Awel y Môr Offshore Wind Farm

Category 6: Environmental Statement

Volume 4, Annex 6.1: Fish and Shellfish Ecology Technical Baseline

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FISH AND SHELLFISH ECOLOGY TECHNICAL BASELINE REPORT

RWE Renewables UK
Awel y Môr Offshore Wind Farm

Project Number: 01-41

Date: March 20222

Revision: 2.0 (ES)

Confidentiality

This document is confidential.

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Glossary

Term	Definition
AEPM	Annual Egg Production Method
AFBI	Agri-Food Bioscience Institute
AyM	Awel y Môr Offshore Wind Farm
BAP	Biodiversity Action Plan
BGS	British Geological Survey
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIEEM	Chartered Institute for Ecology and Environmental Management
CMACS	Centre for Marine and Coastal Studies
CPA	Coast Protection Act
DEFA	Department of Environment, Food and Agriculture
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
ES	Environmental Statement
ETG	Expert Topic Group
FEPA	Food and Environmental Protection Act
GyM	Gwynt y Môr Offshore Wind Farm
ICES	International Council for the Exploration of the Sea
IUCN	International Union for Conservation of Nature
MCZ	Marine Conservation Zone

MHWS	Mean High Water Springs
MMO	Marine Management Organisation
NIGFS	Northern Ireland Ground Fish Survey
NWGFS	North West Groundfish Survey
NPS	National Policy Statement
NRW	Natural Resources Wales
OWF	Offshore Wind Farm
PINS	The Planning Inspectorate
PSA	Particle Size Analysis
SAC	Special Area of Conservation
SEL	Sound Exposure Level
SMB	Scallop Management Board
SSC	Suspended Sediment Concentration
UWTV	Underwater Television
VER	Valued Ecological Receptors
ZoI	Zone of Influence

1 Introduction

1.1 Project Background

1 Awel y Môr Offshore windfarm Limited (hereafter the Applicant) is proposing to develop the Awel y Môr Offshore Wind Farm (hereafter referred to as AyM) as a proposed sister project to the operational Gwynt y Môr offshore wind farm (GyM). AyM will be located approximately 10.6 km offshore of Conwy, North Wales in the eastern Irish Sea and would provide a significant contribution to the Welsh Government's renewable energy targets (which are for 70% of electricity consumed in Wales to be generated by renewable sources by 2030).

1.2 Purpose and Structure of this Document

2 A scoping report for the project was published in June 2020 (Innogy, 2020) and a formal scoping opinion received from the Planning Inspectorate (PINS) in July 2020. Following a review of the scoping responses, discussion with the relevant consultees during Evidence Plan Expert Topic Group (ETG) meetings, and responses received during statutory consultation on the Preliminary Environmental Information Report (PEIR) it was noted that further evidence was required regarding the adequacy of the data sources proposed to characterise the fish and shellfish community. In particular it was noted that several of the datasets are in excess of 10 years old and would require some validation before agreement could be reached with regards the adequacy of the data for the purposes characterising the receiving environment prior to undertaking an Environmental Impact Assessment (EIA).

3 This primary purpose of this report is therefore to provide a contemporary and comprehensive analysis of site-specific and regional fish and shellfish ecology data within the study area and potential Zones of Influence (ZoI) defined for AyM. The report has been prepared to form a technical annex to Volume 2, Chapter 6: Fish and Shellfish Ecology (application ref: 6.2.6), as part of the application for AyM.

4 This report provides the technical baseline for fish (both pelagic and demersal, including elasmobranch species) and shellfish (molluscs and crustaceans) ecology within the AyM site boundary and in the wider surrounding area. The remainder of this document is structured in the following way:

- A summary of relevant guidance, legislation and planning policy;
- Definition of the proposed study area;
- Outline of data sources used to inform the characterisation;
- A review of the baseline (existing) conditions of the array area;

- A review of the baseline conditions of the Export Cable Route (ECC);
- Discussion; and
- Conclusion.

1.3 Guidance

5 The characterisation of fish and shellfish receptors will comply with the following guidance documents where they are specific to this topic:

- Guidelines for EIA in Britain and Ireland. Terrestrial, Freshwater, Coastal and Marine, Final Document (CIEEM, 2018);
  - Requires that the baseline conditions for each ecological feature should be described clearly, objectively and succinctly;
  - Requires that the ecological information is adequate for the purposes of EIA;
- Guidance note for EIA in respect of the Food and Environmental Protection Act 1985 (FEPA) and Coast Protection Act 1949 (CPA) requirements (Cefas *et al.*, 2004);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Cefas, 2012); and
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).

1.4 Policy and Legislation

6 The following policy and legislation is also important when considering the requirements for characterisation of the receiving environment, and species of conservation importance:

1.4.1 Policy

- National Policy Statement (NPS) (NPS EN-3) and Draft NPS for Renewable Energy (Draft NPS EN-3);
  - Specifies the need to identify the fish species that are the most likely receptors of potential impacts with respect to spawning grounds, nursery grounds, feeding grounds, over-wintering areas for crustaceans, migration routes and protected areas.

1.4.2 Legislation

- EIA Directive (85/337/EEC) 1985 (as amended):
  - Requires adequate characterisation of the receiving environment.
- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2007 (as amended)
  - Requires a description of the relevant aspects of the current state of the environment (baseline scenario).
- Environment (Wales) Act 2016:
  - This legislation captures species of principle importance under Section 7.
- The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended):
  - This legislation requires a description of the relevant aspects of the current state of environment.
- EC Habitats Directive, and Directive 2009/147/EC 2009 on the conservation of wild birds:
  - Transposed into UK legislation by the legislation below.
- Conservation of Habitats and Species Regulations 2017 (as amended):
  - This legislation identifies Annex 2 Species of Importance.
- Wildlife and Countryside Act 1981 (as amended):
  - This legislation identifies Biodiversity Action Plan species.

7 In accordance with the Cefas *et al*. (2004), CIEEM guidance and the NPS for Renewable Energy the assessment phase of the Environmental Impact Assessment (EIA), the following aspects will be considered for fish and shellfish resource in the area:

- Spawning grounds;
- Nursery grounds;
- Feeding grounds;
- Overwintering areas for crustaceans; and
- Migration routes.

2 Scope and Methodology

8 This report provides a baseline characterisation of the existing environment as it relates to fish and shellfish ecology, collating the data sources gathered in order to provide a complete picture of the condition of the baseline environment for the purposes of carrying out an EIA. This report accompanies the fish and shellfish ecology ES chapter (Volume 2, Chapter 6).

