic areas with macroalgal cover and was observed during seabed imagery analysis.

12.9.2.2 PELAGIC AND SEMI-PELAGIC TELEOSTS

The following pelagic and semi-pelagic species are likely to occur in the wider area:

- Atlantic mackerel (*Scomber scombrus*) – A highly migratory species that may transit through the region during seasonal feeding movements.
- Sand smelt (*Atherina presbyter*) – A small schooling fish commonly found in shallow, inshore waters.
- Sprat (*Sprattus sprattus*) – Forms large schools in productive coastal environments and may pass through the study area.
- Herring (*Clupea harengus*) – Juveniles in particular may use nearby coastal areas as feeding habitat or movement corridors.

12.9.2.3 HABITAT SUITABILITY AND OBSERVATIONS

The benthic drop-down video survey recorded low overall faunal biomass and species richness, reflecting the heavily modified nature of the Rosslare Harbour environment and the effects of ongoing dredging and port activity. Nonetheless, small demersal fish such as gobies and dragonets were observed in patches of sand veneer and cobble reef habitats. These areas also supported prey species such as common spider crab (*Maja brachydactyla*), indicating localised potential foraging value for fish.

No spawning aggregations or primary nursery grounds were identified within the PDB. However, areas of suitable sediment type and prey availability may support secondary foraging opportunities for juvenile demersal fish.

The enclosed harbour configuration, combined with frequent vessel traffic and elevated turbidity, reduces the likelihood of persistent pelagic aggregations within the site. Nevertheless, transient pelagic species - particularly forage fish such as sprat and herring - may occur intermittently in nearshore waters during productive seasonal periods.

12.9.2.4 NBDC RECORDS

Additional bony fish species recorded within the T11 10 km² grid, in which the Proposed Development is located, include a range of coastal and demersal taxa such as flounder (*Platichthys flesus*), saithe (*Pollachius virens*), dab (*Limanda limanda*), and whiting (*Merlangius merlangus*). These records reflect the presence of typical inshore assemblages associated with sandy and muddy substrates in the Irish Sea. Species such as Ballan wrasse (*Labrus bergylta*), shanny (*Lipophrys pholis*), and rocklings (*Gaidropsarus spp.*, *Ciliata mustela*) are also indicative of structured coastal habitats, including rocky reef or artificial hard substrates.

Occasional records of more pelagic or wide-ranging species, including mackerel (*Scomber scombrus*), sea bass (*Dicentrarchus labrax*), and garfish (*Belone belone*), suggest transient use of the area by mobile taxa. Notably, rare or sporadic records of oceanic or warm-water species such as opah (*Lampris guttatus*) and swordfish (*Xiphias gladius*) were also documented. These are considered ecologically incidental, given their isolated nature and limited habitat overlap with the Proposed Development area.

A full list of fish species records within the T11 grid, along with record dates and data sources, is provided in Table 3-2.

Table 3-4 Fish Species Records in T11 10km² Grid

Bony fish species (*Actinopterygii*)	No. of Records	Date of Most Recent Record	Data Source
Ballan Wrasse (*Labrus bergylta*)	7	01/10/2014	Irish Federation of Sea Anglers Catch

Bony fish species (*Actinopterygii*)	No. of Records	Date of Most Recent Record	Data Source
Bull Rout (*Myoxocephalus scorpius*)	3	03/07/2014	Irish Federation of Sea Anglers Catch
Corkwing Wrasse (*Symphodus* (*Crenilabrus*) *melops*)	6	01/10/2014	Irish Federation of Sea Anglers Catch
Dab (*Limanda limanda*)	1	20/07/1994	BioMar Survey of Ireland
Five-bearded Rockling (*Ciliata mustela*)	4	24/11/2014	Irish Federation of Sea Anglers Catch
Flounder (*Platichthys flesus*)	9	24/11/2014	Irish Federation of Sea Anglers Catch
Garfish (*Belone belone*)	2	13/07/2014	Irish Federation of Sea Anglers Catch
Grey Triggerfish (*Balistes capriscus*)	3	13/08/1986	Rare marine fishes 1786–2008
Long-fin Tuna (*Thunnus alalunga*)	1	31/08/1901	Rare marine fishes 1786–2008
Mackerel (*Scomber scombrus*)	1	01/10/2014	Irish Federation of Sea Anglers Catch
Opah (*Lampris guttatus*)	1	27/07/1923	Rare marine fishes 1786–2008
Pilot-fish (*Naucrates ductor*)	1	07/08/2020	Explore Your Shore
Pouting (*Trisopterus luscus*)	1	01/10/2014	Irish Federation of Sea Anglers Catch
Saithe (*Pollachius virens*)	6	24/11/2014	Irish Federation of Sea Anglers Catch
Sand Goby (*Pomatoschistus minutus*)	1	20/07/1994	BioMar Survey of Ireland
Sea Bass (*Dicentrarchus labrax*)	2	19/11/2014	Irish Federation of Sea Anglers Catch
Sea Scorpion (*Taurulus bubalis*)	3	01/10/2014	Irish Federation of Sea Anglers Catch
Shanny (*Lipophrys pholis*)	5	25/03/2023	Explore Your Shore
Shore Rockling (*Gaidropsarus mediterraneus*)	2	01/10/2014	Irish Federation of Sea Anglers Catch
Swordfish (*Xiphias gladius*)	1	31/12/1786	Rare marine fishes 1786–2008
Whiting (*Merlangius merlangus*)	3	01/10/2014	Irish Federation of Sea Anglers Catch

12.10 DIADROMOUS FISH

The western Irish Sea supports several diadromous fish species—those that migrate between marine and freshwater environments during different phases of their life cycle. These species are of high ecological and conservation value and are protected under Irish and EU legislation. The following species are considered to have the potential to occur within or near the PDB:

- Atlantic salmon (*Salmo salar*)
- Sea trout (*Salmo trutta* morph. *trutta*)
- River lamprey (*Lampetra fluviatilis*)
- Sea lamprey (*Petromyzon marinus*)
- Twaite shad (*Alosa fallax*)
- European eel (*Anguilla anguilla*)

The Slaney River, which flows into the Irish Sea via Wexford Harbour approximately 6 km north of the Proposed Development, is the nearest river designated as salmonid waters under the Salmonid River Regulations. The river is open to catch-and-release angling only from 17th March to 31st August and is closed to fishing for the remainder of the year (IFI, 2024a).

The River Slaney and River Boyne are regionally significant catchments and are both designated Special Areas of Conservation (SACs). These rivers support Annex II species listed under the EU Habitats Directive, including Atlantic salmon, lamprey species, and European eel. The Slaney River Valley SAC (Site Code: 000781) specifically lists Atlantic salmon, sea lamprey, river lamprey, and twaite shad as Qualifying Interests (QIs) (NPWS, 2024). The River Avoca, while historically affected by mining-related pollution, continues to support sea trout and may offer limited habitat for other diadromous species.

12.10.1 SALMONIDS

Both Atlantic salmon and sea trout are anadromous species, meaning they spawn in freshwater and migrate to sea for feeding and growth.

12.10.1.1 ATLANTIC SALMON (*SALMO SOLAR*)

Atlantic salmon typically return from the North Atlantic to natal rivers in spring or summer after spending one or more winters at sea. Spawning occurs between November and March in well-oxygenated rivers with gravel substrates. Juveniles (parr) remain in freshwater for 2–3 years before undergoing smoltification and migrating to sea between March and June (IFI, n.d. Atlantic Salmon species information).

During the marine phase, salmon may use Irish coastal waters for feeding and early dispersal. However, acoustic telemetry studies have shown that smolts originating from rivers along the northeast coast of Ireland tend to migrate northward through the North Channel, avoiding the western Irish Sea (Barry *et al.*, 2020). Similarly, salmon from SAC rivers in Wales are believed to migrate northward along the eastern Irish Sea before entering offshore waters (Cefas, 2024).

Populations from southeast Ireland and northwestern Spain have been tracked crossing the Celtic Sea, targeting offshore frontal systems and shelf-edge habitats en route to transatlantic feeding grounds near East Greenland (Rikardsen *et al*., 2021; refer to Figure 3-4 below). These findings indicate that while Irish coastal waters may serve as staging and early dispersal areas for smolts, the core migratory corridors of salmon from eastern catchments generally bypass the western Irish Sea.

Field surveys along the River Slaney in 2016 found no evidence of Atlantic salmon spawning activity in the tidally influenced section downstream of Seamus Rafter Bridge (Jacobs, 2017). Furthermore, no Young of the Year (0+) salmonids were recorded during electrofishing or freshwater pearl mussel surveys in this reach, and overall densities of salmonid hosts were considered low (EcoFact, 2016; Jacobs, 2017). However, redds believed to be from adult salmon were observed upstream of Enniscorthy town during lamprey spawning surveys in April 2016 (Jacobs, 2017), suggesting some limited use of upstream gravels for spawning.

More recent electrofishing surveys conducted across 61 sites in the River Slaney Catchment between July and September 2023 confirmed Atlantic salmon presence at 42 sites (68%), making it the second most commonly recorded species (IFI, 2024b). Salmon were captured across two age classes (0+ and 1+), with the 0+ cohort being the most abundant. Individuals ranged in length from 3.0 to 16.4 cm. The highest total salmon density was recorded at Site 15 (Lucas Bridge) in the Derreen sub-catchment, with 0.456 fish/m², including a 0+ salmon density of 0.396 fish/m². The highest density of older salmon (1+ and above) was observed at Site 59 (Ballycarney Bridge), where it reached 0.101 fish/m².

Despite this relatively broad distribution, evidence of salmon recruitment failure was noted at a number of sites, contributing to classifications of Moderate or Poor ecological status under the Water Framework Directive (WFD). These failures were attributed to low densities or the absence of expected age cohorts, indicating likely recruitment constraints. Potential limiting factors include nutrient enrichment, habitat degradation, and migration barriers within the catchment (IFI, 2024b).

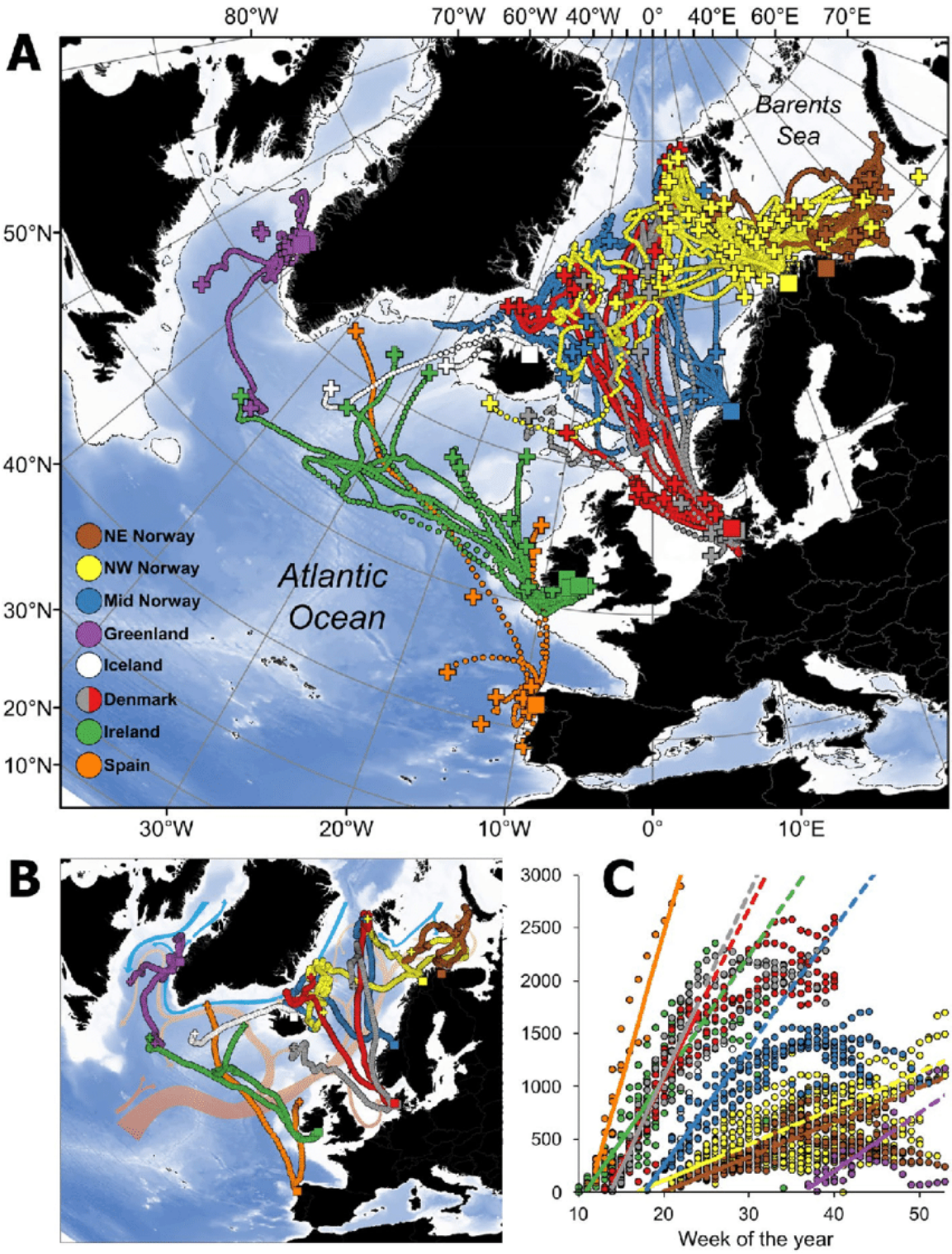

Figure 3-7 Migrations of Atlantic salmon tagged in eight different geographic areas (Rikardsen *et al.*, 2021).

12.10.1.2 SEA TROUT (*SALMO TRUTTA*)

Sea trout are the anadromous form of brown trout and typically remain in estuarine and coastal environments during their marine phase, exhibiting strong coastal fidelity. Tagging studies show that

post-smolt and post-spawning sea trout often remain within 20–40 km of their natal estuaries, particularly during early marine life stages (CSTP, 2016). Adults return to freshwater between June and December to spawn.

This shallow coastal behaviour makes sea trout more likely than Atlantic salmon to interact with nearshore marine developments. The waters around Rosslare Europort, though modified and subject to frequent vessel activity, may still provide secondary habitat for foraging and transit, particularly during summer and autumn.

Surveys of the River Slaney also recorded low densities of brown trout, the freshwater-resident form of sea trout, with only two individuals captured during electrofishing at seven sites in July 2016 (Jacobs, 2017). No evidence of sea trout spawning or juvenile presence was recorded in the surveyed tidally influenced section, though suitable gravel substrates were noted. Given their use of estuarine and inshore areas for feeding and movement, these results support the view that sea trout may use the waters near Rosslare Europort opportunistically, but not as core habitat.

Although generally less abundant, sea trout were recorded at 7 of the 61 sites (12%) during the 2023 IFI electrofishing survey (IFI, 2024b). A total of nine (9) individuals were captured, most measuring under 30 cm and representing two age classes (2.0+ and 2.1+), with 2.0+ being more common. These records confirm that sea trout still occur within the Slaney Catchment, albeit at low densities. Their presence across multiple sub-catchments supports the species' known migratory use of the system during spawning return phases. However, their low abundance aligns with broader national trends in population decline and supports a precautionary approach when evaluating potential marine-phase interactions with the Proposed Development.

Sea trout undergo smoltification after approximately two years in freshwater, transforming physiologically to tolerate saltwater and migrating downstream between March and June (IFI, n.d. Sea trout species information). At sea, they utilise productive inshore waters to feed and grow before returning to rivers to spawn. Individual variation is high: some sea trout return after only a few months (finnock), while others remain at sea for over a year (maidens). Return migrations may include movement through multiple estuaries, highlighting the ecological importance of accessible and low-disturbance coastal zones.

Although typically associated with western Ireland, sea trout also occur in south-eastern rivers, including the Slaney, which lies within the wider regional context of Rosslare Harbour. Given this connectivity, the harbour and adjacent waters may be used opportunistically during marine phases. Sea trout are considered a sensitive species, with population declines reported in recent decades due to pressures such as sea-lice infestations, habitat degradation, and climate-related changes (IFI, n.d.; Sea trout species information).

12.10.2 CLUPEIDS

Twaite shad is a native, anadromous species in Irish waters and a member of the Clupeidae (herring) family. It is currently listed under Annex II and Annex V of the EU Habitats Directive and is classified as Vulnerable on the Ireland Red List (King *et al*., 2011). In Ireland, its distribution is now limited, with confirmed spawning populations primarily in the River Barrow and River Suir (IFI, n.d., Twaite

Shad species information). Although historical records suggest former presence in the River Slaney and River Boyne, recent reports indicate a decline in the Slaney population, despite its designation as a QI within the Slaney River Valley SAC (King *et al*., 2011).

Twaite shad are typically found in coastal waters and estuaries in the southeast of Ireland, including areas potentially overlapping with the Rosslare Europort development footprint. During their marine phase, they forage on plankton, invertebrates, and small fish in inshore waters. Adult fish migrate into large rivers in spring and early summer (April–June), where spawning occurs at night over clean gravel substrates in the lower reaches of rivers and larger tributaries (IFI, n.d. Twaite Shad species information). Unlike salmon, twaite shad may survive post-spawning and can reproduce in multiple years.