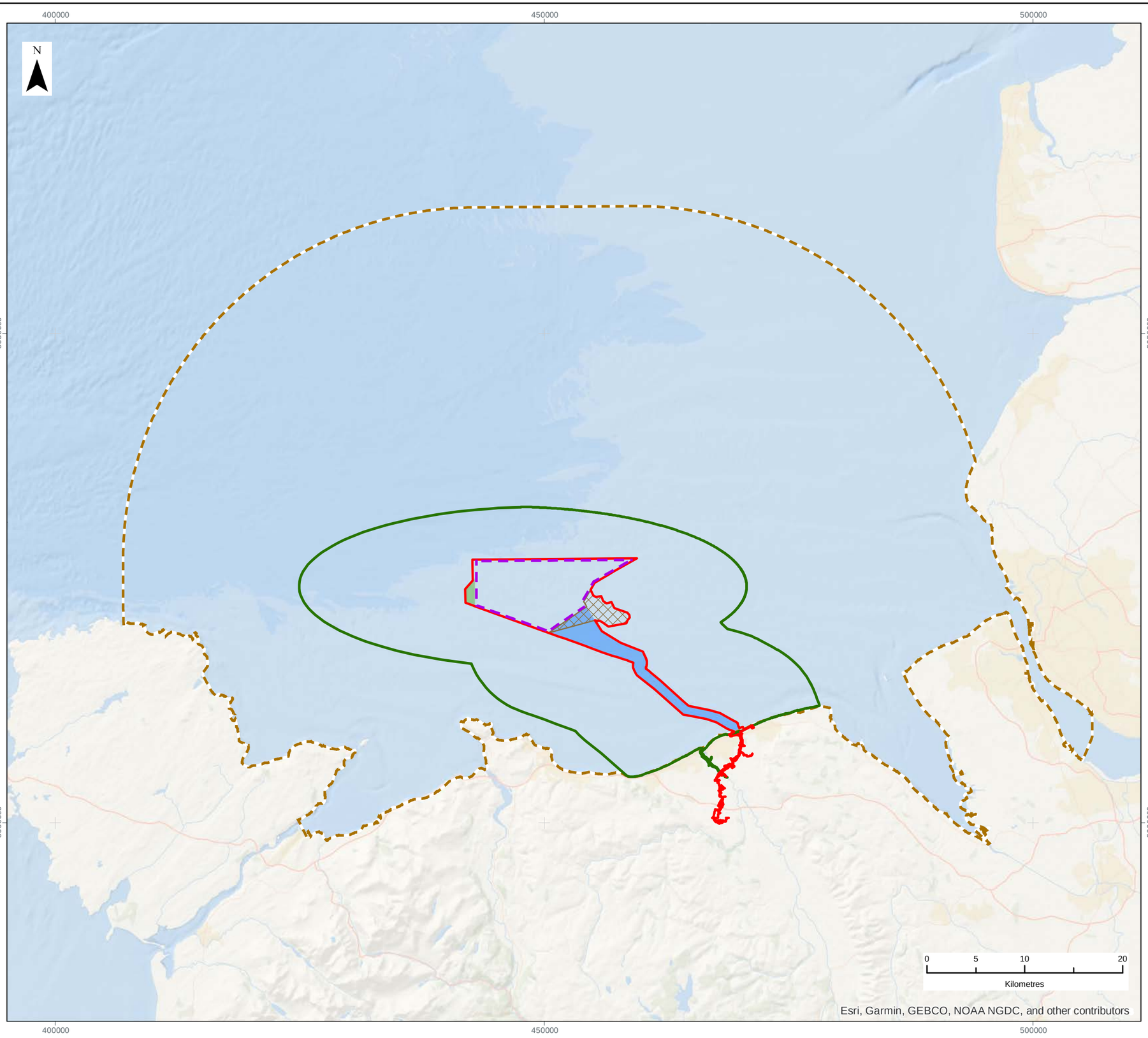
9 Baseline characterisation data on fish and shellfish resources were gathered through a desktop study combining site-specific survey data collected for the GyM project, the study area for which overlaps with some of the AyM study area, along with other regional datasets.

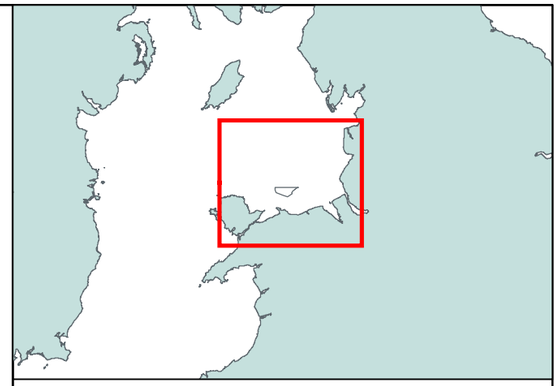
2.2 Study Area

10 The fish and shellfish ecology study area is dynamic, in that it varies according to the nature of the impact being studied. The study area is therefore defined as the following spatial scales:

- For direct (primary) impacts on fish and shellfish receptors, the study area includes the proposed wind farm array area and the more linear offshore Export Cable Corridor (ECC), beyond the array boundary, up to and including the intertidal zone, up to Mean High Water Springs (MHWS).
- For secondary impacts with a larger zone of influence (ZoI) (the Sedimentary ZoI) that can extend to receptors beyond the direct footprint of the proposed development, for example increased Suspended Sediment Concentrations (SSCs), a wider study area has been used based on the project specific hydrodynamic modelling undertaken (Volume 4, Annex 2.3: Physical Processes Modelling Results Report (application ref: 6.4.2.3)). The ZoI for this assessment has been defined as a maximum elliptical ZoI which extends to a maximum of 18 km to the west of the array area (and less to the east), and a maximum of 8.5 km around the offshore Export Cable Corridor (ECC). These ZoIs encapsulate the maximum extent of measurable plumes predicted by the modelling, although the majority of suspended sediment is expected to be deposited much closer to the disturbance activity.
- A 36 km study area for underwater noise impacts has been defined in accordance with outputs from the underwater noise modelling (Volume 4, Annex 6.2: Underwater Noise Technical Report (application ref: 6.4.6.2)).

11 Additionally, in response to consultation with the Isle of Man Department of Environment, Food and Agriculture (DEFA), a wider contextual area consisting of the northern Irish Sea has also been considered to give due regard to concerns raised in response to the Scoping Report. The extent of the wider area provides a regional context on fish and shellfish ecology but is not directly associated with a particular impact.





LEGEND

- Order Limits
- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- GyM Interlink Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Fish and Shellfish Study Area

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	03/03/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:400,000	A3	WGS84	UTM30N

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AWEL Y MÔR
Offshore Wind Farm

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2.3 Data Sources

12 A detailed desktop review was carried out to establish the baseline information available on fish and shellfish populations in the fish study area for AyM. Information was sought on fish and shellfish ecology in general and on spawning and nursery activity. The baseline characterisation utilises a broad combination of datasets and provides a robust temporal analysis and validation of the site-specific monitoring datasets and regional monitoring datasets.

13 Data to support the baseline characterisation of the AyM study area was utilised from the sources listed in Table 2.1 below.

Table 2.1: Data sources used to inform the AyM baseline characterisation.

Data Source	Data Utilisation
Gwynt y Môr OWF baseline characterisation (CMACS, 2005a)	Used to provide information regarding the fish and shellfish ecology of the site.
Burbo Bank Extension Adult and Juvenile Fish Characterisation surveys (BMM, 2011)	
Annual FEPA Monitoring Report for North Hoyle OWF (Cefas, 2005)	
Rhyl Flats Offshore Wind Farm Beam Trawl Survey Report (CMACS, 2005b)	
British Geological Survey (BGS) Seabed Sediment datasets (Cefas, 2015)	PSA data presented to provide an indication on the location of suitable habitat and spawning grounds for sandeel and herring.
Broadscale Marine Habitat data (UKSeaMap, 2018, (published in 2019)).	Sediment data presented to provide an indication on the location of suitable habitat and spawning grounds for sandeel and herring.
Northern Ireland Ground Fish Survey (NIGFS) (ICES, 2010)	Used to inform locations of nursery grounds of sensitive receptors and to provide a temporal benchmark for analysis and validation of existing site-specific data.
North West Groundfish Survey (Cefas, 2013)	
Fisheries Sensitivity Maps in British Waters (Coull *et al.*, 1998)	Used to provide information on likely spawning or nursery areas for commercial species.
Highly mobile fish species distributions in UK waters (Cefas, 2010)	Used to provide information on the distribution of highly mobile fish species within the region.
Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones) (Ellis *et al.*, 2010)	Provided information on fish spawning and nursery grounds.
Spawning and nursery grounds of selected fish species in UK waters. Scientific Series Technical Report (Ellis *et al.*, 2012)	
UK sea fisheries annual statistics report (MMO, 2020)	Used to provide information on commercial important fish species.
Landings statistics for the period 2012-2018 (MMO, 2018)	Used to inform the shellfish populations baseline, and to provide a temporal benchmark for analysis and validation of existing site-specific data.

Data Source	Data Utilisation
Agri-Food and Biosciences Institute (AFBI) Herring Acoustic Survey (2014)	Used to inform the herring population baseline.
AFBI annual scallop surveys (2019)	Used to inform the scallop population baseline.
Regional and national underwater noise monitoring campaigns and ES documents	Gwynt y Mor in particular for regional monitoring, and national ES chapters to identify the likely, precautionary, ZoI of construction phase underwater noise for the purposes of characterisation and study area definition
Additional Data Sources	
Particle Size Analysis (PSA) data	Information from other aspects and chapters of the EIA will be cross-referred to.
Benthic habitats data from Benthic Ecology baseline characterisation	
Commercial Fisheries baseline characterisation	
International Bottom Trawl Survey (2019-2021)	These, together with additional data sources used in this report will be used to provide a temporal benchmark for analysis and validation of existing site-specific data.
Irish Sea Annual Egg Production Method (AEPM) Plankton Survey (2000)	

2.3.2 Data Limitations

Fish and Shellfish Ecology

14 Mobile species such as fish, exhibit varying spatial and temporal patterns. All surveys described here were undertaken to provide a semi-seasonal description of the fish and shellfish assemblages within the fish and shellfish study area. It should be noted, however, that the data collected during these surveys represent snapshots of the fish and shellfish assemblage within the study area at the time of sampling and the fish and shellfish assemblages may vary considerably both seasonally and annually.

15 Furthermore, the efficiency of the survey methods employed at collecting species will vary depending on the nature of the survey methods used and the species recorded. For example, the semi-pelagic otter trawl would not collect pelagic species (e.g. herring (*Clupea harengus*) and sprat (*Sprattus sprattus*)) as efficiently as a pelagic trawl and the 2 m scientific beam trawl would not be as efficient at collecting sandeel (*Ammodytes spp.*) and shellfish species as other methods used commercially in the study area (e.g. sandeel or shrimp trawls and shellfish potting). As such, to minimise the limitations from the survey equipment used, for the purposes of this baseline report, the species requiring consideration in the assessment have been identified on the presence or absence of these species, rather than a consideration of the relative contribution to the recorded assemblage from the surveys.

16 The description of spawning and nursery grounds provided in this report is primarily based on the information presented in Coull *et al*. (1998) and Ellis *et al*. (2012). The limitations of these sources of information should, however, be recognised. These publications provide an indication of the general location of spawning and nursery grounds. They do not define precise boundaries of spawning and nursery grounds. Similarly, the spawning times given in these publications represent the maximum duration of spawning on a species/stock basis. In some cases, the duration of spawning may be much more contracted, on a site-specific basis, than reported in Coull *et al*. (1998) and Ellis *et al*. (2012). Therefore, where available, additional research publications have also been reviewed to provide site-specific information.

17 Mobile species such as fish, exhibit varying spatial and temporal patterns. Site-specific surveys for GyM, North Hoyle, Rhyl Flats and Burbo Bank Extension were undertaken to provide semi-seasonal descriptions of the fish and shellfish. These datasets represent snapshots of the fish and shellfish assemblage at the time of sampling and the fish and shellfish assemblages may vary considerably both seasonally and annually.

18 It is important to note, that although the data used in the characterisation of the fish and shellfish baseline conditions span a long time period, with some sources published over a decade ago, this means the information presented represents a long-term dataset. Accordingly, this allows for a detailed overview of the characteristic fish and shellfish species in the study area. The diversity and abundance of many species, particularly demersal fish species, is linked to habitat types, which have remained relatively constant in the study area, indicating no major shift in the fish and shellfish communities over the time period of the data used in this report.

19 The EUNIS and Folk (1954) (Stephens and Diesing, 2015) broadscale marine habitat data used as one of the datasets to identify preferred sandeel and herring spawning habitats is limited by the broadscale nature of the data, since it does not account for small scale, localised differences in seabed sediments, unlike the data obtained from site-specific grab sampling. In this case it is important to review all of the datasets presented, to develop a clear overview of preferred sandeel and herring habitat.

20 It should also be noted that the use of PSA data and broad scale habitat mapping only provides a proxy for the presence of sandeel and herring spawning habitat in these locations (based on suitability of habitats; i.e. the potential for spawning rather than actual contemporary spawning activity); therefore, this data should be reviewed alongside other datasets presented in this chapter in determining the location and relative importance of spawning habitats.

3 Baseline Conditions

21 Information on the fish and shellfish communities in the area around the proposed AyM site (including the 15 km buffer area) were compiled through extensive desk-based searches. A summary of these sources is provided below (and in Table 2.1). This adds to an extensive knowledge of the area based on other offshore wind developments in the Irish Sea.

22 Based on the data sources described, including surveys, a wide range of fish and shellfish species are expected to inhabit the study area, including Atlantic salmon (*Salmo salar*), Atlantic cod (*Gadus morhua*), whiting (*Merlangius merlangus*), plaice (*Pleuronectes platessa*), common sole (*Solea solea*), herring, mackerel (*Scomber scombrus*), lesser sandeel, spotted ray (*Raja montagui*) and thornback ray (*Raja clavata*). The sections below describe the broadscale spawning and nursery habitats, followed by a more focused description of the baseline within the array and offshore ECC.