Morphologically, twaite shad are deep-bodied, herring-like fish with a sharp ventral keel, radiating lines on the gill covers, a notched upper jaw, and (in some cases) dark lateral spots. They are difficult to distinguish from the closely related allis shad (*Alosa alosa*), and hybridisation is known to occur, particularly where access to spawning grounds is limited by migration barriers (IFI, n.d., Twaite Shad species information).

The species' conservation status is of concern, with key pressures including pollution, river fragmentation by weirs and dams, and incidental capture in commercial fisheries. The occurrence of twaite shad in coastal waters near Rosslare during their marine phase remains plausible, especially given the historical use of the River Slaney system. Consequently, while the species is unlikely to be a permanent resident within the immediate footprint of the Proposed Development, a precautionary approach is warranted when considering potential impacts on migratory pathways or estuarine foraging areas.

No twaite shad were recorded during fish surveys or electrofishing carried out on the River Slaney in 2016 (EcoFact, 2016; Jacobs, 2017) or during the more recent catchment-wide surveys undertaken in 2023 by Inland Fisheries Ireland (IFI, 2024b). The absence of records, combined with degraded habitat conditions in the tidally influenced lower reaches, suggests that the species may no longer regularly utilise this section of the river. However, given the species' former presence in the Slaney system and its ongoing designation as a QI of the Slaney River Valley SAC, the possibility of occasional marine-phase use of the estuary or adjacent coastal waters cannot be excluded.

12.10.3 JAWLESS FISHES – PETROMYZONTIDS

Two additional diadromous species of conservation concern in Irish waters are the river lamprey and sea lamprey, both members of the jawless fish family Petromyzontidae. These species are of high ecological value due to their anadromous life histories and are listed under Annex II of the EU Habitats Directive.

River lamprey typically undertake short-range migrations, spawning in autumn and winter in clean, well-oxygenated gravel substrates of freshwater rivers. The larval stage (ammocoetes) persists in soft river sediment for several years before metamorphosing and migrating downstream to estuarine and coastal waters in spring. In contrast, sea lamprey undertake a longer marine phase

and return to freshwater to spawn from April to June, favouring large, unimpeded rivers with suitable gravelly substrate.

During their marine phase, both species are parasitic, feeding on the blood and body fluids of host fish. Common hosts include salmonids (e.g. Atlantic salmon and sea trout), clupeids (e.g. twaite shad), and other marine species such as herring and cod (Maitland, 2003). While this interaction generally does not cause host mortality, it forms part of the trophic structure in the western Irish Sea and can influence migratory fish populations.

Field surveys conducted in 2016 confirm that the River Slaney supports multiple life stages and species of lamprey. Spawning surveys recorded Brook and River Lamprey redds at several locations upstream of the Seamus Rafter Bridge in Enniscorthy, with spawning activity observed primarily in April and May (Jacobs, 2017). Redds believed to be from Atlantic salmon were also detected during this period. Juvenile lamprey surveys at seven sites recorded a total of 268 ammocoetes, all identified as Brook/River Lamprey. These were mainly found upstream of the tidal limit, with only a single juvenile recorded near the upper edge of the tidally influenced reach. No spawning or larval lamprey were recorded at the lower end of the study area, suggesting that tidal influence and sediment quality limit habitat suitability in downstream reaches (Jacobs, 2017).

A targeted survey for adult sea lamprey in June 2016 recorded only one dead individual at Clohamon. No live sea lampreys or confirmed redds were detected during the study period (Jacobs, 2017). These results suggest that the River Slaney supports River Lamprey and likely Brook Lamprey, with only limited or intermittent use by Sea Lamprey, potentially due to spawning habitat constraints or timing mismatches during survey windows.

Lamprey species were recorded at 10 of the 61 sites (17%) in the 2023 electrofishing survey (IFI, 2024b). While species-level identification was not provided in the summary results, previous surveys (Jacobs, 2017) confirmed the presence of Brook and River Lamprey in the system. The 2023 findings show lamprey presence predominantly in mid- and upper catchments, supporting the continued presence of suitable spawning and rearing habitats. However, as with salmonids, some areas showed reduced age-class diversity or absence, indicating recruitment constraints potentially linked to sedimentation, flow regulation, or fish passage issues.

Lamprey populations in the River Slaney and River Boyne are of particular conservation concern due to their sensitivity to water quality, flow regulation, and the presence of barriers to migration (NPWS, 2024; IFI, n.d., Sea and River Lamprey species information). Both rivers are designated SACs partly due to their importance for lamprey conservation.

Although neither species is expected to reside within the Rosslare Europort area, the proximity of the Slaney River estuary suggests that coastal waters near the Proposed Development may be used intermittently during the marine feeding phase, particularly by River Lamprey, which are known to utilise transitional and nearshore habitats.

Given the parasitic dependence of lampreys on Annex II host species such as Atlantic salmon and twaite shad, understanding lamprey distribution and habitat use is closely tied to host fish occurrence and migratory pathways. In this context, potential marine-phase use of waters near

Rosslare may occur; however, functional connectivity with designated SAC rivers is largely limited to those within a precautionary 35 km foraging range, as recommended by JNCC (2019). More distant SACs, particularly those without direct marine connectivity, are unlikely to support regular interaction with the Proposed Development area.

12.10.4 ANGUILLIDS – EELS

The European eel (*Anguilla anguilla*) is a catadromous species native to the North Atlantic Ocean and associated river systems across Ireland, Europe, and North Africa. Unlike anadromous species, European eels spawn in the ocean and migrate to freshwater and estuarine habitats as juveniles, where they spend the majority of their adult lives before returning to the Sargasso Sea to spawn. The species is listed as Critically Endangered on the IUCN Red List and is protected under Council Regulation (EC) No. 1100/2007 (EU Eel Regulation), which prohibits commercial and recreational fisheries for eels in Ireland (IFI, n.d., European Eel species information).

After hatching, eel larvae (*leptocephali*) are transported by ocean currents to the coasts of Europe and North Africa. Upon reaching coastal waters, they metamorphose into transparent glass eels and migrate into estuarine and freshwater systems, typically from February to May. These juvenile eels (elvers or “bootlace” eels) then settle in riverine and lacustrine habitats, feeding on benthic invertebrates and small fish, and developing into the yellow eel stage. Eels are extremely long-lived, with individuals reaching over 25 years, and some recorded as old as 50 years in Irish waters (IFI, n.d., European Eel species information).

As eels reach maturity, they transform into silver eels, marked by physiological adaptations such as increased eye size, elongation of pectoral fins, and silver pigmentation of the belly. This transformation prepares them for their transoceanic spawning migration. Downstream escapement typically occurs between September and January, often timed with flooding events and new moon phases, which offer darker conditions to avoid predation during the migration.

Telemetry studies conducted in Irish catchments such as the Shannon, Bann, and Burrishoole indicate that most tagged eels exit via the Celtic Sea, following a southwesterly migration route toward the Azores and Sargasso Sea, where spawning is believed to occur (Righton *et al*., 2016). Notably, no tagged eels were observed passing through the North Channel, and no tagging studies have released eels within the Irish Sea between eastern Ireland and Britain. While this limits definitive conclusions, the available data suggest that the Irish Sea does not serve as a primary migratory corridor for silver eels originating in Ireland.

Multiple pressures contribute to the species' critical decline, including climate-driven changes in ocean currents, barriers to migration, overfishing, pollution, and the introduction of invasive parasites such as *Anguillicola crassus*, which damages the swim bladders of eels and impairs their ability to complete the spawning migration (Inland Fisheries Ireland, n.d.).

Field survey evidence confirms continued use of the River Slaney Catchment by *Anguilla anguilla*. A total of 24 European eels were captured during electrofishing at seven sites in July 2016 (Jacobs, 2017), and more recently, Inland Fisheries Ireland (2024b) recorded eel presence at 17 of 61 sites (28%) during the 2023 catchment-wide survey. These records suggest that the River Slaney

continues to provide suitable habitat for elvers and yellow-phase eels, particularly in mid and upper catchment areas. However, the species' apparent absence from some survey locations, and its patchy distribution, may reflect localised recruitment challenges or reduced upstream connectivity. These findings support the view that the Slaney Catchment remains functionally important for eel maturation, even though the Irish Sea is not considered a primary migratory route for silver eel escapement to the Sargasso Sea.

12.11 SHELLFISH

Shellfish species within the Study Area include both freshwater and marine taxa of ecological and conservation interest. These organisms play important roles in aquatic ecosystems through nutrient cycling, sediment stabilisation, and as prey for higher trophic levels. Freshwater pearl mussels are of particular conservation concern due to their reliance on salmonid hosts and declining population trends. In the marine environment, shellfish assemblages include a mix of infaunal bivalves, epifaunal crustaceans, and ecologically important mobile species, some of which also support local fisheries. This section presents the baseline information on freshwater and marine shellfish species relevant to the Proposed Development, based on field surveys, desktop reviews, and consultation with local stakeholders.

12.11.1 FRESHWATER PEARL MUSSEL (*MARGARITIFERA MARGARITIFERA*)

The freshwater pearl mussel (FWPM) is a long-lived, Critically Endangered bivalve species of international conservation concern, protected under Annexes II and V of the Habitats Directive and listed as Critically Endangered on the Ireland Red List (Byrne *et al*., 2009). It exhibits an obligate parasitic larval stage (glochidia) that must attach to the gills of suitable salmonid host species, particularly Atlantic salmon and brown trout (the freshwater-resident form of sea trout), to complete its early development. The long-term viability of FWPM populations is therefore dependent on the presence and successful recruitment of these anadromous fish species.

Although no freshwater pearl mussels are present in the marine or intertidal areas of the Proposed Development, their inclusion in this appendix is justified by the potential for indirect impacts via effects on migratory fish hosts. This is particularly relevant for the Slaney River Valley SAC, which supports a recognised population of FWPM, especially in its upstream freshwater habitats.

A FWPM survey was carried out on the River Slaney at Enniscorthy in July and September 2016 (EcoFact, 2016). A total of 51 live mussels were recorded, with most (n=42) found in the uppermost 500 m of the survey stretch. A particularly important 180 m section supported 32 individuals, mostly in cobble/rock substrates near the channel centre and right bank. Habitat quality was generally poor, with unstable, silted bed conditions, and no evidence of recent recruitment. Densities of host salmonids were low, and no 0+ salmon or trout were recorded during this survey or associated electrofishing.

A single live mussel was recorded in the tidally influenced reach, though this area was considered unsuitable for sustaining populations. Additional spot-checks upstream confirmed presence at Scarawalsh Bridge and near the River Bann confluence, with dead shells recorded at Clohamon,

indicating a previously wider distribution. A separate aquatic survey (Jacobs, 2017) also confirmed the presence of live *M. margaritifera* within the affected reach, supporting the EcoFact findings.

Overall, the River Slaney supports a significant but ageing population of FWPMs in upstream sections, with no active recruitment and high sensitivity to sedimentation and host fish decline. Conservation of this species remains strongly linked to maintaining healthy salmonid populations, and the Slaney River Valley SAC is of continuing ecological importance in this regard.

12.11.2 MARINE SHELLFISH SPECIES

Marine shellfish assemblages within the Benthic Study Site were characterised through detailed site-specific benthic grab sampling, drop-down video transects and supporting habitat mapping. These investigations confirmed the presence of diverse infaunal and epifaunal taxa associated with sedimentary and reef habitats, consistent with a moderately disturbed nearshore environment.

12.11.2.1 SUBTIDAL INFAUNAL COMMUNITIES

Subtidal grab sampling across 40 stations revealed sediment communities dominated by taxa typical of circalittoral muddy sands and slightly mixed sediments, including high densities of *Abra alba*, *Nucula nitidosa*, *Corbula gibba*, and *Tellina fabula*. The biotope *SS.SSa.CMuSa.AalbNuc* (*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment) was assigned to the majority of sand-dominated stations, particularly in the central and eastern portions of the site (Technical Appendix 11: Benthic Ecology). In some locations, *A. alba* reached exceptional densities of over 1,900 individuals per 0.1 m² (e.g., Station 18), contributing to low community evenness and diversity indices.

In more gravel-rich areas, the assemblages shifted towards mixed sediment biotopes such as *SS.SMx.IMx.MedCirr* (*Mediomastus fragilis* and *cirratulids* in infralittoral mixed sediment). These communities supported moderate numbers of polychaetes such as *Nephtys hombergii*, *Euclymene oerstedii*, and *Spirobranchus lamarcki*, alongside estuarine indicators including *Tubificoides benedii* and *Cirriformia tentaculata*. Some sites, such as Station 23, were assigned the biotope *SS.SMu.SMuVS.CapTubi*, which includes *Capitella capitata* and *Tubificoides* spp., both indicative of slightly enriched or brackish conditions.

12.11.2.2 EPIFAUNAL AND REEF-ASSOCIATED SHELLFISH

Drop-down video transects confirmed the presence of patchy cobble reef areas classified as *IR.HIR.KSed.ProtAhn – Polyides rotundus*, *Ahnfeltia plicata*, and *Chondrus crispus* on sand-covered infralittoral rock. These habitats occurred primarily along the southern margin and at the northwestern and northeastern extents of the site, often in mosaic with mobile sediments (Technical Appendix 11: Benthic Ecology). Although these reefs supported relatively low faunal diversity, they provided structurally complex habitats supporting species such as the anemones *Anemonia viridis* and *Cereus pedunculatus*.

A key ecological feature observed during video analysis was the widespread occurrence of the common spider crab (*Maja brachydactyla*), particularly in reef areas. Notable aggregations were recorded at several transects (e.g., 14, 16, 17), sometimes associated with discarded fishing gear.

This species was also observed occasionally on adjacent sediment habitats, reflecting its role as a mobile predator-scavenger in nearshore food webs (Technical Appendix 11: Benthic Ecology).

12.11.2.3 INTERTIDAL SHELLFISH HABITAT

Intertidal surveys of the Small Boat Harbour and adjacent rocky shores identified four fucoid-dominated biotopes: *LR.LLR.F.Fves*, *LR.LLR.FVS.Fcer*, *LR.MLR.BF.FspiB*, and *LR.MLR.BF.Fser*. Shellfish taxa observed included *Littorina littorea*, *Patella vulgata*, *Mytilus edulis*, and *Steromphala cineraria*, all typical of mid- to lower-shore habitats in moderately exposed rocky shorelines. No rare or sensitive shellfish features such as *Zostera* beds, maerl, or native oyster beds were recorded, and no invasive alien species were detected, though specific IAS surveys were not undertaken (Technical Appendix 11: Benthic Ecology).

12.11.2.4 MOBILE AND COMMERCIALLY IMPORTANT SHELLFISH SPECIES

The desk-based review, local knowledge from the Fisheries Consultative Group, and habitat data confirmed the likely presence of several mobile or commercially important shellfish species within the wider Study Area:

- Razor clam (*Ensis siliqua*) – Present in suitable muddy sand habitats at 4–14 m depth; slow-growing, with pelagic larvae.
- Surf clam (*Spisula solida*) – Likely present based on sandy substrate; forms localised stocks and contributes to sediment stability.
- Whelk (*Buccinum undatum*) – Confirmed presence; found in sandy and mixed sediments; reproduces via direct-developing egg masses.
- Lobster (*Homarus gammarus*) – Likely associated with nearby reef habitats; larvae disperse pelagically.
- Velvet crab (*Necora puber*) – Confirmed from records and suitable habitat; contributes to predation and prey dynamics in shallow reef-mixed areas.
- Brown crab (*Cancer pagurus*) – Likely presence inferred from regional stocks and habitat availability.
- Spider crab (*Maja brachydactyla*) – Observed in aggregations across cobble reef and soft sediments; a key ecological indicator species.
- Shrimp (*Palaemon serratus*) – Short-lived, likely present in mixed sediment habitats; an important prey species.
- Scallop (*Pecten maximus*) – Potentially present in deeper sandy and gravelly areas; low mobility but ecologically relevant.

Overall, the marine shellfish community within the Benthic Study Site is characterised by opportunistic infaunal taxa and ecologically functional epifaunal assemblages in sediment and reef mosaics. Species of conservation or commercial importance are present or likely to occur based on substrate suitability and regional records. However, the absence of sensitive or protected shellfish features suggests that overall vulnerability of the shellfish community to the Proposed Development

is limited, though effects on foraging and shelter habitats for mobile shellfish should be considered further in impact assessments.

12.12 NURSERY AND SPAWNING GROUNDS

The early life stages of fish and shellfish are highly sensitive to environmental change, particularly in relation to habitat disturbance, increased suspended sediments, and water quality degradation (Wenger *et al*., 2017; Kjelland *et al*., 2015). Accordingly, the identification and characterisation of spawning and nursery grounds within the zone of impact[1]/influence[2] is essential to understanding the potential ecological risks associated with the Proposed Development.

Spatial data provided by the Marine Institute's Marine Atlas (https://atlas.marine.ie) and ICES were reviewed to identify spawning and nursery ground distributions for key marine species within and around the Proposed Development Boundary. These datasets consolidate long-term fisheries-independent survey data and expert knowledge and are commonly used in EIAs to characterise baseline conditions.

These datasets consolidate long-term fisheries-independent survey data and expert knowledge and are commonly used in EIAs to characterise baseline conditions. However, the spatial resolution of these datasets is relatively coarse, and mapped areas may extend into reclaimed or modified zones such as Rosslare Europort. Therefore, presence within mapped zones does not confirm current habitat suitability but indicates the general ecological importance of the area at a regional scale.