3.2 Spawning and Nursery Grounds

23 Many species of fish and shellfish are known to either spawn or have nursery areas in relatively close proximity to, or potentially overlapping with AyM (Coull *et al*., 1998; Ellis *et al*., 2012). This section describes the fish species which have spawning and nursery areas that overlap, or are in close proximity to, AyM array area or ECC search area. Within the received Scoping Opinion, it was particularly noted that consideration should be given as to the validity of older sources, such as Coull *et al*., 1998 and Ellis *et al*., 2012. In this context it is important to note that the spawning maps presented in those sources were developed from a combination of fisheries monitoring data, such as eggs, larvae, and commercial species data, underpinned by sediment and acoustic survey data which characterise the primary physical drivers of spawning and nursery grounds.

24 Spawning and nursery areas are categorised by Ellis *et al*. (2012) as either high or low intensity dependent on the level of spawning activity or abundance of juveniles recorded in these habitats. Coull *et al*. (1998) does not always provide this level of detail. The spatial extent of the spawning grounds and the duration of spawning periods indicated in these studies are therefore considered likely to represent the maximum theoretical extent of the areas and periods within which spawning will occur.

25 The spawning and nursery grounds (Coull *et al*, 1998 and Ellis *et al*, 2010), discussed and illustrated below are considered robust sources of information, as the physical drivers such as sediment type remain the same (UKSeaMap, 2018).

3.2.2 Spawning Grounds

26 Several species of fish and shellfish are known to either spawn or have nursery areas in relatively close proximity to, or potentially overlapping with the AyM study area (Coull *et al*. 1998, Ellis *et al* 2010). These spawning and nursery sites identified within and in proximity to AyM are presented in Figure 2 to Figure 8 below.

27 A number of species with 'high intensity' spawning overlap the AyM study area, including sandeel, plaice, sole and cod (Figure 2, Figure 3 and Figure 5) . However, it should be noted that annual cod larval count surveys (AEPM, 2000), and subsequent monitoring undertaken in 2006 and reported in Pitois and Armstrong (2014), indicate that the areas of high larval density are located to the north of the AyM array area, therefore indicating that AyM does not directly overlap areas of high intensity spawning for cod. (Figure 5). Plaice larval count surveys (AEPM, 2000) showed high larval densities across the Eastern Irish Sea, supporting the Coull *et al* (1998) spatial distribution of high intensity plaice spawning grounds. (Figure 2).

28 Species with low intensity spawning grounds that cross the Study Area (as well as widely around the UK) include cod, sandeel, whiting, plaice, ling (*Molva molva*), mackerel, horse mackerel (*Trachurus trachurus*), hake (*Merluccius bilinearis*) and Nephrops (*Nephrops norvegicus*).

29 Following consultations with Natural Resource Wales (NRW), further consideration has been given to the high intensity herring spawning ground off the east coast of the Isle of Man (Coull *et al*, 1998), this is detailed below.

3.2.3 Herring and Sandeel Spawning Grounds

30 Herring and sandeel are of particular relevance when considering impacts to spawning areas as they are demersal spawners. Sandeel, as their name suggests, spawn in coarse sands to gravelly sands, whilst herring prefer to spawn in coarser sediments comprising sandy gravels to gravel.

31 Data from Coull *et al* (1998) and Ellis *et al* (2010) suggests that the AyM fish and shellfish study area lies within sandeel spawning and nursery habitats (Figure 8). Spawning areas for sandeel across the Irish Sea are large, extending across much of Liverpool Bay. It is important to note that sediment type is considered an important determinant in the distribution of sandeel spawning habitat.

32 As stated above, further consideration has been given to herring spawning grounds following consultation with NRW. The nearest herring spawning ground is located off the east coast of the Isle of Man (Coull *et al*, 1998). This spawning ground is a well-known and historic spawning ground, which is still in use. Further to this, the Douglas Bank herring closure area (Figure 10) was implemented in 1994 (Council Regulation (EC) 850/98 Article 20(1)(f)(as amended)), to protect aggregates of spawning herring within the spawning ground (Figure 7) from the 21st September to the 15th November. The spawning ground is located approximately 65.4 km from the Awel y Môr array area, outside of the defined Study Area, and outside of the ZoI of the array and ECC search area. Given the contemporary nature of the monitoring undertaken to inform the Douglas Bank closed area, and the recognised importance of the underlying sediment as a determinant for the presence of herring and/or sandeel spawning, these data are considered to be robust and appropriate for the purposes of characterising the receiving environment for the purposes of EIA.

3.2.4 Potential Herring and Sandeel Habitats

33 Noting that the study area and ZoI is considered to be of low importance for herring, it is relevant to consider whether there is the potential for spawning to occur in the future, or for the area to be of importance in the future. Sandeel and herring are of particular relevance when considering impacts to spawning areas as they are demersal spawners.

34 As demersal spawners, herring and sandeel lay demersal eggs. As such, they have specific requirements in terms of spawning grounds, with seabed sediment being the primary determinant (Maravelias *et al*., 2000).

Herring

35 The preferred sediment habitat for herring spawning is gravel, with some tolerance of more sandy sediments, although these are primarily on the edge of any spawning grounds (Stratoudakis *et al*. 1998). Atlantic herring spawning beds are typically small, localised features. Actual spawning habitat, or habitat that could be used for spawning activity, likely comprises relatively small seabed features, with discrete spatial extents, although these may be spread across wide area of suitable seabed spawning habitat at a regional scale (e.g. spawning grounds (MarineSpace *et al*., 2013)). Eggs are laid on the seabed, usually in water 10-80 m deep, in areas of gravel, or similar coarse habitats (e.g. coarse sand, shell and maerl), with well oxygenated waters (Ellis *et al*., 2012; Bowers, 1980; de Groot, 1980; Rakine, 1986, Aneer, 1989; Stratoudakis *et al*., 1998).

36 As noted above, the nearest herring spawning ground is located off the east coast of the Isle of Man, and approximately 65.4 km from the AyM study area. Information from Coull *et al*. (1998) indicates that the herring spawning grounds off the Isle of Man are predominantly used from August to September.

37 Annual herring larvae surveys undertaken across the northern Irish Sea by AFBI (from 1993 to 2007) observed consistently high larval abundances to the east and the north of the Isle of Man. The surveys also observed considerable interannual variability in the mean spawning date and length of the production period, with the estimated mean spawning date for larvae caught in 2007 being 7th October, with the larval production period estimated at 23 days (ICES, 2008).

38 Areas of potential herring spawning habitat have been identified using broadscale habitat mapping (UKSeaMap, 2018). These data have been supplemented by BGS sediment data, and PSA data collected for the GyM site classification to refine areas of potential herring spawning habitat. A stated above in Table 2.1, site-specific data has also been collected across the Awel y Môr OWF array and ECC search area. These data have been interpreted to further refine the understanding of areas of potential herring spawning habitat within the proposed development site.

39 UKSeaMap (2018) data, as illustrated in Figure 7 shows that the array and the ECC area are dominated in sand and coarse substrates. Whilst this data indicates the potential for herring spawning habitats within the AyM array area and across the ECC area, and across the Irish Sea, historic data from Coull *et al*. (1998) and the annual herring larvae surveys (ICES, 2008) indicate that areas of active herring spawning are limited to the east coast of the Isle of Man.

Sandeel

40 Sandeel also spawn in coarse sediments, though as their name suggests, their preferred spawning habitats are sandier than those of herring. Sandeel prefer habitats composed of sand to gravelly sand but will tolerate sandy gravels as a marginal spawning habitat.

41 AyM is located within a high intensity sandeel spawning ground. Spawning areas for sandeel are large, with spawning grounds identified across the Irish Sea (Ellis *et al*., 2010).

42 Sandeel are highly substrate specific (Wright *et al*., 2000); after an initial larval dispersal period, sandeel display a degree of site fidelity (Jensen *et al*., 2011) so their settled distribution reflects the distribution of preferred habitat. Sandeel rarely occur in sediments where the silt content (particle size <0.63µm) is greater than 4%, and they are absent in substrates with a silt content greater than 10% (Holland *et al*., 2005, Wright *et al*., 2000).

43 Areas of potential sandeel spawning habitat have been identified using broad scale habitat mapping (UKSeaMap, 2018). These data have been supplemented by BGS sediment data, and PSA data collected for the GyM site classification to refine areas of potential sandeel habitat. A stated above in Table 2.1, site-specific PSA data have been collected across the AyM array and ECC to further ground-truth the site and identify areas of potential sandeel spawning habitat within the proposed development site.

44 The UKSeaMap (2018) data and supplementary PSA data, as illustrated in Figure 8 shows that sandeel spawning habitats are present across the AyM array and ECC. However, it should be noted that suitable spawning substrates are also present across much of Liverpool Bay. Given the sediment distribution envelope within the study area and broader region is considered to have remained consistent over the last 20 years, as evidenced through reference to the named sources above, the data are considered to remain robust and appropriate for the purposes of undertaking an EIA.

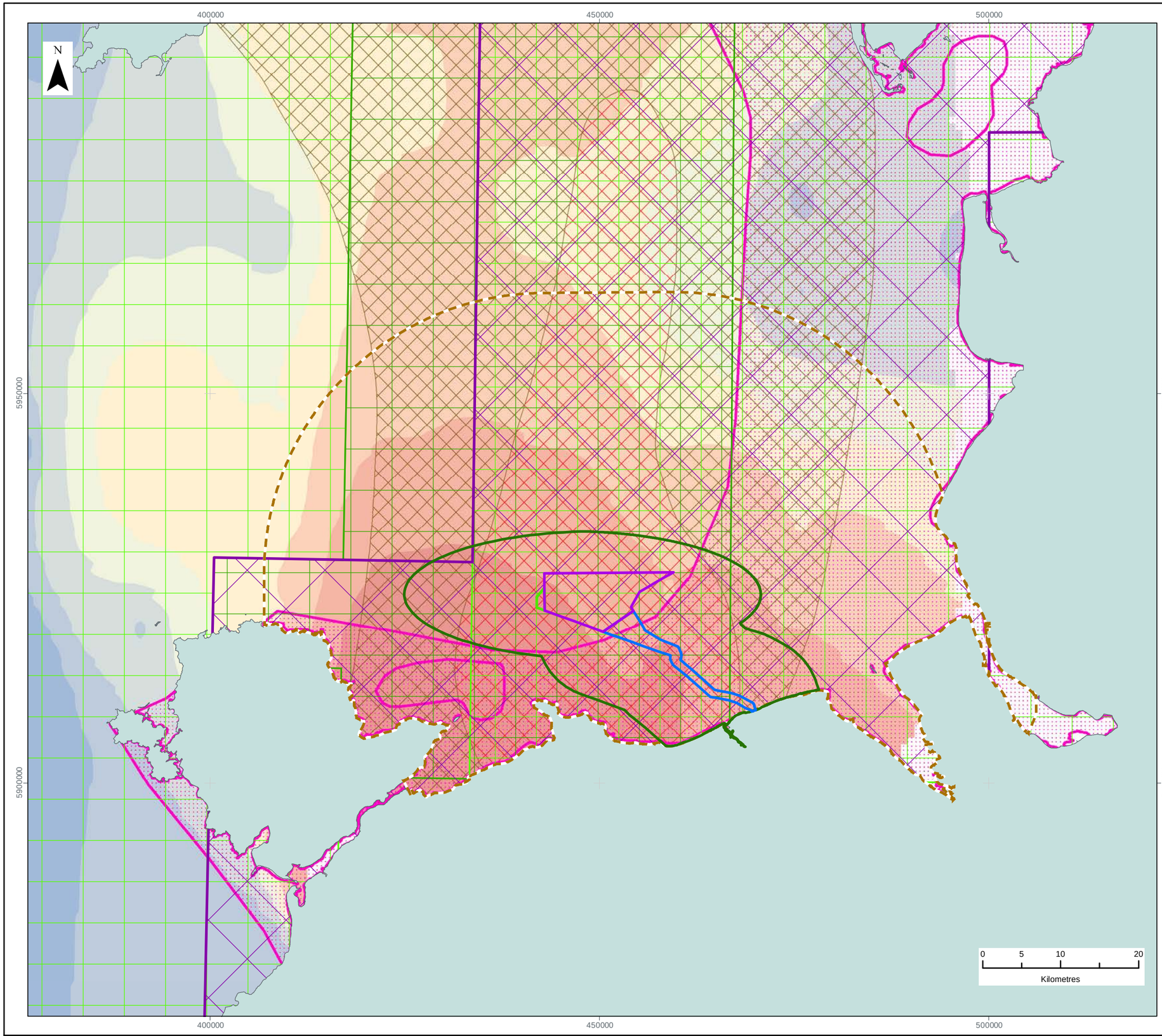
3.2.5 Nursery Grounds

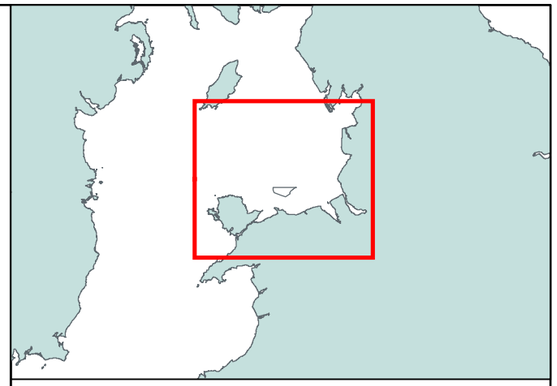
45 The Irish Sea provides important nursery ground habitat for a variety of fish species. For fish nursery grounds, the only species with 'high intensity' nursery grounds in the Study Area are spurdog (*Squalus spp.)*, herring, cod, whiting and sole (Coull *et al*, 1998; Ellis *et al*, 2010). However, the high intensity nursery area for spurdog is primarily in the northern Irish Sea and extends across from the Solway Firth to the Irish coast outside of the ZoI and has therefore not been illustrated in this report

46 The cod nursery grounds extend across the whole eastern Irish Sea and in a broader context along most of the North Sea coast. High intensity herring nursery grounds extend around the entire northern UK, and the North Sea coast.