Although *Nephrops norvegicus* is a crustacean species, it is presented here alongside fish species for consistency with the structure of the referenced datasets. The following species are recorded as having recognised spawning and/or nursery grounds overlapping with or adjacent to the Proposed Development Boundary:

- Nephrops (*Nephrops norvegicus*): Recognised spawning and nursery areas directly overlap with the Proposed Development Boundary. Nephrops utilise soft, muddy substrates, and juveniles remain in burrows for extended periods following larval settlement.
- Lemon sole (*Microstomus kitt*): Both spawning and nursery areas coincide with the Proposed Development area. This species is demersal and typically associated with sandy and muddy substrates.
- Sprat (*Sprattus sprattus*): Spawning grounds overlap with the Proposed Development. Sprat is an important forage species, with eggs and larvae dispersed in the water column. It plays a critical trophic role in the Irish Sea, serving as a key prey species for seabirds, marine mammals, and larger fish. The presence of spawning grounds within the Proposed

[1] **Zone of Impact (ZoI)**: The spatial area within which a specific pressure (e.g. underwater noise, sedimentation) from the Proposed Development is predicted to cause measurable effects on ecological receptors, based on modelling outputs or established thresholds.
[2] The **Zone of Influence (ZoI)** is broader and includes all areas where ecological receptors could be affected, directly or indirectly, by any aspect of the Proposed Development, whereas the **Zone of Impact** refers to the specific area where a given pressure produces measurable effects.

Development Boundary highlights the potential for indirect ecological effects from habitat disturbance on predator species dependent on early life stages of forage fish.

- Cod (*Gadus morhua*) and Whiting (*Merlangius merlangus*): Cod nursery grounds overlap with the Proposed Development, while both spawning and nursery grounds for whiting are also present. These are demersal species of ecological and commercial significance.
- Horse mackerel (*Trachurus trachurus*) and Mackerel (*Scomber scombrus*): Nursery grounds for both pelagic species overlap with Rosslare Europort. Juveniles of both species may utilise the wider inshore areas as nursery habitat.
- Herring (*Clupea harengus*): The Proposed Development overlaps with recognised nursery grounds, while the nearest mapped spawning grounds lie just outside the Development Boundary. Herring is another key forage fish and has demersal adhesive eggs that require clean gravel or macroalgal substrates.

These species-specific distributions are illustrated in Figure 3-5 to Figure 3-14. Each figure presents spawning and nursery ground extents for key species in relation to the Proposed Development Boundary and surrounding Irish Sea region.

Although spawning and nursery grounds are present within or near the Proposed Development Boundary, it is important to consider the existing highly modified and anthropogenically disturbed nature of Rosslare Europort, which may reduce the functional value of these habitats relative to more natural or undisturbed areas. However, the potential for these areas to provide some ecological function, particularly for early life stages, cannot be discounted.

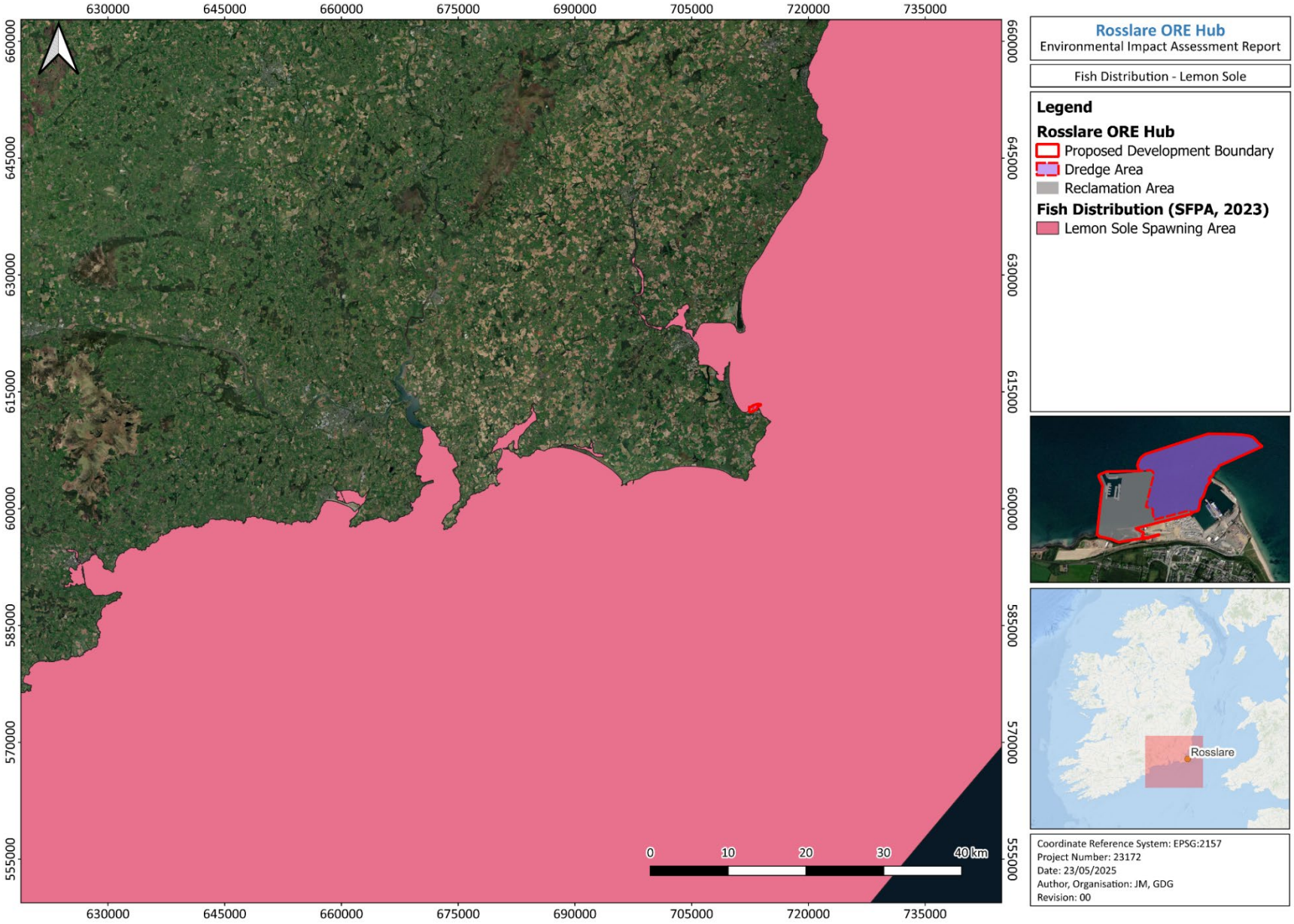

Figure 3-8 Lemon Sole Distribution: Spawning Area (SFPA, 2023)

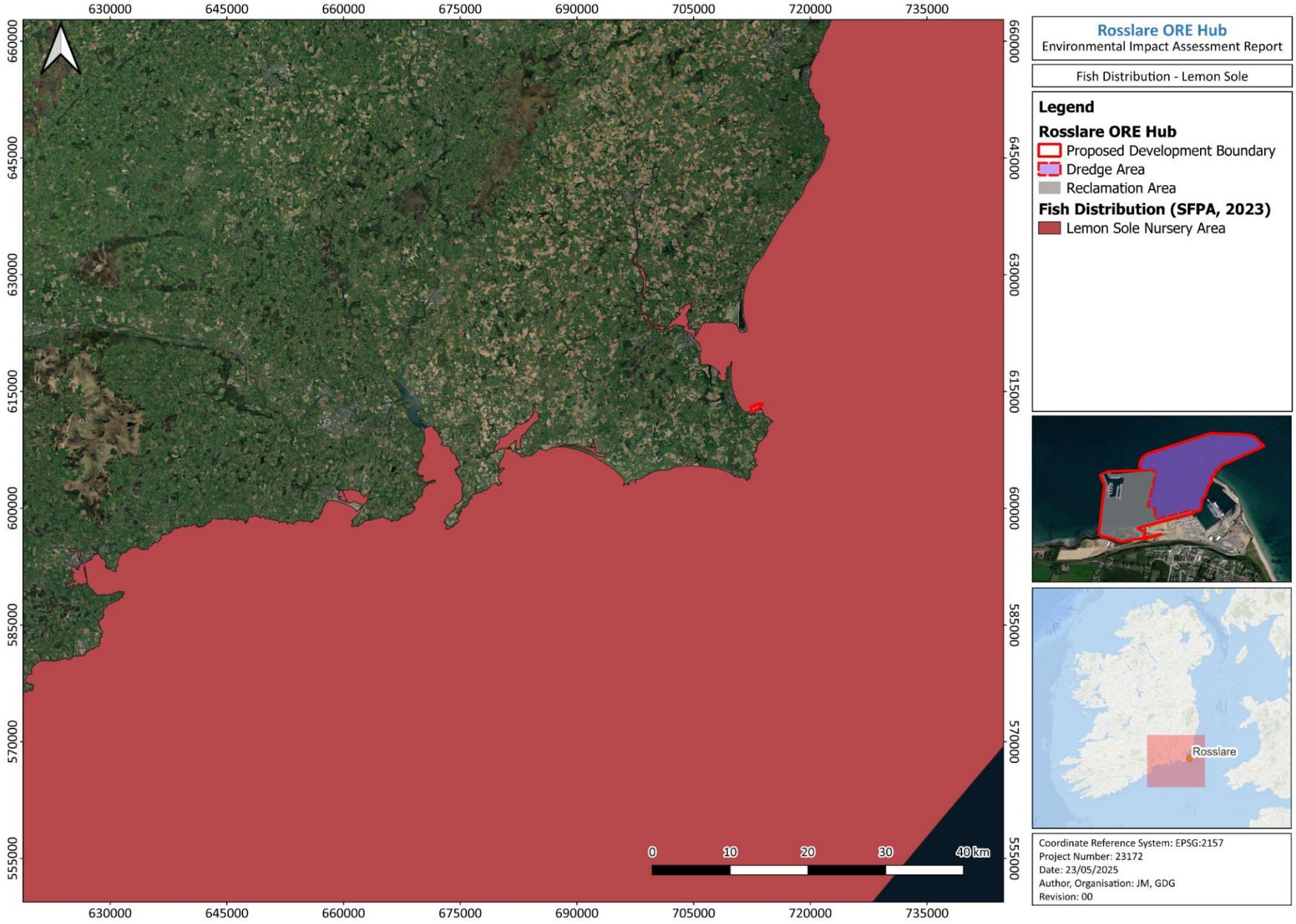

Figure 3-9 Lemon Sole Distribution: Nursery Area (SFPA, 2023)

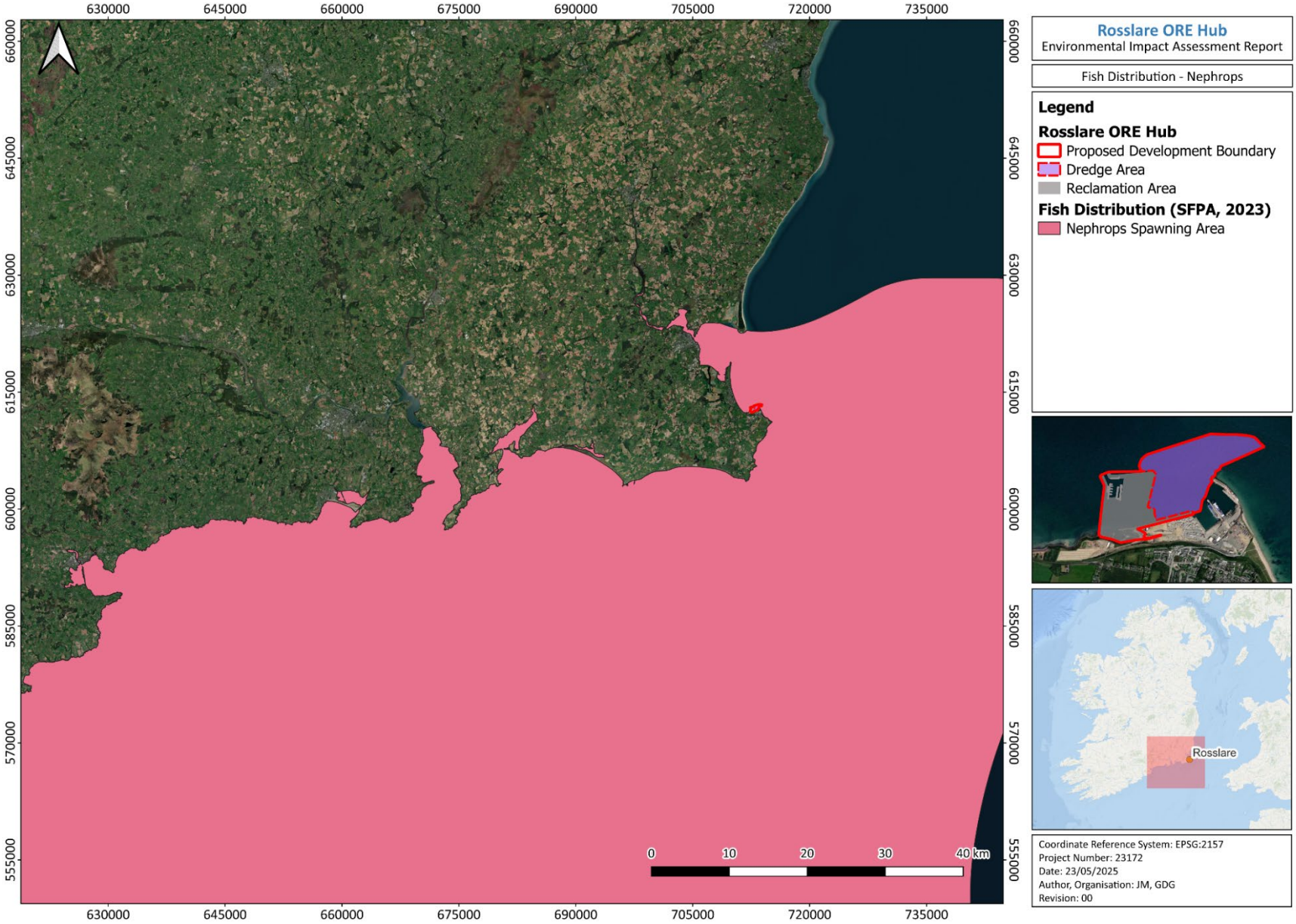

Figure 3-10 Nephrops Distribution: Spawning Area (SFPA, 2023)

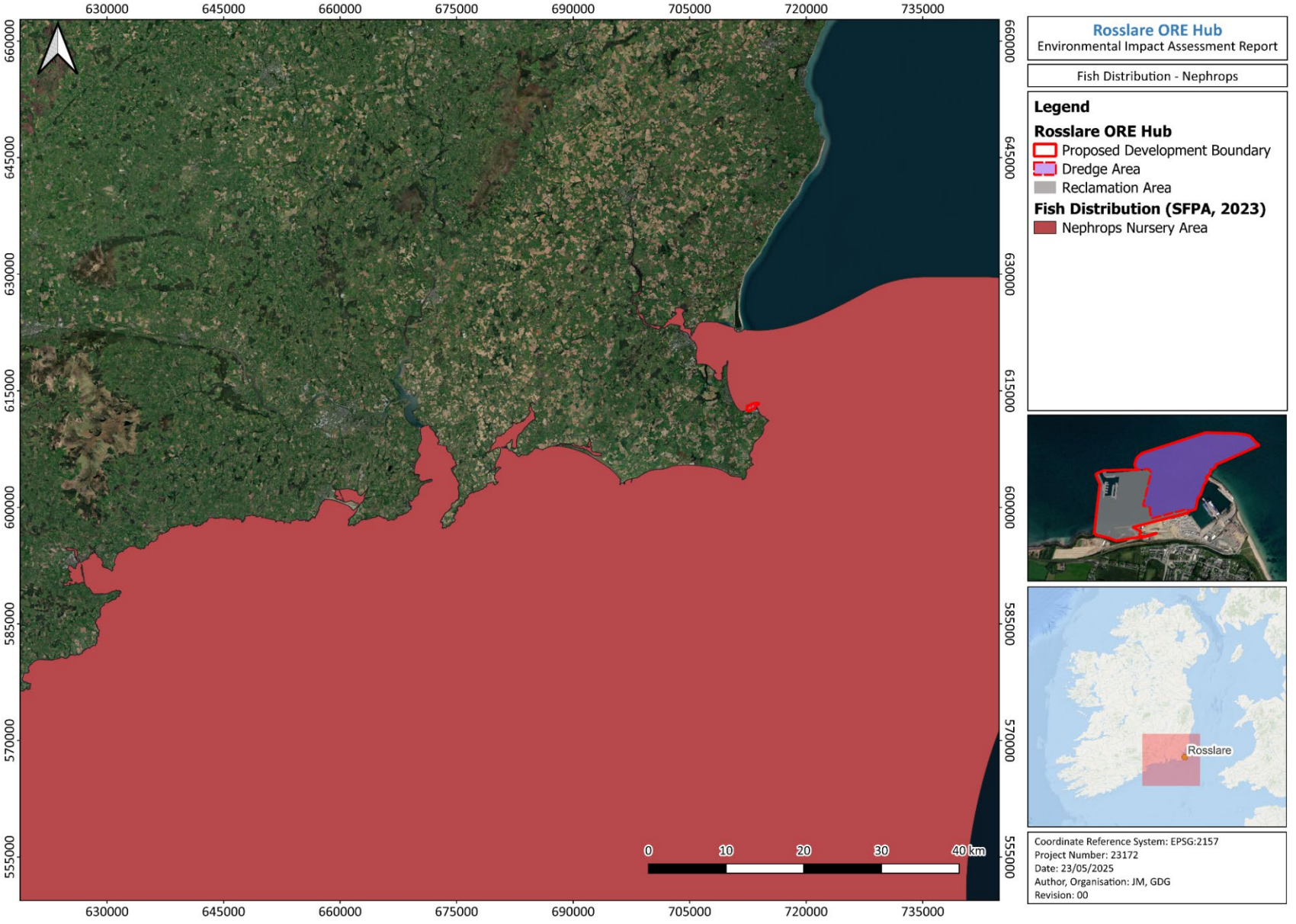

Figure 3-11 Nephrops Distribution: Nursery Area (SFPA, 2023)