47 Species with low intensity nursery areas that cross the Study Area (as well as widely around the UK) comprise of tope (*Galeorhinus galeus*), thornback ray, spotted ray, sandeel, mackerel, anglerfish (*Lophius piscatorius*) and plaice.

48 The following sections of this report present an analysis of site specific and regional datasets which indicate the species identified in this section to remain present. As such the nursery data presented by Coull et al (*ibid*) and Ellis et al (*ibid*) are considered to remain adequate for the purposes of characterising the receiving environment. The data analysis presented does not indicate any new nursery grounds are present, and as such the data will adequately identify the species nursery grounds for consideration within the EIA.





LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Nursery Grounds (Coull et al, 1998)

- Plaice

Nursery Grounds (Ellis et al, 2010)

- Plaice, Lower Intensity

Spawning Grounds (Coull et al,1998)

- Plaice, Lower Intensity
- Plaice, Higher Intensity

Spawning Grounds (Ellis et al, 2010)

- Plaice, Lower Intensity
- Plaice, High Intensity

Annual Plaice larval count during spawning season (AEPM, 2000)

- 0 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 250
- 250 - 500
- 500 - 1,000

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Plaice spawning and nursery grounds, and larval density relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	24/01/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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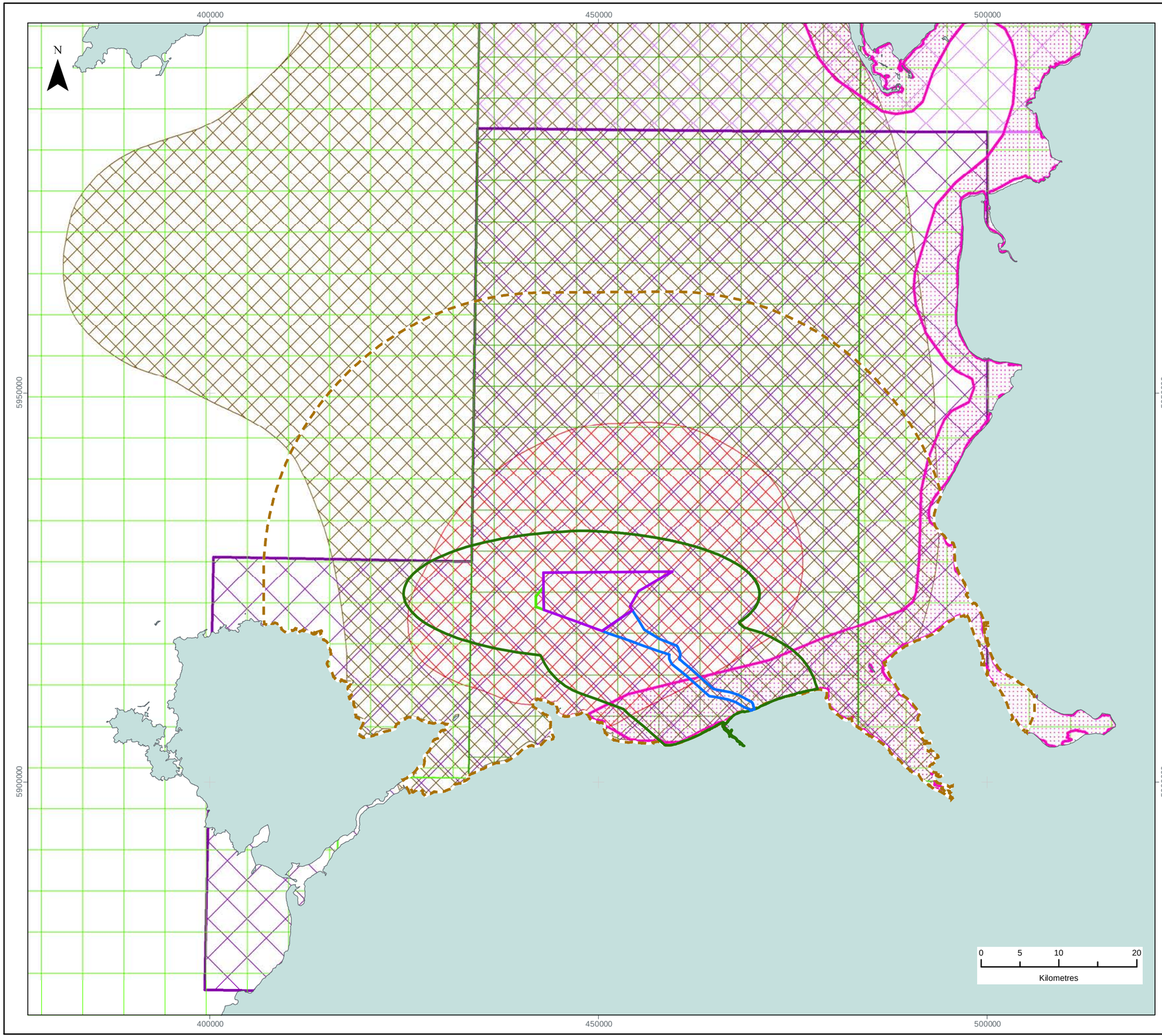

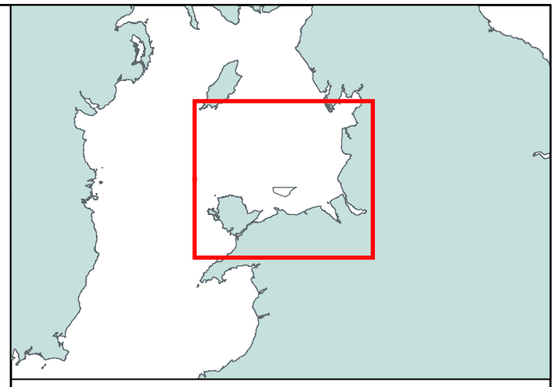

LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Nursery Grounds (Coull et al, 1998)

- Sole

Nursery Grounds (Ellis et al, 2010)

- Sole, Lower Intensity
- Sole, Lower Intensity

Spawning Grounds (Coull et al,1998)

- Sole, Lower Intensity
- Sole, Higher Intensity

Spawning Grounds (Ellis et al, 2010)