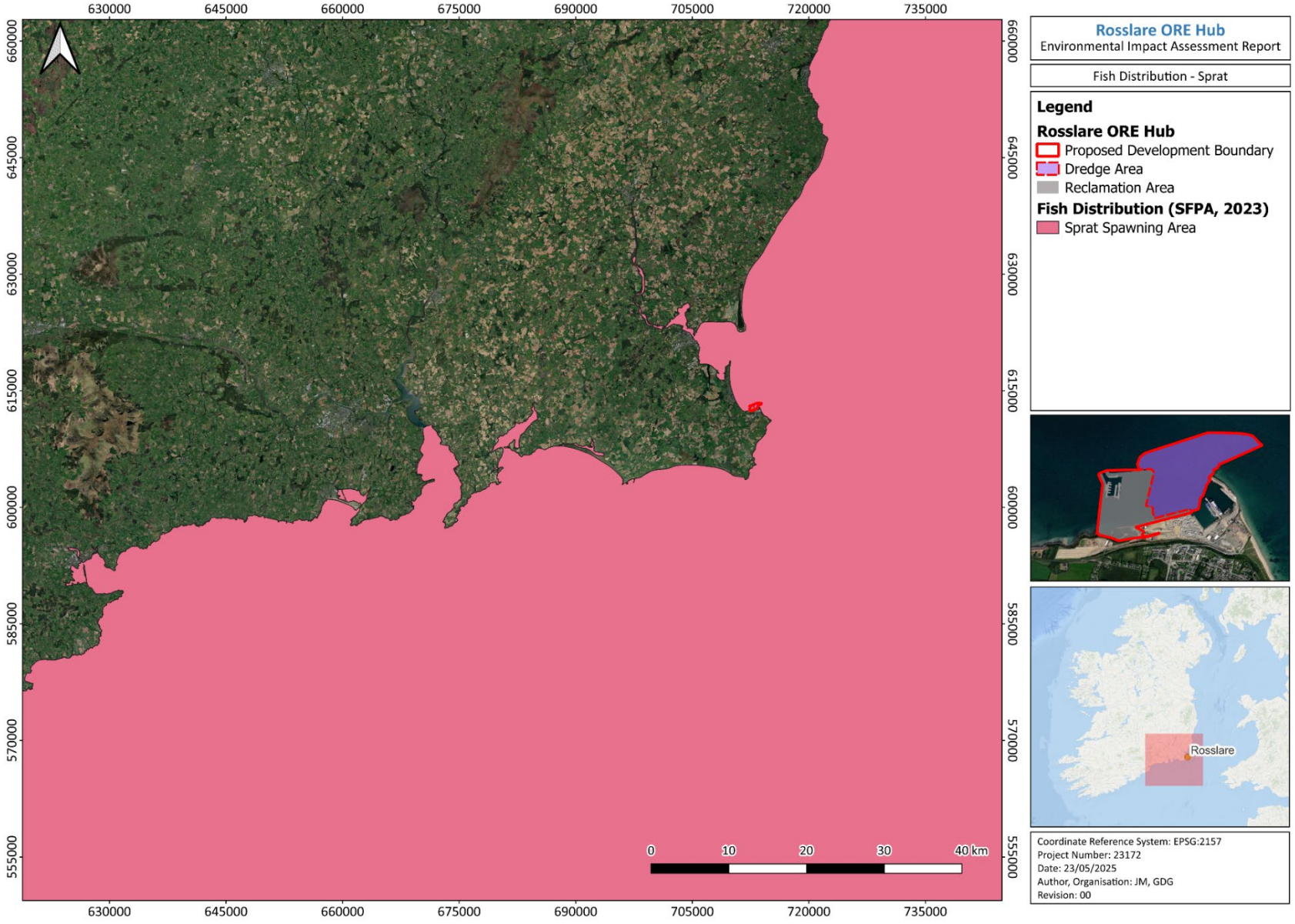

Figure 3-12 Sprat Distribution: Spawning Area (SFPA, 2023)

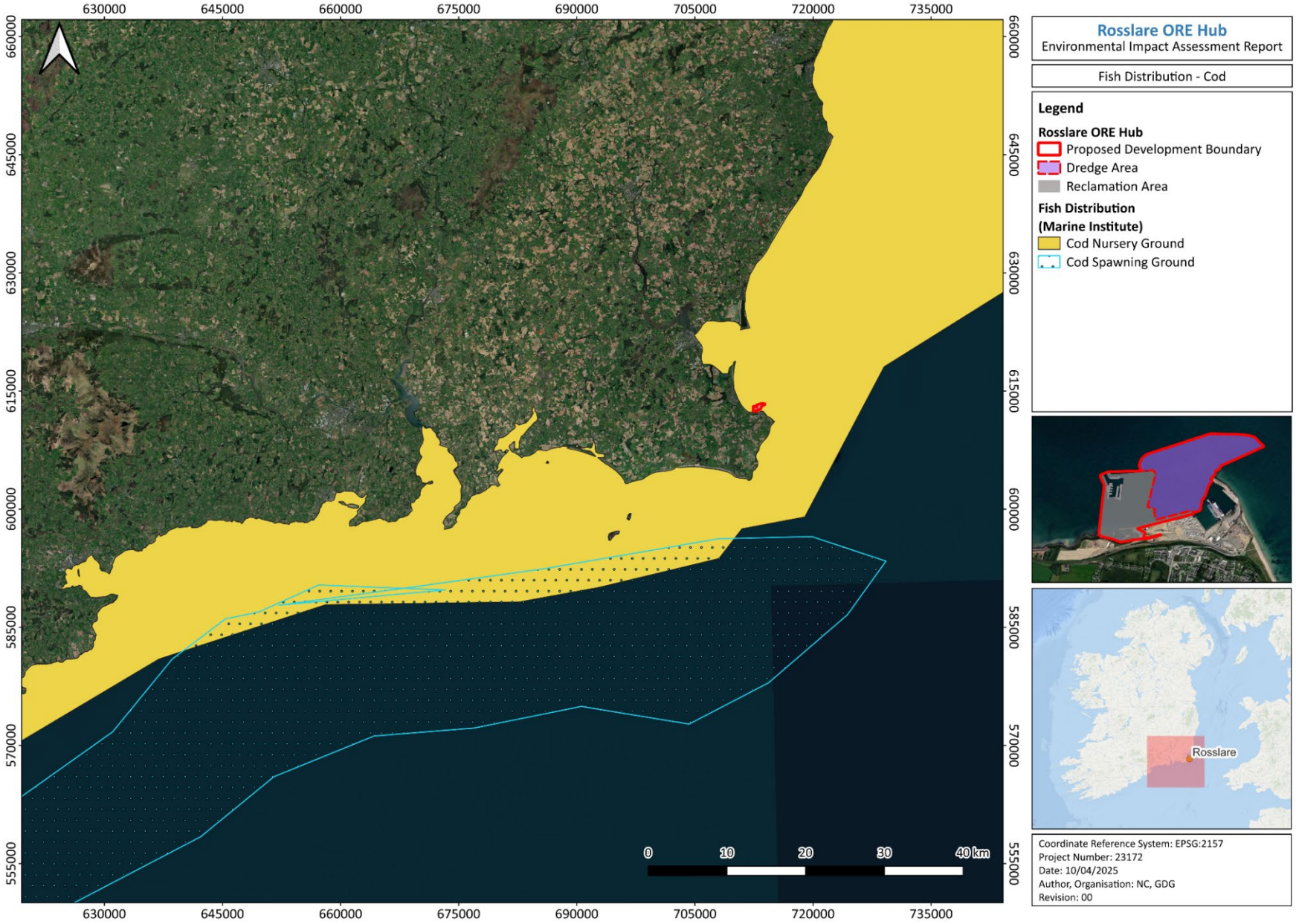

Figure 3-13 Cod Distribution; Nursery and Spawning Grounds (Marine Atlas, 2024)

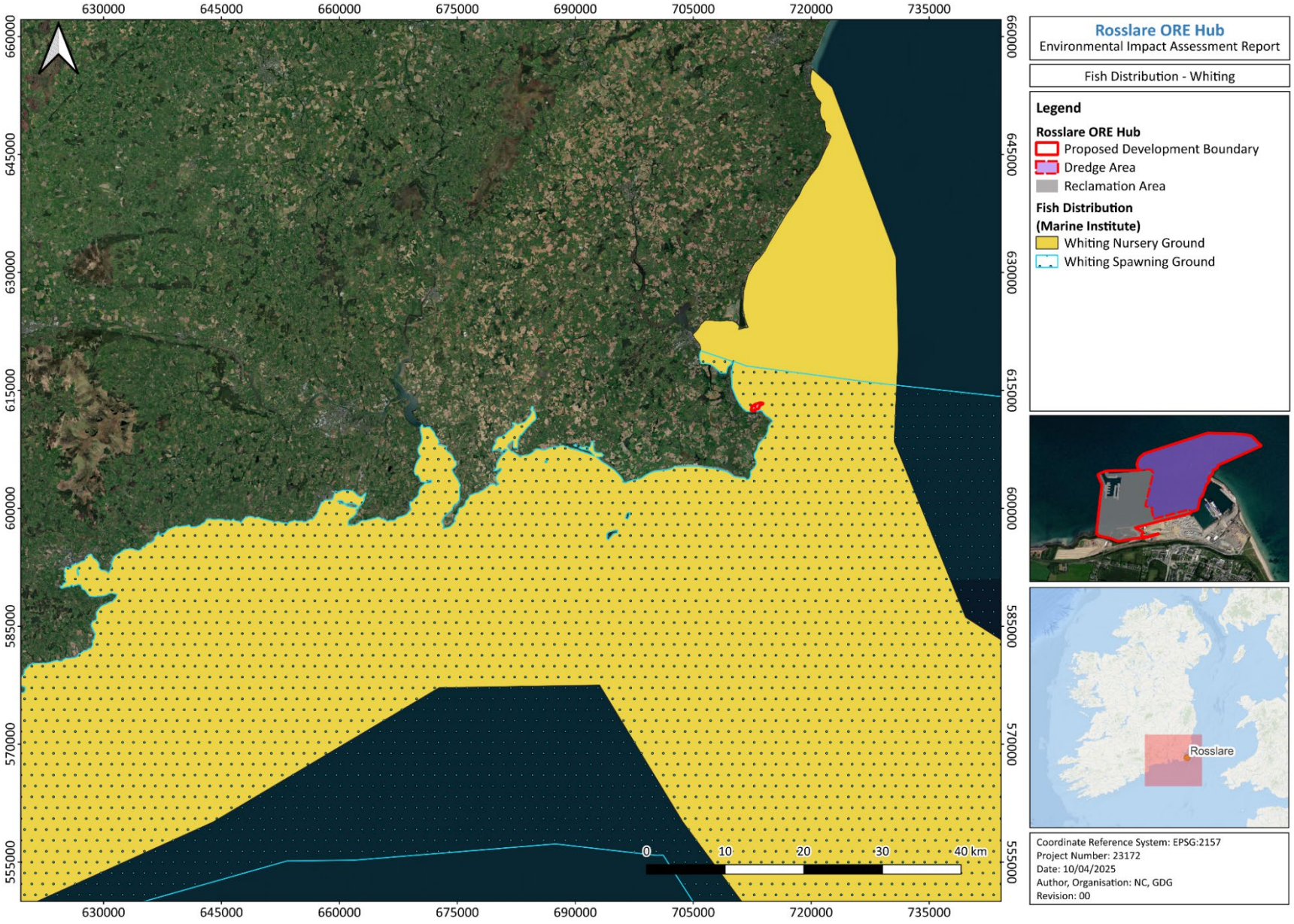

Figure 3-14 Whiting Distribution; Nursery Grounds (Marine Atlas, 2024)

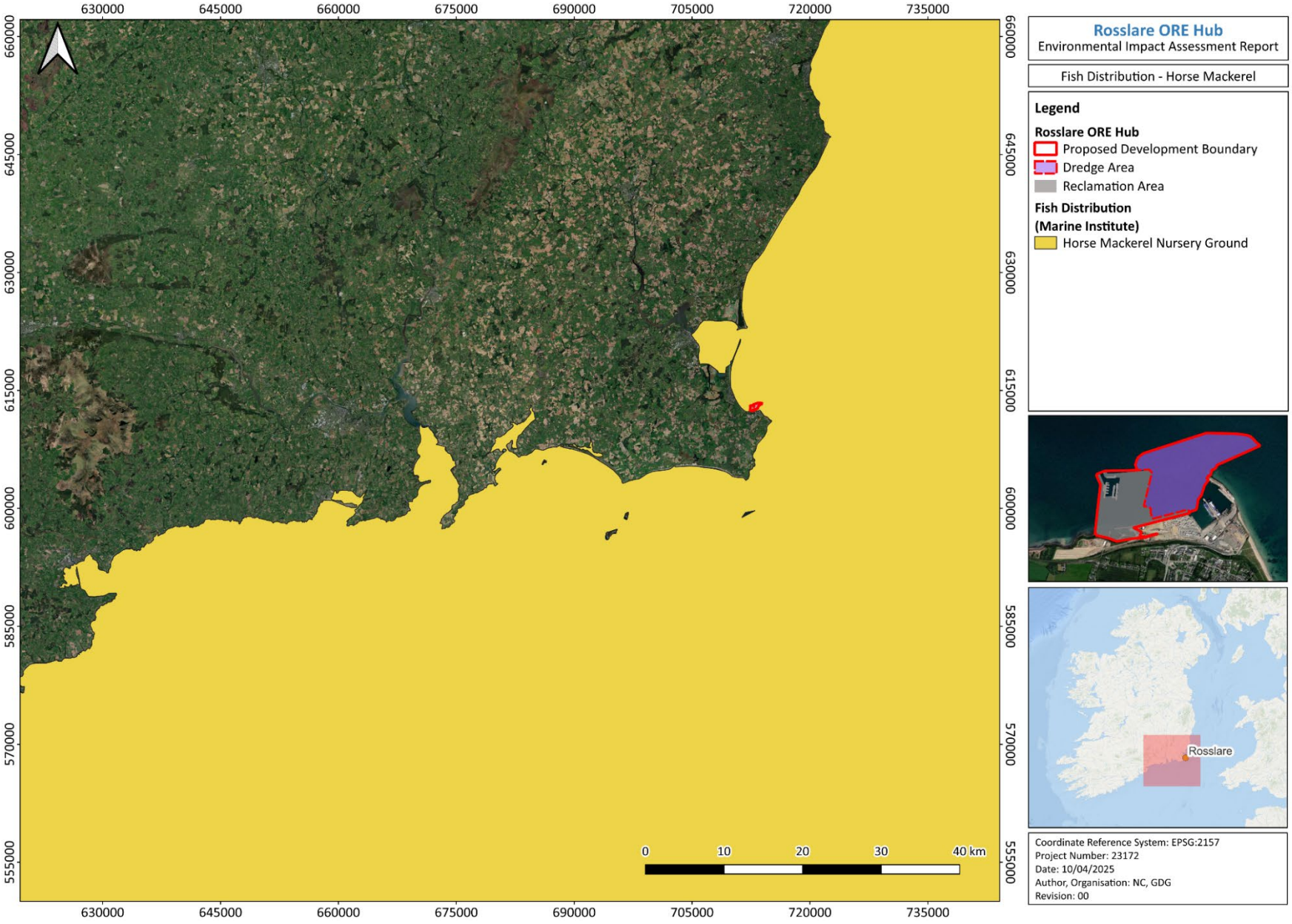

Figure 3-15 Horse Mackerel Distribution; Nursery Grounds (Marine Atlas, 2024)

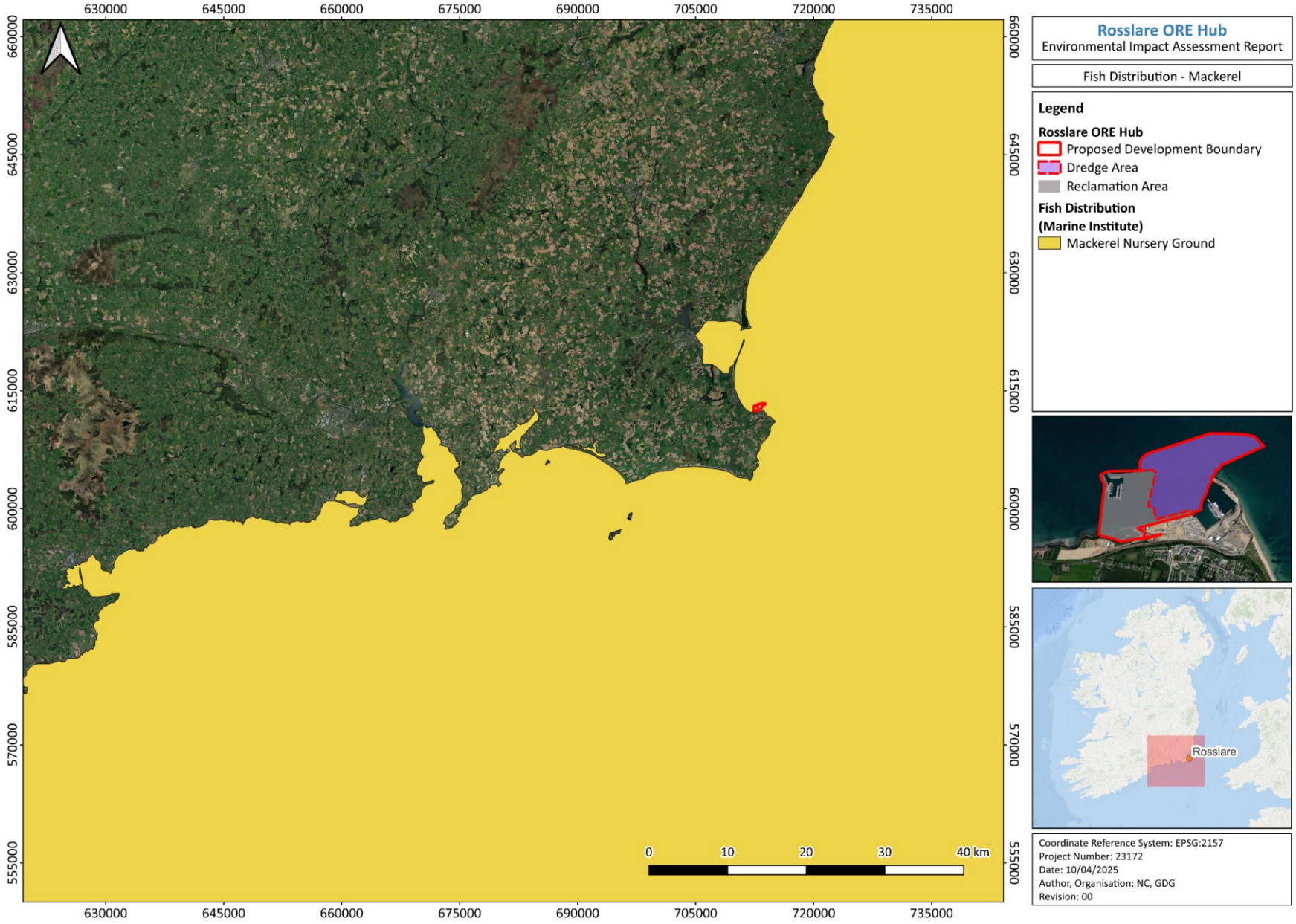

Figure 3-16 Mackerel Distribution; Nursery Grounds (Marine Atlas, 2024)

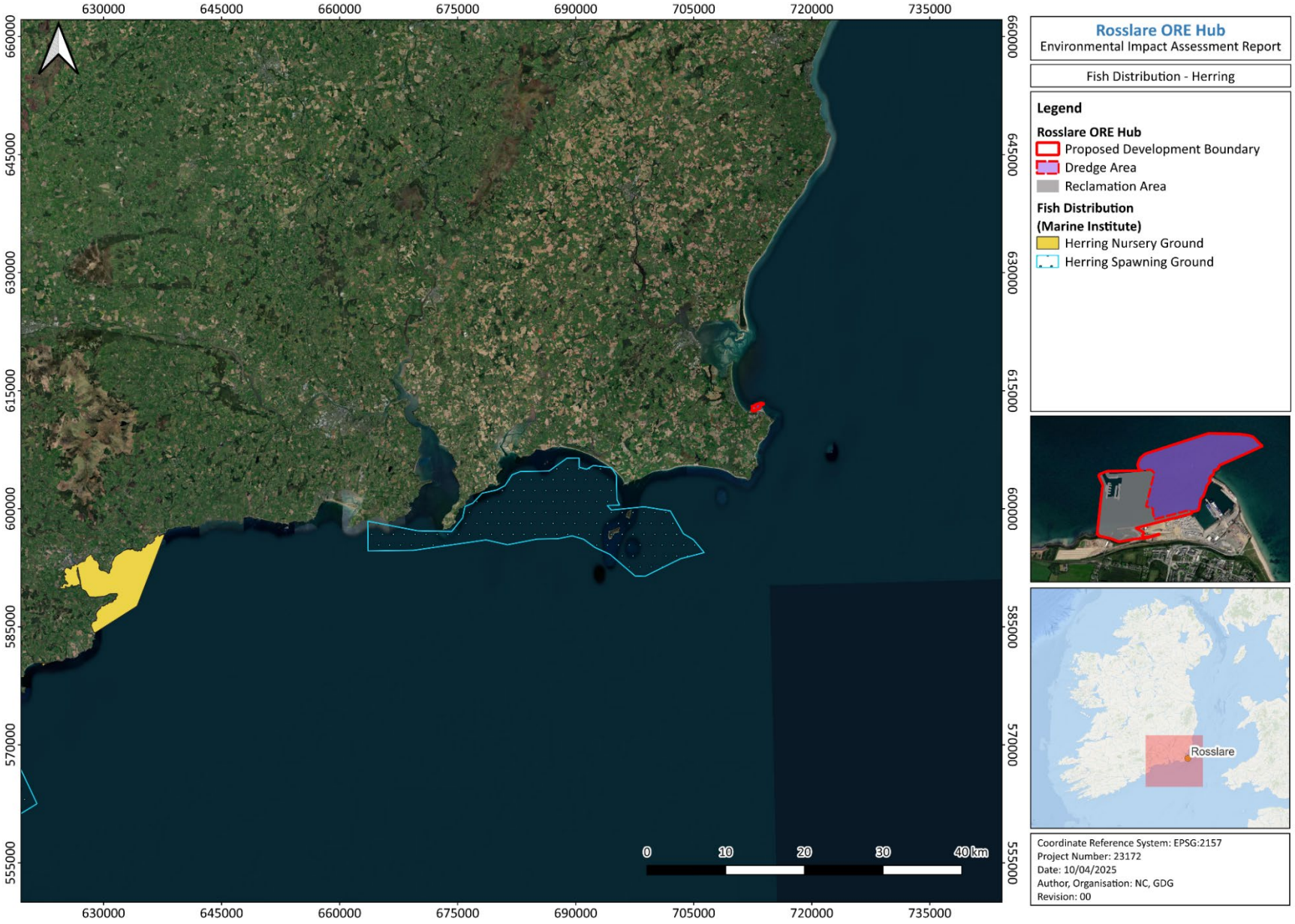

Figure 3-17 Herring Distribution; Nursery and Spawning Grounds (Marine Atlas, 2024)

12.13 ELASMOBRANCHS

Elasmobranchs, comprising sharks, skates, and rays, are cartilaginous fish characterised by K-selected life histories - slow growth, delayed maturity, and low fecundity - making them particularly vulnerable to anthropogenic pressures (Dulvy *et al*., 2014). These traits contribute to their high conservation concern globally and regionally. In Irish waters, several species of elasmobranchs, both benthic and pelagic, are known to occur. This section presents an overview of the key species considered relevant to the Rosslare ORE Hub study area based on a desk-based review of existing literature, distributional databases, and national monitoring programmes. Site-specific benthic and aerial surveys did not record any elasmobranchs within the Proposed Development footprint; however, potential presence is inferred based on regional data and known habitat preferences.

12.13.1 SHARKS

Among pelagic elasmobranchs, shark species such as blue shark (*Prionace glauca*) and basking shark (*Cetorhinus maximus*) are of particular interest due to their periodic presence in Irish offshore waters and their conservation status.

12.13.1.1 BLUE SHARK (*PRIONACE GLAUCA*)

The blue shark is a wide-ranging pelagic elasmobranch that occurs throughout temperate and tropical oceanic waters, including the northeast Atlantic. It is one of the most widely distributed shark species globally and exhibits extensive seasonal migrations influenced by sea surface temperature, prey availability, and oceanographic conditions (Campana *et al*., 2011; Queiroz *et al*., 2016).

Blue sharks are typically associated with deep, offshore waters but also utilise continental shelf habitats during the summer and autumn months for foraging. Their diet primarily consists of pelagic fish and cephalopods. Tagging and telemetry studies show they are highly mobile, with individuals capable of trans-oceanic movements spanning thousands of kilometres (Queiroz *et al*., 2012; Vandeperre *et al*., 2014). Ireland lies along one of the principal northeast Atlantic migratory corridors used by blue sharks moving between subtropical overwintering areas and temperate feeding grounds.

Despite their broad distribution and frequent occurrence in offshore waters, blue sharks are considered vulnerable to anthropogenic pressures due to high bycatch rates in pelagic longline and drift net fisheries. They are currently listed as Near Threatened on the IUCN Red List (Rigby *et al*., 2019). While they are not protected under Irish national legislation, they are included in data collection frameworks under the EU Data Collection Multiannual Programme (DC-MAP).

No blue sharks were recorded within the Irish Sea during either Phase I or Phase II of the ObSERVE aerial survey programme. However, sightings were frequent in continental shelf waters to the south and west of Ireland, particularly during summer months. During Phase II, a total of 149 sightings comprising 155 individuals were recorded. All sightings occurred during summer, with only two individuals observed in winter. Model-based abundance estimates for blue shark in Irish waters were 3,053 individuals (95% CI: 1,218–4,351) in Summer 2021 and 1,033 individuals (95% CI: 291–2,114) in

Summer 2022, highlighting both a strong seasonal presence and interannual variability (Giralt Paradell *et al.,* 2024). The predicted spatial distribution of blue sharks from Phase II is illustrated in Figure 3-15.

In addition to confirmed blue shark records, 50 sightings of unidentified shark species were reported during Phase II, all occurring during summer and primarily within shelf waters, with some observations extending into deeper regions such as the Rockall Trough and Porcupine Seabight. These sightings also support the broader pattern of strong seasonality in surface presence. The spatial distribution of these sightings is presented in Figure 3-16 (Giralt Paradell *et al*., 2024).

During Phase I of ObSERVE, blue sharks were again recorded almost exclusively during summer months and were concentrated in shelf waters south and west of Ireland. Sightings from 2015 and 2016 produced design-based abundance estimates of 2,037 individuals (CV: 27.37%) and 2,596 individuals (CV: 25.45%), respectively (Rogan *et al*., 2018). These estimates were not corrected for availability bias and are thus likely conservative. The distribution of blue shark sightings from Phase I is illustrated in Figure 3-17.

Although blue sharks have not been recorded in the Irish Sea, their regular seasonal presence in the Celtic Sea and along the south coast indicates some potential for overlap with offshore infrastructure projects situated in southern Irish shelf waters. Nonetheless, due to their preference for deeper offshore environments, direct interaction with the nearshore footprint of the Proposed Development is considered unlikely.

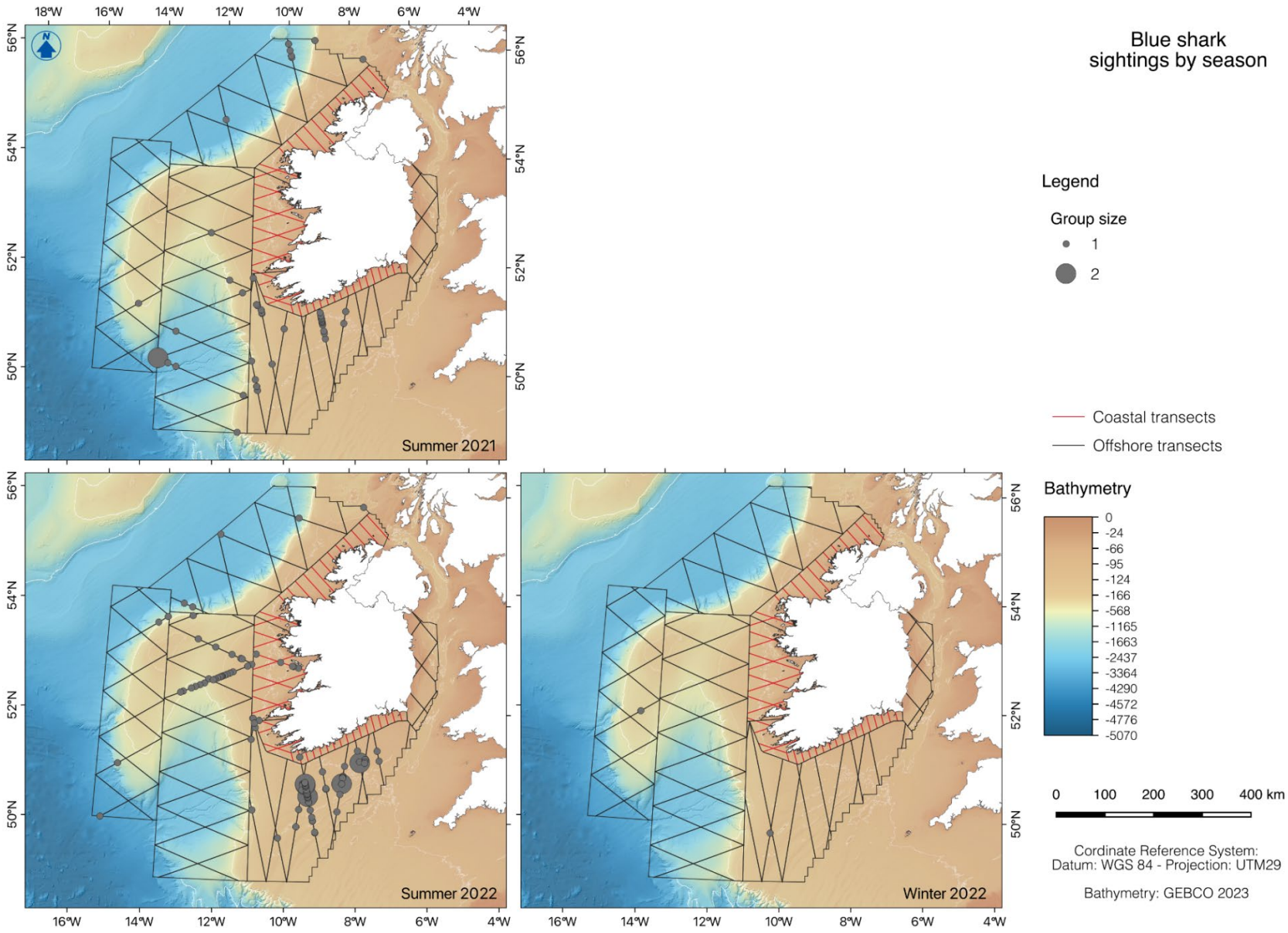

Figure 3-18 Blue shark sightings during Phase II of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey track lines in the offshore strata and red lines indicate the track lines in the coastal strata. Circles are proportional to the number of individuals in each sighting (Giralt Paradell *et al.*, 2024).

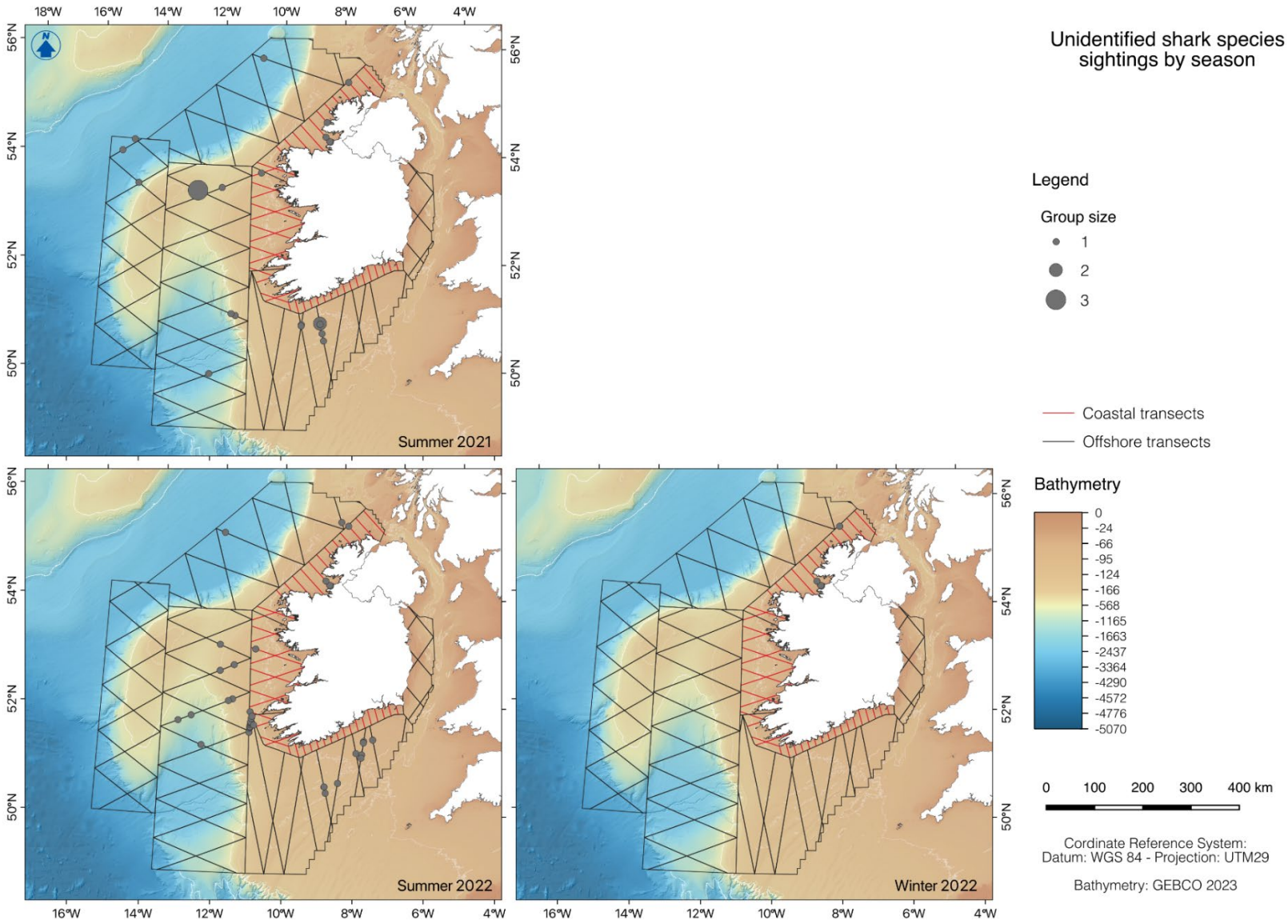

Figure 3-19 Unidentified shark sightings during Phase II of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey track lines in the offshore strata and red lines indicate the track lines in the coastal strata. Circles are proportional to the number of individuals in each sighting (Giralt Paradell *et al.*, 2024).