- Sole, Lower Intensity
- Sole, Higher Intensity

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Sole spawning and nursery grounds relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	24/01/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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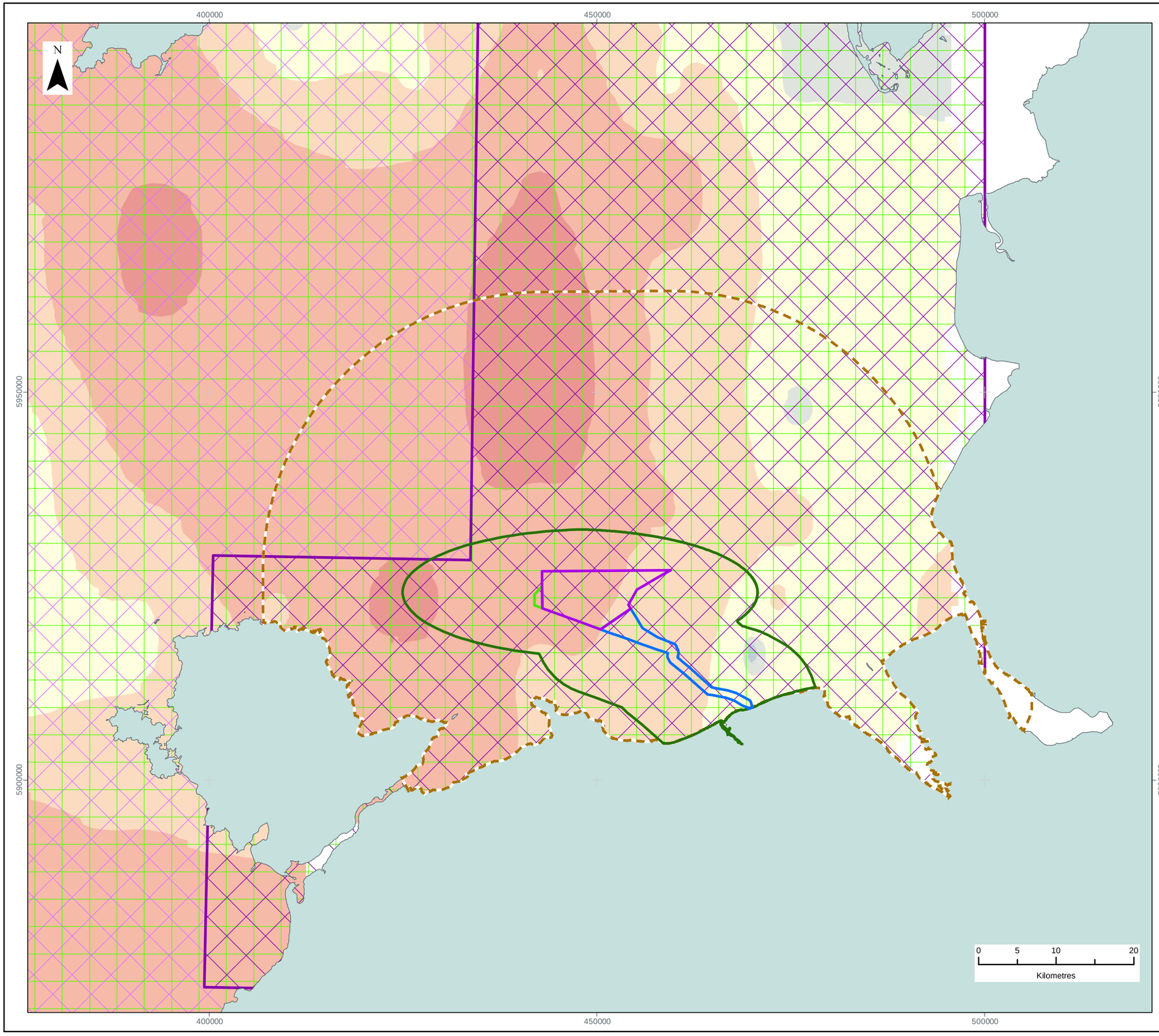

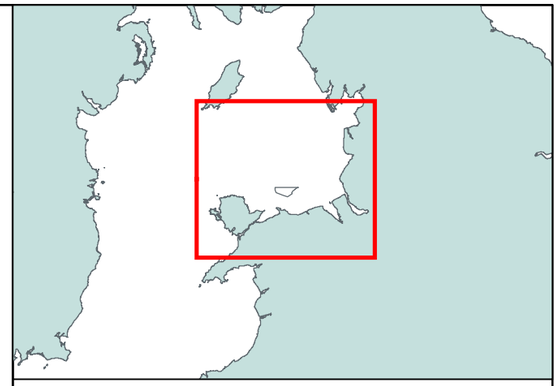

LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Nursery Grounds (Ellis et al, 2010)

- Whiting, Low Intensity
- Whiting, High Intensity

Spawning Grounds (Ellis et al, 2010)

- Whiting, Lower Intensity

Annual Whiting larval count during spawning season (AEPM, 2000)

- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 20
- 20 - 40
- 40 - 80

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Whiting spawning and nursery grounds, and larval density relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	24/01/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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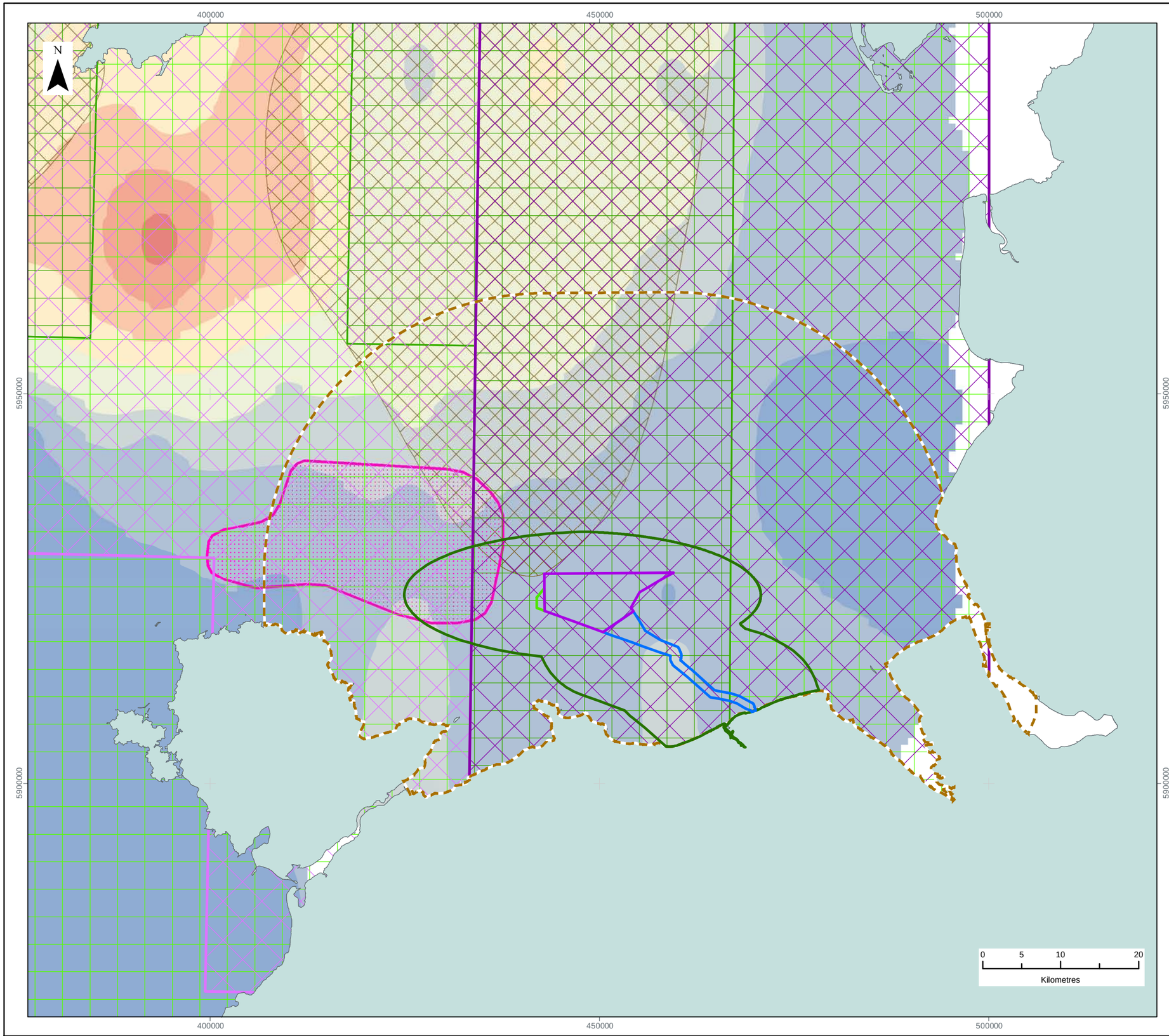