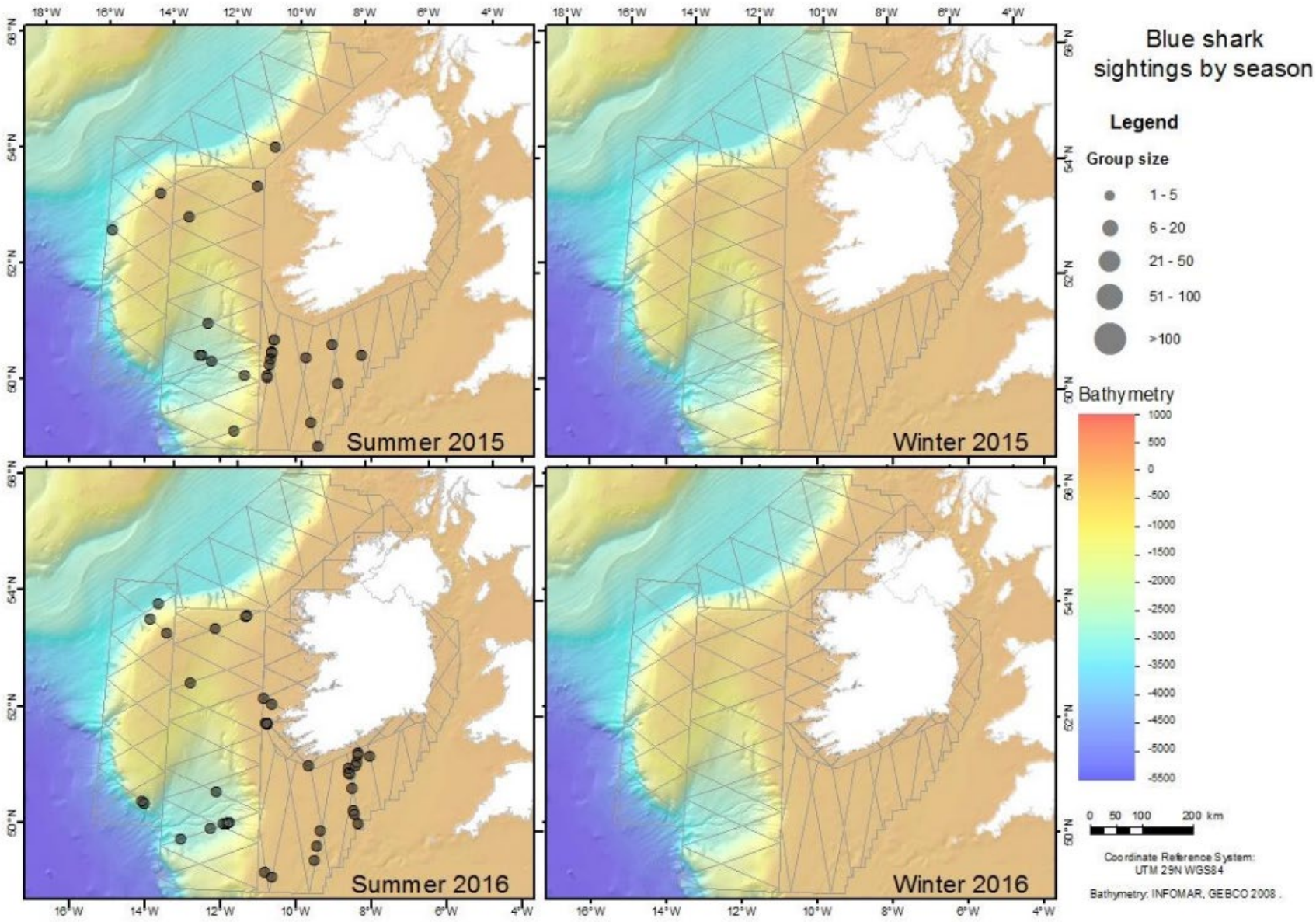

Figure 3-20 Blue shark sightings during the Phase I of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey tracklines along which sightings were made. Circles are proportional to the number of individuals in each sighting (Rogan et al., 2018).

12.13.1.2 BASKING SHARK (*CETORHINUS MAXIMUS*)

Basking sharks are obligate filter feeders, relying on zooplankton as their primary food source. As such, their seasonal distribution is closely linked to the availability of suitable foraging areas, particularly those rich in planktonic prey (Sims, 2008; Sims *et al*., 2006). Sightings are most common during summer months, particularly in recognised aggregation areas or 'hotspots' such as western Ireland, western Scotland, southwest England, and the Isle of Man (Witt *et al*., 2012). Although not a core aggregation area, the Irish Sea is regularly used by basking sharks during summer and forms part of their wider seasonal range (Berrow and Heardman, 1994; Southall *et al*., 2005; Doherty *et al*., 2017; Witt *et al*., 2012).

Tagging and telemetry studies have demonstrated that basking sharks exhibit both localised site fidelity and long-distance movements, with individuals capable of travelling rapidly between regions in search of plankton-rich feeding grounds (Sims *et al*., 2003). More recently, genetic tagging studies have indicated that the Irish Sea may act as a migratory corridor connecting multiple foraging sites across the northeast Atlantic (Lieber *et al*., 2020).

During summer, basking sharks are commonly observed swimming near the surface, either singly or in small groups, feeding at slow speeds when plankton concentrations are high. In contrast, winter behaviour is characterised by deeper diving (>750 m) and more extensive movement patterns, sometimes involving migrations of over 3,000 km to locate alternative foraging areas (Sims *et al*., 2003).

Despite increased scientific attention, many aspects of basking shark life history remain poorly understood, particularly in relation to reproduction. Courtship-like behaviours have been observed in Irish coastal waters, particularly off the west coast, during late summer, and recent video tagging studies using animal-borne cameras have provided new insights into potential social interactions occurring at depth (Rudd *et al*., 2021).

In contrast, winter months are associated with more extensive migrations and deep diving behaviour (>750 m), as sharks move further offshore to locate alternative prey sources (Sims *et al*., 2003). Despite increased research attention, many aspects of basking shark life history remain poorly understood, particularly in relation to mating and breeding sites. While courtship-like behaviours have been observed off western Ireland and Scotland between May and November, these events are not spatially consistent, suggesting the possibility of environmental drivers influencing site selection (Sims *et al.,* 2022).

In Ireland, basking sharks are now afforded full legal protection under Section 23 of the Wildlife Act 1976, as amended, which prohibits their deliberate capture, disturbance, or interference with breeding or resting areas.

During Phase II of the ObSERVE aerial survey programme, a total of 25 sightings comprising 41 individuals were made over the course of the surveys, with basking sharks recorded almost exclusively in continental shelf waters shallower than 200 m (Giralt Paradell *et al*., 2024). Sightings showed strong seasonality, with 96% of sightings recorded during the summer survey periods, and

only two observations made in deeper offshore waters, including one during Winter 2022–2023. The majority of sightings occurred in coastal stratum 6B accounting for the majority of sightings. Additional sightings occurred in Strata 1, 2, 3, 4, and 6A. **No basking sharks were recorded in the Irish Sea**. Figure 3-18 presents the observed distribution of basking sharks during the Phase II of ObSERVE summer (2021 and 2022) aerial surveys, highlighting the species' preference for coastal shelf waters, particularly along the south-western margin of the Irish EEZ.

Basking sharks were recorded during both summer seasons of Phase I of the ObSERVE aerial survey programme, with an additional single sighting in winter 2016–2017 (Rogan *et al*., 2018). In contrast to blue sharks, most basking sharks were observed in coastal strata, reflecting a stronger association with inshore waters, although **one sighting was made in the Irish Sea**. The abundance estimates suggested higher abundance in the second survey year, which likely reflects increased survey effort in inshore strata in 2016. The model estimated 2,019 individuals in summer 2016 (CV: 39.85%) and a density of 0.006 basking sharks per km², though as with blue sharks, estimates were not corrected for availability bias and are therefore likely to be conservative. Figure 3-19 shows the distribution of basking shark sightings recorded during Phase I, highlighting the species' coastal preference and limited presence in offshore areas.

A data request submitted to the IWDG in March 2025 confirmed only a single basking shark sighting in the vicinity of the Proposed Development over a ten-year period. One adult basking shark was recorded near Tuskar Rock on 8th August 2017 (latitude 52.2454N, longitude -6.3032W) under good sea conditions (sea state 1, swell <1 m, visibility >20 km).

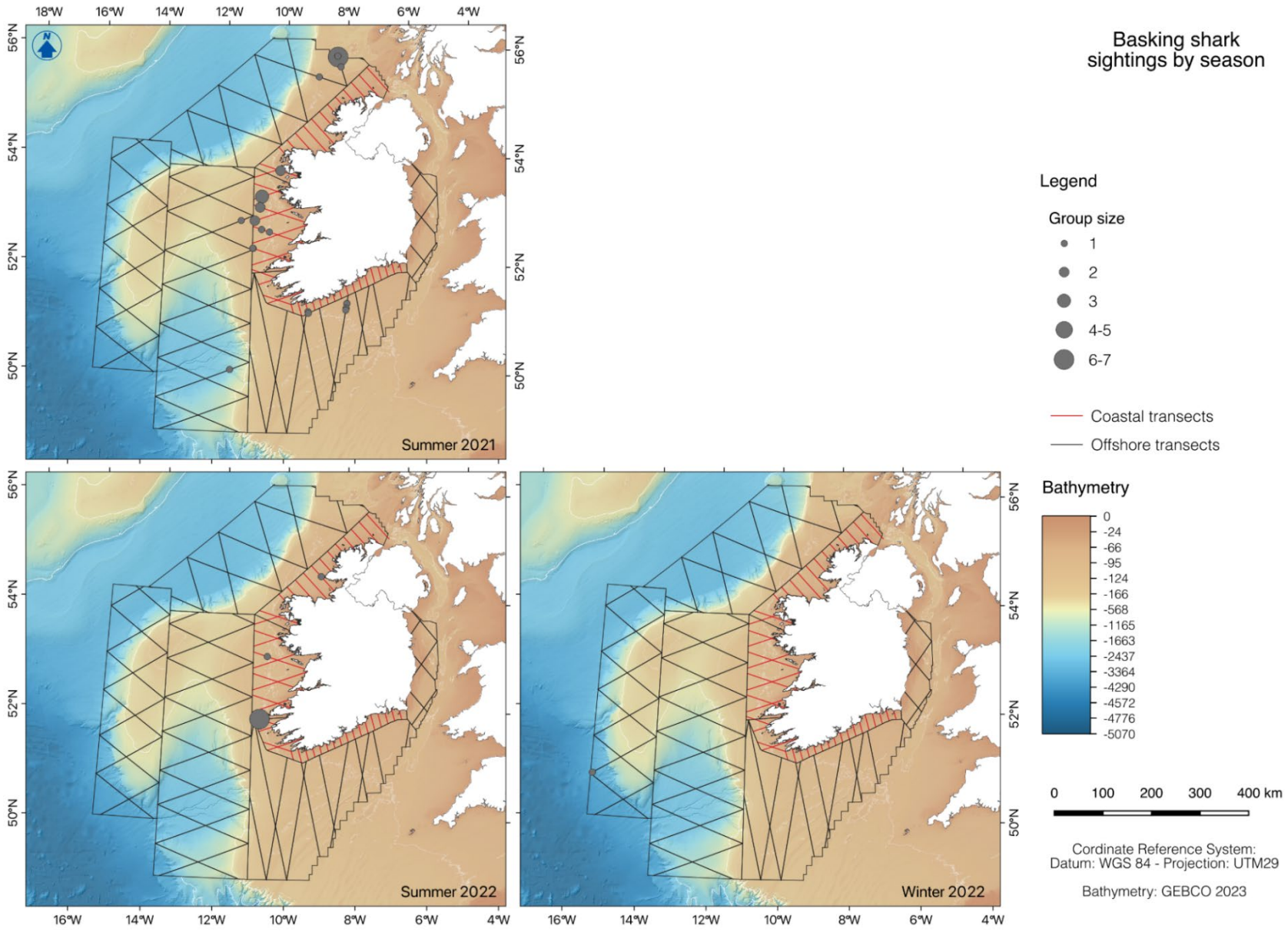

Figure 3-21 Basking shark sightings during Phase II of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey track lines in the offshore strata and red lines indicate the track lines in the coastal strata. Circles are proportional to the number of individuals in each sighting (Giralt Paradell *et al.*, 2024).

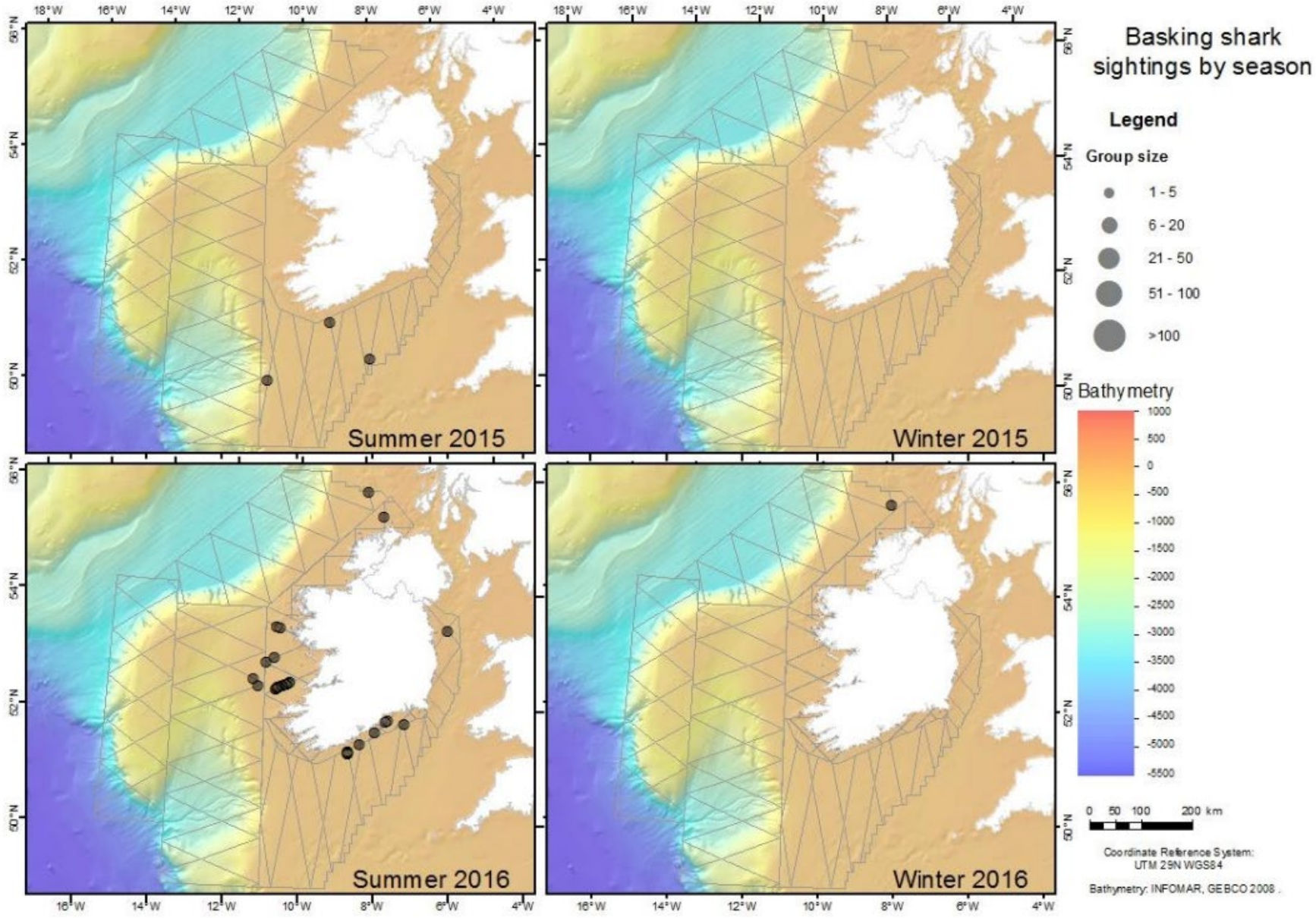

Figure 3-22 Basking shark sightings during the Phase I of the ObSERVE Aerial Surveys – during each survey period. Grey lines indicate the survey tracklines along which sightings were made. Circles are proportional to the number of individuals in each sighting (Rogan *et al.*, 2018)

12.13.1.3 OTHER SHARK SPECIES

Several shark species are known to occur in the wider western Irish Sea region, including the lesser spotted dogfish (*Scyliorhinus canicula*), starry smooth hound (*Mustelus asterias*), spurdog (*Squalus acanthias*), and tope (*Galeorhinus galeus*) (Lynam and Ribeiro, 2022; Ellis et al., 2005). These species have been identified through a desk-based review of published literature and fisheries-independent survey data. Although no targeted elasmobranch surveys have been conducted for the Proposed Development, their known distributions inform the ecological baseline for the marine fish assemblage.

Site-specific benthic habitat mapping within the Proposed Development footprint, characterised by mixed sediments and sandy substrates, suggests that suitable habitat is available for benthic and demersal shark species. Given their broad habitat preferences and regional distribution, the occurrence of lesser spotted dogfish, starry smooth hound, spurdog and tope within or near the Proposed Development site is considered likely.

Lesser Spotted Dogfish (Scyliorhinus canicula)

This small demersal shark is among the most common species in coastal and shelf waters of the Northeast Atlantic, including the Irish Sea. It occupies a wide range of substrates - from sand and gravel to mixed and muddy sediments - and is typically associated with shallow to mid-shelf depths. Its diet consists mainly of benthic invertebrates such as crustaceans, molluscs, and annelid worms, as well as small fish (Ellis *et al*., 1996). Given its abundance, generalist habitat preferences, and relatively fast life-history traits, it is categorised as *Least Concern* on Ireland's Red List of cartilaginous fishes (Clarke *et al*., 2016). The dominant sandy and mixed sediment habitats present within the Proposed Development footprint are considered suitable for this species, suggesting local occurrence is likely, particularly for foraging.

Within the NBDC 10km^2 grid T11, twelve (12) lesser spotted dogfish were documented with the most recent record dating 7th August 2024.

Starry Smooth hound (Mustelus asterias)

A benthic coastal shark, the starry smooth hound favours sandy and gravelly substrates and is commonly recorded in the Irish and Celtic Seas. It primarily feeds on decapod crustaceans, especially crabs, and exhibits seasonal patterns in distribution associated with temperature and prey availability. While less intensively studied than other species, fisheries data indicate it can be locally abundant in suitable habitats. It is not currently regarded as threatened; however, as with other coastal elasmobranchs, it may be susceptible to localised habitat disturbance or bycatch. Its presence within the receiving environment of the Proposed Development is considered possible, especially in summer when inshore habitat use typically increases.

Spurdog (Squalus acanthias)

Spurdog is a slow-growing, long-lived shark species that occurs widely in Irish coastal and deeper shelf waters. It forms seasonal aggregations and is associated with a range of substrate types, particularly mixed or muddy seabeds. Its diet includes fish, cephalopods, and benthic invertebrates

(Ellis *et al*., 2005). Due to its low reproductive output and historical overfishing, it is listed as *Endangered* on the Irish Red List (Clarke *et al*., 2016). Although no direct records exist for the Proposed Development site, the species may occur occasionally in deeper or less disturbed areas of the wider study area, especially where suitable habitat is present.

Tope (Galeorhinus galeus)

Tope is a wide-ranging, benthopelagic shark species found in temperate regions worldwide. In the Northeast Atlantic, including Irish waters, it exhibits seasonal movements and occupies a broad range of habitats, from shallow coastal areas to deeper continental shelf zones. Tope are regularly recorded at depths ranging from approximately 17 to 200 m in the Irish Sea, where they forage on demersal and pelagic prey such as fish and cephalopods (Ellis *et al*., 1996; Ellis *et al*., 2005). This species is slow-growing and late-maturing, with low fecundity and extended gestation, traits that confer limited resilience to population pressures. Although subject to protective measures in EU waters, tope is listed as Vulnerable on Ireland's Red List of cartilaginous fishes (Clarke *et al*., 2016), reflecting past population declines and continued vulnerability to bycatch.

12.13.2 SKATES AND RAYS

Skates represent an important component of the benthic fish assemblage in the Irish Sea. Species such as thornback ray (*Raja clavata*) and spotted ray (*Raja montagui*) are widely distributed across coastal and offshore areas (Ellis *et al*., 2005).

Skates and rays are demersal elasmobranchs typically associated with sandy or muddy seabeds in coastal and shelf waters. Unlike their pelagic shark counterparts, these species are generally more sedentary, often exhibiting strong site fidelity to nursery and foraging habitats, some of which may overlap with the zone of influence of nearshore developments. In Irish waters, several skate and ray species are of conservation concern due to population declines linked to fishing pressure, habitat degradation, and inherently low reproductive rates.

Their life history traits - including late maturity, large egg cases (in oviparous species), and limited dispersal - increase their sensitivity to anthropogenic disturbance. Although no individuals were recorded during site-specific marine surveys, the potential for occurrence of skate and ray species within the vicinity of the Proposed Development is acknowledged.

Within the NBDC 10km2 grid T11, four records are available: two (2) spotted rays, with the most recent record dating 7th August 2024, and two (2) thornback ray, with the most recent sighting on 1st November 2021. Both species are listed as Threatened Species under the OSPAR Convention.

12.14 MARINE TURTLES

Marine turtles are infrequent visitors to Irish waters, with the leatherback turtle (*Dermochelys coriacea*) being the most commonly recorded species. These turtles are known to migrate to temperate regions, including the Celtic and Irish Seas, primarily during the summer months (July to September), coinciding with the abundance of their gelatinous prey, such as jellyfish.

In Irish and UK waters, five marine turtle species have been documented:

- Leatherback turtle (*Dermochelys coriacea*)
- Loggerhead turtle (*Caretta caretta*)
- Kemp's ridley turtle (*Lepidochelys kempii*)
- Green turtle (*Chelonia mydas*)
- Hawksbill turtle (*Eretmochelys imbricata*)

Among these, the leatherback is the most frequently observed, while the others are considered rare visitors, often recorded as strandings.

The east coast of Ireland, including the vicinity of the Proposed Development near Rosslare, is not recognized as a significant area for marine turtle activity. Notably, the ObSERVE aerial surveys, conducted to assess the occurrence and distribution of marine megafauna in Irish waters, did not report any sightings of marine turtles in the Irish Sea region during their extensive survey periods.

12.14.1 LEATHERBACK TURTLE (*DERMOCHELYS CORIACEA*)

The leatherback turtle (*Dermochelys coriacea*) is the only species of sea turtle regularly recorded in Irish waters and is considered a vagrant visitor to the region. This species is listed as critically endangered on the IUCN Red List (global population) and is afforded strict protection under both Annex IV of the EU Habitats Directive and the Wildlife Acts in Ireland. Leatherbacks are known to forage in temperate and boreal waters during the summer months, primarily feeding on jellyfish and other gelatinous zooplankton. The species typically occurs offshore but may occasionally approach coastal areas during peak foraging periods. Irish waters represent a migratory foraging range for individuals originating from nesting beaches in the western Atlantic, including the Caribbean and South America.

Within the 10 km^2 grid T11, two (2) records of leatherback turtles are held by the NBDC. The most recent of these records is dated 31st July 2011. No leatherback sightings were recorded within the Proposed Development Boundary during marine mammal or ornithological vantage point surveys, and no more recent records are available from the IWDG or NBDC within the immediate vicinity.

During Phase II of the ObSERVE aerial survey programme, two sightings of leatherback turtle were recorded in Summer 2021, both located off the west coast of Ireland. One individual was observed in deep waters beyond the continental slope, while the other was recorded within continental shelf waters (Giralt Paradell *et al*., 2024). These sightings reflect the occasional seasonal presence of leatherback turtles in Irish waters, likely associated with foraging behaviour during summer months. Due to the very low number of detections, no abundance or density estimates were generated for this species. Figure 3-20 illustrates the recorded locations of leatherback turtle sightings during ObSERVE Phase II.

As part of Phase I of the ObSERVE aerial survey programme, Rogan *et al*. (2018) recorded a small number of turtle sightings over two years of aerial monitoring across the Irish EEZ. All positively identified sightings of leatherback turtle occurred during summer surveys (Figure 3-21), while one additional sighting in summer and one in winter were attributed to an unidentified turtle species

(Figure 3-22). Leatherback turtle sightings were confined to the southernmost extent of the survey area, specifically within stratum 4 (Figure 3-21), while there was a summer and winter sighting of an unidentified turtle species observed in deeper offshore waters of strata 1 and 4 (Figure 3-22). Due to the low number of observations, no abundance or density estimates were generated for either species group.

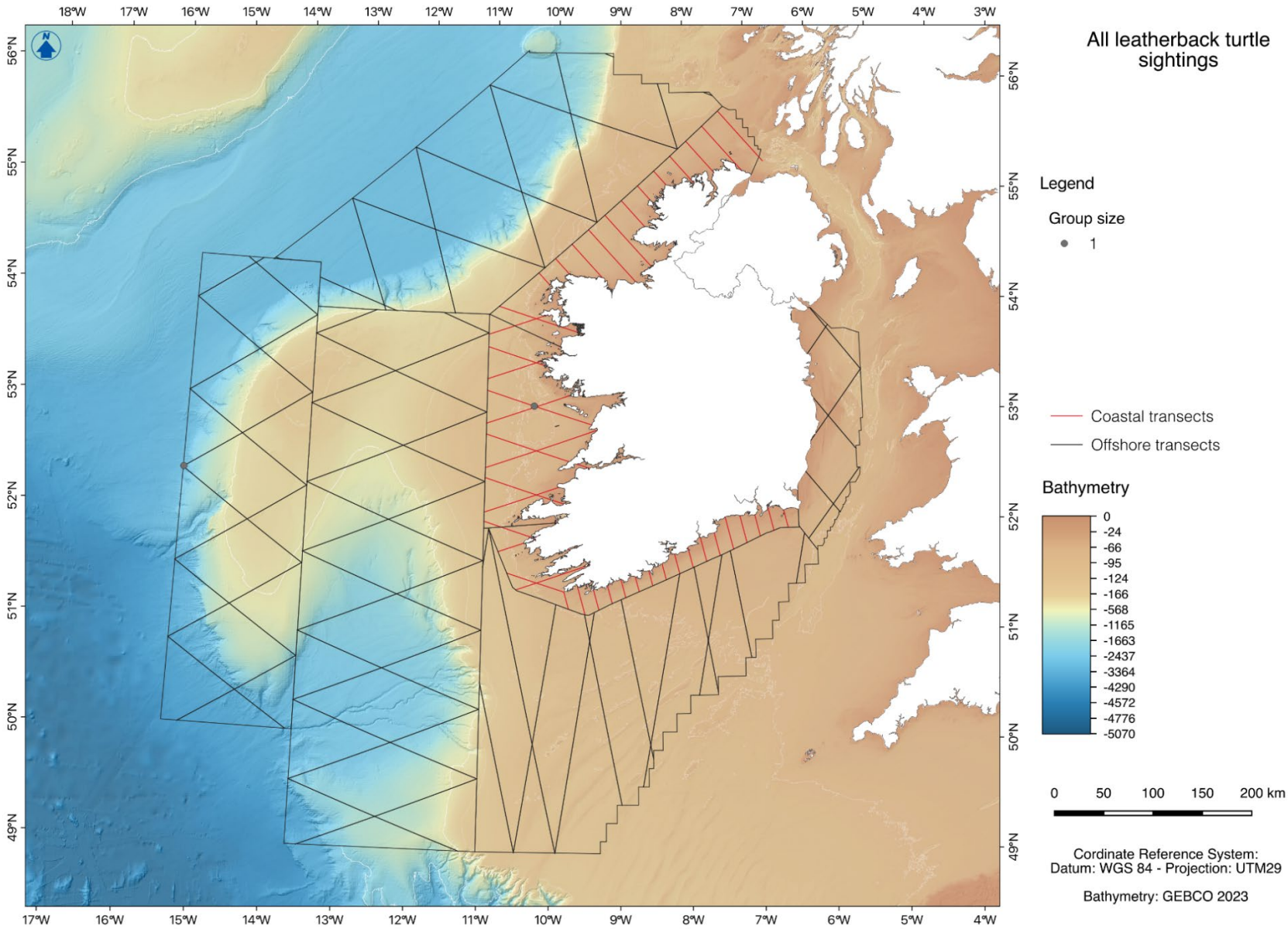

Figure 3-23 Leatherback turtle sightings during Phase II of the ObSERVE Aerial Surveys – all surveys combined. Grey lines indicate the survey track lines in the offshore strata and red lines indicate the track lines in the coastal strata. Circles are proportional to number of leatherback turtles in each sighting (Giralt Paradell *et al.*, 2024)

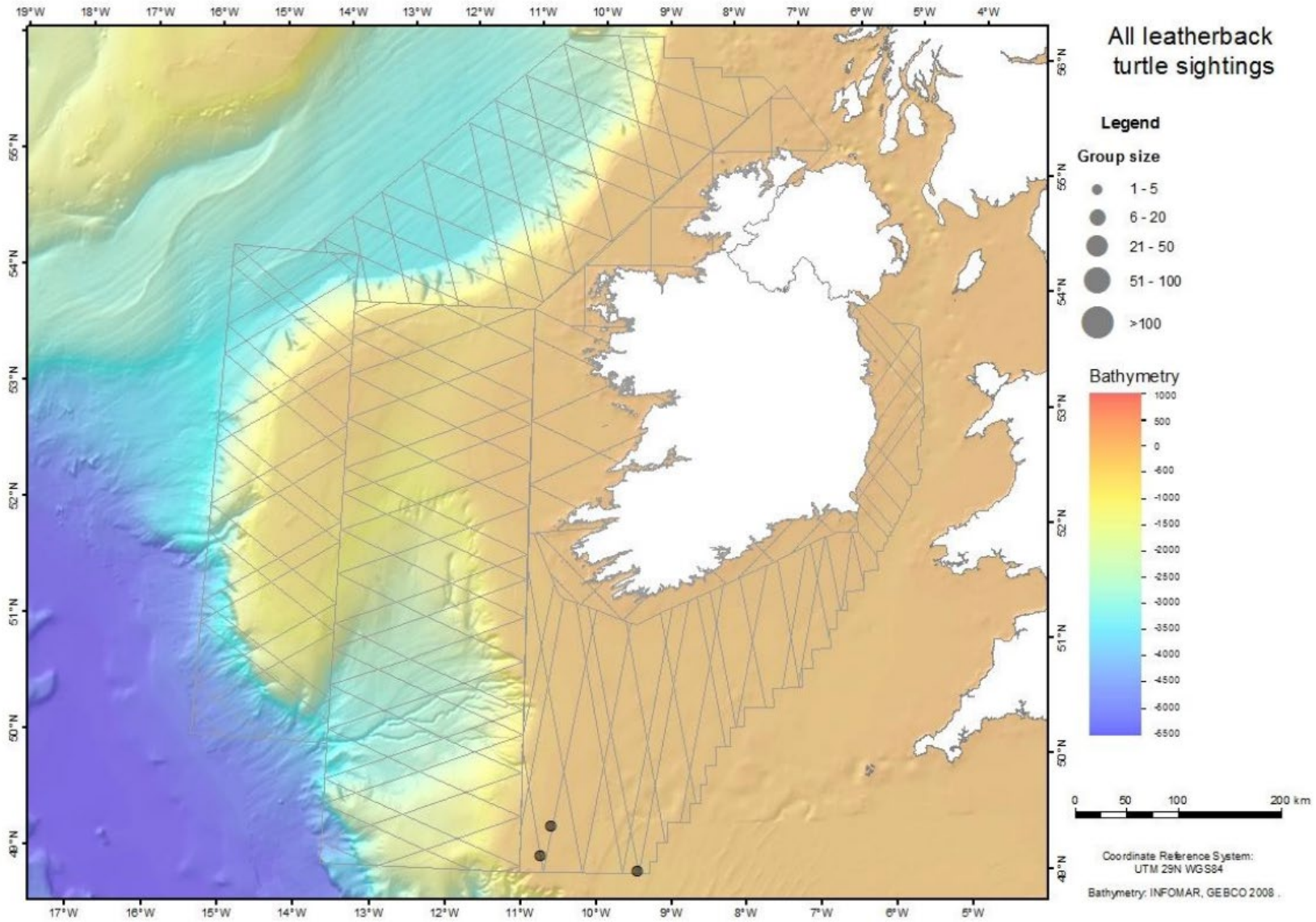

Figure 3-24 Leatherback turtle sightings during the Phase I of the ObSERVE Aerial Surveys at the southern tip of the survey effort in stratum 4 – all surveys combined, however, all sightings occurred in the summer 2015 and summer 2016. Grey lines indicate the survey tracklines along which sightings were made. Circles are proportional to the number of individuals in each sighting (Rogan *et al.*, 2018).

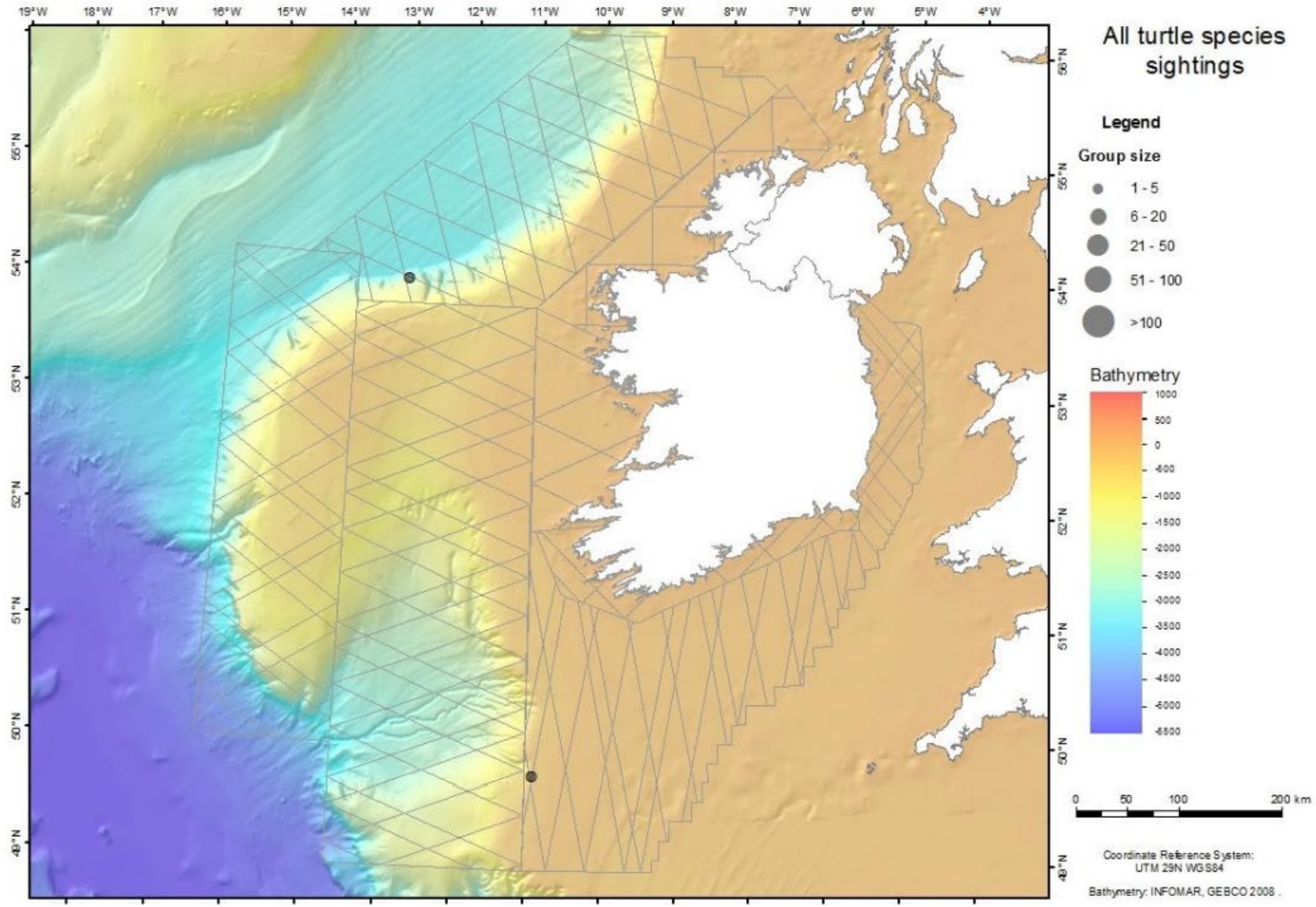

Figure 3-25 Unidentified turtle species sightings during the Phase I of the ObSERVE Aerial Surveys located in deeper water, in strata 1 (summer 2015) and 4 (winter 2015) – all surveys combined. Grey lines indicate the survey tracklines along which sightings were made. Circles are proportional to the number of individuals in each sighting (Rogan *et al.*, 2018).

12.14.2 LOGGERHEAD TURTLE (*CARETTA CARETTA*)

The loggerhead turtle is a large, hard-shelled sea turtle species that occurs infrequently in Irish waters. It is primarily associated with subtropical and temperate regions but is occasionally recorded in the northeast Atlantic, typically as a result of passive drift during the early life stages or following disorientation caused by oceanic currents. Loggerhead turtles are listed under Annex IV of the EU Habitats Directive and are protected under the Irish Wildlife Acts. Although Ireland lies outside their typical migratory or foraging range, juvenile individuals have occasionally stranded along the Irish coast, particularly during periods of strong westerly winds or storms. No loggerhead turtle records were returned from the Irish Whale and Dolphin Group (IWDG) database or within the 10 km grid square T11 from the National Biodiversity Data Centre (NBDC), indicating that the species has not been recorded in the vicinity of the Proposed Development.

12.15 REFERENCES

Barry, J., Kennedy, R. J., Rosell, R., & Roche, W. K. (2020). Atlantic salmon smolts in the Irish Sea: first evidence of a northerly migration trajectory. Fisheries Management and Ecology, 27(5), 517-522.

Berrow, S.D. and Heardman, C. (1994) The basking shark (*Cetorhinus maximus*) in Irish waters: patterns of distribution and abundance. *Biology and Environment: Proceedings of the Royal Irish Academy*, 94B(3), pp.101–107.

Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. and Regan, E.C. (2009) *Ireland Red List No. 2: Non-Marine Molluscs*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

Campana, S.E., Joyce, W., and Manning, M.J. (2011) Bycatch and discard mortality in commercially exploited blue sharks, *Prionace glauca*, assessed using archival satellite pop-up tags. *Marine Ecology Progress Series – MAR ECOL-PROGR SER.*, 387, pp.241-253. https://doi.org/10.3354/meps08109

Cefas (2024). *Irish Sea Salmon Migration Report: Movements of Atlantic salmon from SAC rivers in Wales*. Lowestoft: Centre for Environment, Fisheries and Aquaculture Science.

Clarke, M., Farrell, E.D., Roche, W., Murray, T.E., Foster, S. and Marnell, F. (2016) Ireland Red List No. 11: Cartilaginous fish [sharks, skates, rays and chimaeras]. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. Dublin, Ireland.

CSTP (2016). (Milner, N., McGinnity, P. & Roche, W. Eds) Celtic Sea Trout Project – Technical Report to Ireland Wales Territorial Co-operation Programme 2007-2013 (INTERREG 4A). [Online] Dublin, Inland Fisheries Ireland. Available: http://celticseatrout.com/downloads/technical-report/

https://doi.org/10.1046/j.1365-2656.2003.00775.x

Doherty, P.D., Baxter, J.M., Gell, F.R., Godley, B.J., Graham, R.T., Hall, G., Hall, J., Hawkes, L.A., Henderson, S.M., Johnson, L. and Speedie, C. (2017) Long-term satellite tracking reveals variable seasonal migration strategies of basking sharks in the north-east Atlantic. *Scientific Reports*, 7, p.42837.

Dulvy, N.K., Fowler, S.L., Musick, J.A., Cavanagh, R.D., Kyne, P.M., Harrison, L.R., Carlson, J.K., Davidson, L.N.K., Fordham, S.V., Francis, M.P., Pollock, C.M., Simpfendorfer, C.A., Burgess, G.H., Carpenter, K.E., Compagno, L.J.V., Ebert, D.A., Gibson, C., Heupel, M.R. & Livingstone, S.R. (2014) Extinction risk and conservation of the world's sharks and rays. *eLife*, 3, e00590. https://doi.org/10.7554/eLife.00590

EcoFact (2016) *Freshwater Pearl Mussel Survey: River Slaney at Enniscorthy*. Prepared for the Enniscorthy Flood Relief Scheme. EcoFact Environmental Consultants Ltd.

Ellis, J., Pawson, M., & Shackley, S. (1996) The Comparative Feeding Ecology of Six Species of Shark and Four Species of Ray (Elasmobranchii) In The North-East Atlantic. Journal of the Marine Biological Association of the United Kingdom, 76(1), 89-106. doi:10.1017/S0025315400029039

Ellis, J.R., Cruz-Martinez, A., Rackham, B.D. and Rogers, S.I. (2005) The distribution of chondrichthyan fishes around the British Isles and implications for conservation. Journal of Northwest Atlantic fishery science, 35(195-213), p.113

Giralt Paradell, O., Cañadas, A., Bennison, A., Todd, N., Jessopp, M., & Rogan, E. (2024). *Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2021-2023.* (260 pp.). Department of the Environment, Climate & Communications and Department of Housing, Local Government & Heritage, Ireland.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J., & Øien, N. (2017; 2021, revised) *Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys*. Retrieved from https://scans3.wp.st-andrews.ac.uk/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf

Hays, G.C., Doyle, T.K. and Houghton, J.D.R., 2009. A paradigm shift in the trophic ecology of leatherback turtles. *Biology Letters*, 6(6), pp.654–656. [Cited for vertical movement comparison]

IFI (n.d.) *Sea trout (Salmo solar)*. Available at: https://www.fisheriesireland.ie/species/sea-trout-salmo-trutta-trutta (Accessed: 16th April 2025).

IFI (n.d.) *Atlantic Salmon (Salmo salar)*. Available at: https://www.fisheriesireland.ie/species/atlantic-salmon-salmo-salar (Accessed: 16/04/25)

IFI (n.d.) *Twaite Shad (Alosa fallax)*. Available at: https://www.fisheriesireland.ie/species/twaite-shad-alosa-fallax (Accessed: 17/04/25).

IFI (n.d.) *Sea Lamprey (Petromyzon marinus)*. Available at: http://fisheriesireland.ie/species/sea-lamprey-petromyzon-marinus (Accessed: 16/04/25)

IFI (n.d.) *River Lamprey (Lampetra fluviatilis)*. Available at: https://www.fisheriesireland.ie/species/river-lamprey-lampetra-fluviatilis (Accessed: 16/04/25)

IFI (n.d.) *European Eel (Anguilla anguilla)*. Available at: https://www.fisheriesireland.ie/species/european-eel-anguilla-anguilla (Accessed: 16/04/25)

IFI (2016). *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters.* Inland Fisheries Ireland.

IFI (2024a) *Salmon and Sea Trout Angling Regulations 2024*. Inland Fisheries Ireland. https://www.fisheriesireland.ie/sites/default/files/2024-01/english-salmon-regs-2024-web.pdf

IFI (2024b) *Fish in Rivers Factsheet 2023 No. 9 – SERBD Slaney River Catchment*. National Research Survey Programme. Inland Fisheries Ireland, Dublin. https://www.fisheriesireland.ie/sites/default/files/2025-02/factsheet_09_slaney_2023.pdf

Jacobs (2017) *Enniscorthy Flood Relief Scheme: Environmental Impact Assessment Report – Aquatic Ecology Surveys*. Prepared for Wexford County Council.

JNCC (2019) The UK Approach to assessing Conservation Status for the 2019 Article 17 reporting under the EU Habitats Directive. Joint Nature Conservation Committee, Peterborough. Available to download from https://jncc.gov.uk/article17.

King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Kjelland, M.E., Woodley, C.M., Swannack, T.M. and Smith, D.L. (2015) A review of potential impacts of suspended sediment on fish and shellfish with relationship to dredging activities in the southeastern United States. *Reviews in Fisheries Science & Aquaculture*, 23(2), pp.141–173.

Lieber, L., Hall, G., Hall, J., Berrow, S., Johnston, E., Gubili, C., Sarginson, J., Francis, M., Duffy, C., Wintner, S. P., Doherty, P. D., Godley, B. J., Hawkes, L. A., Witt, M. J., Henderson, S. M., de Sabata, E., Shivji, M. S., Dawson, D. A., Sims, D. W., Jones, C. S., … Noble, L. R. (2020). Spatio-temporal genetic tagging of a cosmopolitan planktivorous shark provides insight to gene flow, temporal variation and site-specific re-encounters. *Scientific reports*, *10*(1), 1661. https://doi.org/10.1038/s41598-020-58086-4

Lynam, C.P. & Ribeiro, J. 2022. Occurrences of sensitive fish species in scientific trawl surveys of the Northeast Atlantic 1983-2020. Cefas, UK. V1. Doi: https://doi.org/10.14466/CefasDataHub.128

Maitland, P.S. (2003). *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

NPWS, 2024. *Slaney River Valley SAC (000781) Conservation Objectives Supporting Document*. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage. [Online]. Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000781.pdf [Accessed April 2025].

Pope, E.C., Hays, G.C., Thys, T.M., Doyle, T.K. and Sims, D.W., 2010. The biology and ecology of the ocean sunfish *Mola mola*: a review of current knowledge and future research perspectives. *Reviews in Fish Biology and Fisheries*, 20(4), pp.471–487. https://doi.org/10.1007/s11160-009-9155-9

Queiroz, N., Humphries, N.E., Noble, L.R., Santos, A.M. and Sims, D.W. (2012) Spatial dynamics and expanded vertical niche of blue sharks in oceanographic fronts reveal habitat targets for conservation. *PLOS ONE*, 7(2), e32374. https://doi.org/10.1371/journal.pone.0032374

Queiroz, N., *et al*. (2016) Ocean-wide tracking of pelagic sharks reveals extent of overlap with longline fishing hotspots. *Proceedings of the National Academy of Sciences*, 113(6), pp.1582–1587. https://doi.org/10.1073/pnas.1510090113

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. and Winker, H, (2019) *Prionace glauca*. The IUCN Red List of Threatened Species 2019: e.T39381A2915850. https://doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39381A2915850.en

Righton, D., Westerberg, H., Feunteun, E., Økland, F., Gargan, P., Amilhat, E., Metcalfe, J., Lobon-Cervia, J., Sjöberg, N., Simon, J., Acou, A., Vedor, M., Walker, A., Trancart, T., Brämick, U. and Aarestrup, K. (2016) Empirical observations of the spawning migration of European eels: The long and dangerous road to the Sargasso Sea. *Science Advances*, 2(10), p.e1501694. https://doi.org/10.1126/sciadv.1501694

Rikardsen, A. H., Righton, D., Strøm, J. F., *et al*. (2021) Redefining the oceanic distribution of Atlantic salmon. Sci Rep 11, 12266 https://doi.org/10.1038/s41598-021-91137-y

Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S., & Jessopp, M. (2018) *Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017.* Department of Communications, Climate Action and Environment, National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht. Dublin, Ireland. 297pp. Available from NBDC at https://maps.biodiversityireland.ie/Map/Marine/Dataset/322 [Accessed: 14/04/2025]

Rudd, J. L., Bartolomeu, T., Dolton, H. R., Exeter, O. M., Kerry, C., Hawkes, L. A., Henderson, S. M., Shirley, M., & Witt, M. J. (2021) Basking shark sub-surface behaviour revealed by animal-towed cameras. *PloS one*, *16*(7), e0253388. https://doi.org/10.1371/journal.pone.0253388

Sims, David & Southall, Emily & Richardson, Anthony & Reid, Philip & Metcalfe, J. (2003) Seasonal movements and behaviour of basking sharks from archival tagging: No evidence of winter hibernation. Marine Ecology Progress Series. 248. 10.3354/meps248187.

Sims, D.W., Witt, M. J., Richardson, A. J., and Metcalfe, J. D. (2006) Encounter success of free-ranging marine predator movements across a dynamic prey landscape. Proc. R. Soc. B.2731195–1201 http://doi.org/10.1098/rspb.2005.3444

Sims, D.W., 2008. Sieving a living: a review of the biology, ecology and conservation status of the plankton-feeding basking shark (*Cetorhinus maximus*). *Advances in Marine Biology*, 54, pp.171–220. https://doi.org/10.1016/S0065-2881(08)00003-5

Sims, D.W., Berrow, S.D., O'Sullivan, K.M., Pfeiffer, N.J., Collins, R., Smith, K.L., Pfeiffer, B.M., Connery, P., Wasik, S., Flounders, L., Queiroz, N., Humphries, N.E., Womersley, F.C. and Southall, E.J. (2022) 'Circles in the sea: annual courtship "torus" behaviour of basking sharks *Cetorhinus maximus* identified in the eastern North Atlantic Ocean', *Journal of Fish Biology*, 101(5), pp. 1167–1180. https://doi.org/10.1111/jfb.15187.

Southall, E. J., Sims, D. W., Metcalfe, J. D., Doyle, J. I., Fanshawe, S., Lacey, C., … Speedie, C. D. (2005) Spatial distribution patterns of basking sharks on the European shelf: preliminary comparison of satellite-tag geolocation, survey and public sightings data. *Journal of the Marine Biological Association of the United Kingdom*, *85*(5), 1083–1088. doi:10.1017/S0025315405012129

Vandeperre, F., Aires-da-Silva, A., Fontes, J., Santos, M., Santos, R.S. and Afonso, P. (2014) Movements of blue sharks (*Prionace glauca*) across their life history. *PLOS ONE*, 9(8), e103538. https://doi.org/10.1371/journal.pone.0103538

Wenger, A.S., Harvey, E., Wilson, S., Rawson, C.A., Newman, S.J., Clarke, D., Saunders, B.J., Browne, N.K. and Browne, N. (2017) A critical analysis of the direct effects of dredging on fish. *Fish and Fisheries*, 18(5), pp.967–985.

Witt, M.J., Hardy, T., Johnson, L., McClellan, C.M., Pikesley, S.K., Ranger, S., Richardson, P., Solandt, J.L., Speedie, C., and Williams, R. (2012) Basking sharks in the northeast Atlantic: Spatio-temporal trends from sightings in UK waters. *Marine Ecology Progress Series*, 459, pp.121–134. doi: 10.3354/meps09737

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