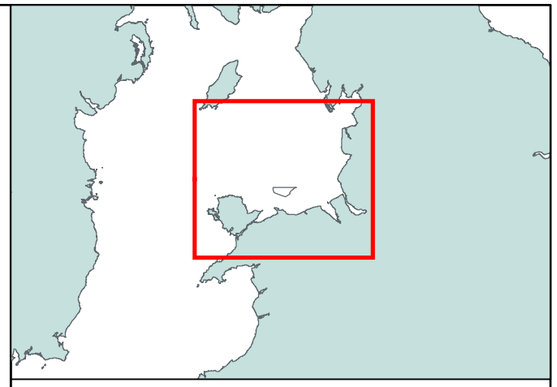

LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Nursery Grounds (Coull et al, 1998)

- Cod

Nursery Grounds (Ellis et al, 2010)

- Cod, Lower Intensity
- Cod, Higher Intensity

Spawning Grounds (Coull et al,1998)

- Cod, Lower Intensity

Spawning Grounds (Ellis et al, 2010)

- Cod, Lower Intensity
- Cod, Higher Intensity

Annual Cod larval count during spawning season (AEPM, 2000)

- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Cod spawning and nursery grounds, and larval density relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	24/01/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 5

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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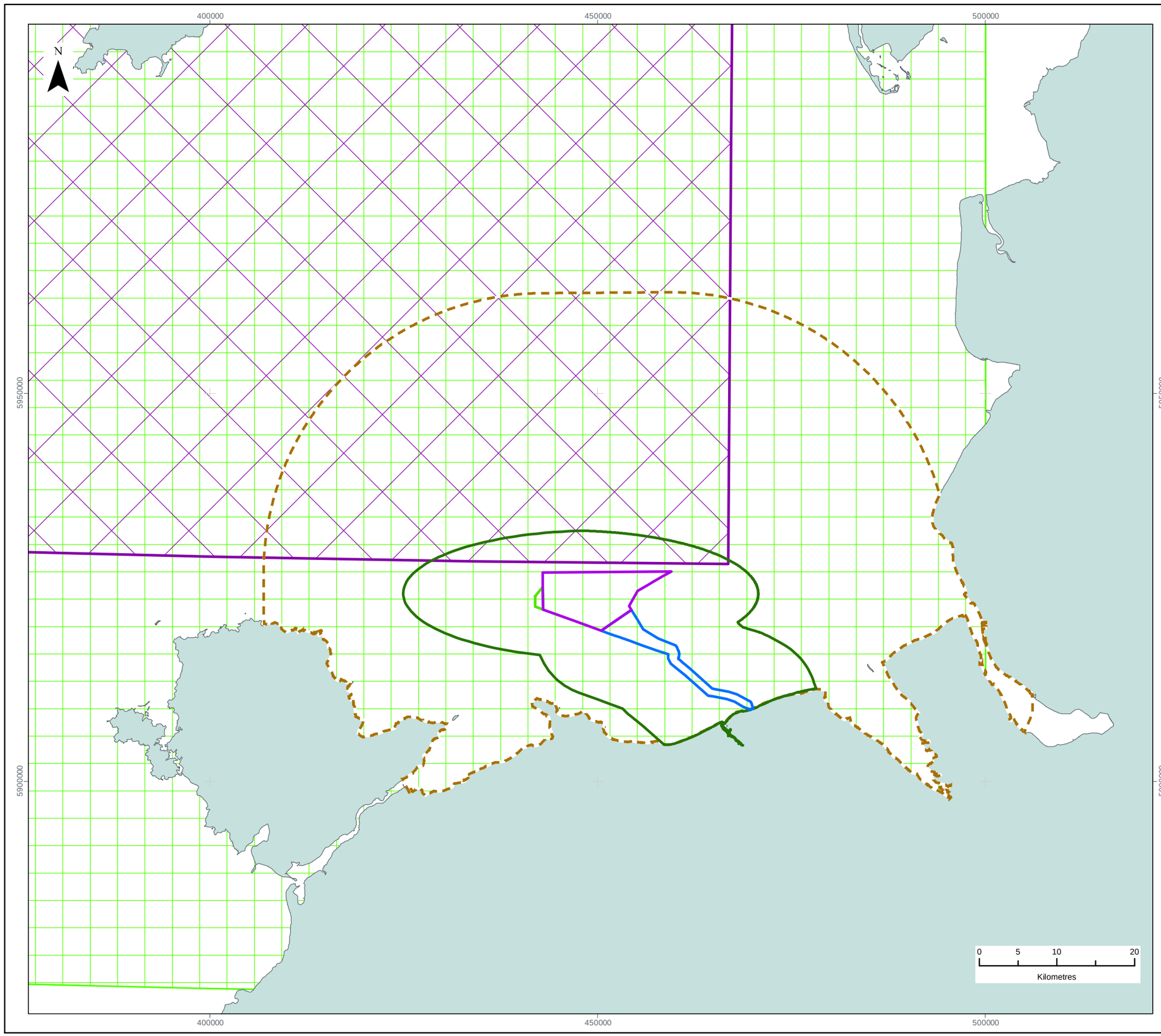

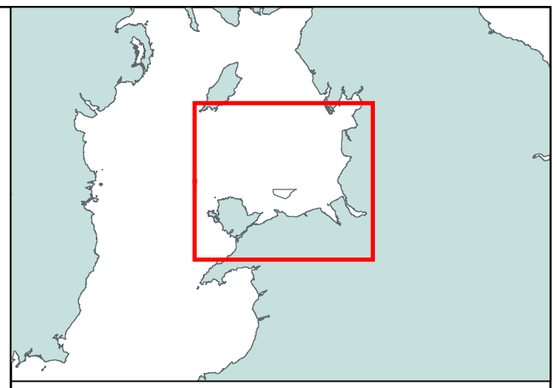

LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Nursery Grounds (Ellis et al, 2010)

- Mackerel, Lower Intensity

Spawning Grounds (Ellis et al, 2010)

- Mackerel, Lower Intensity

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Mackerel spawning and nursery grounds relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	24/01/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 6

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Ailtraeth
AWEL Y MÔR
Offshore Wind Farm

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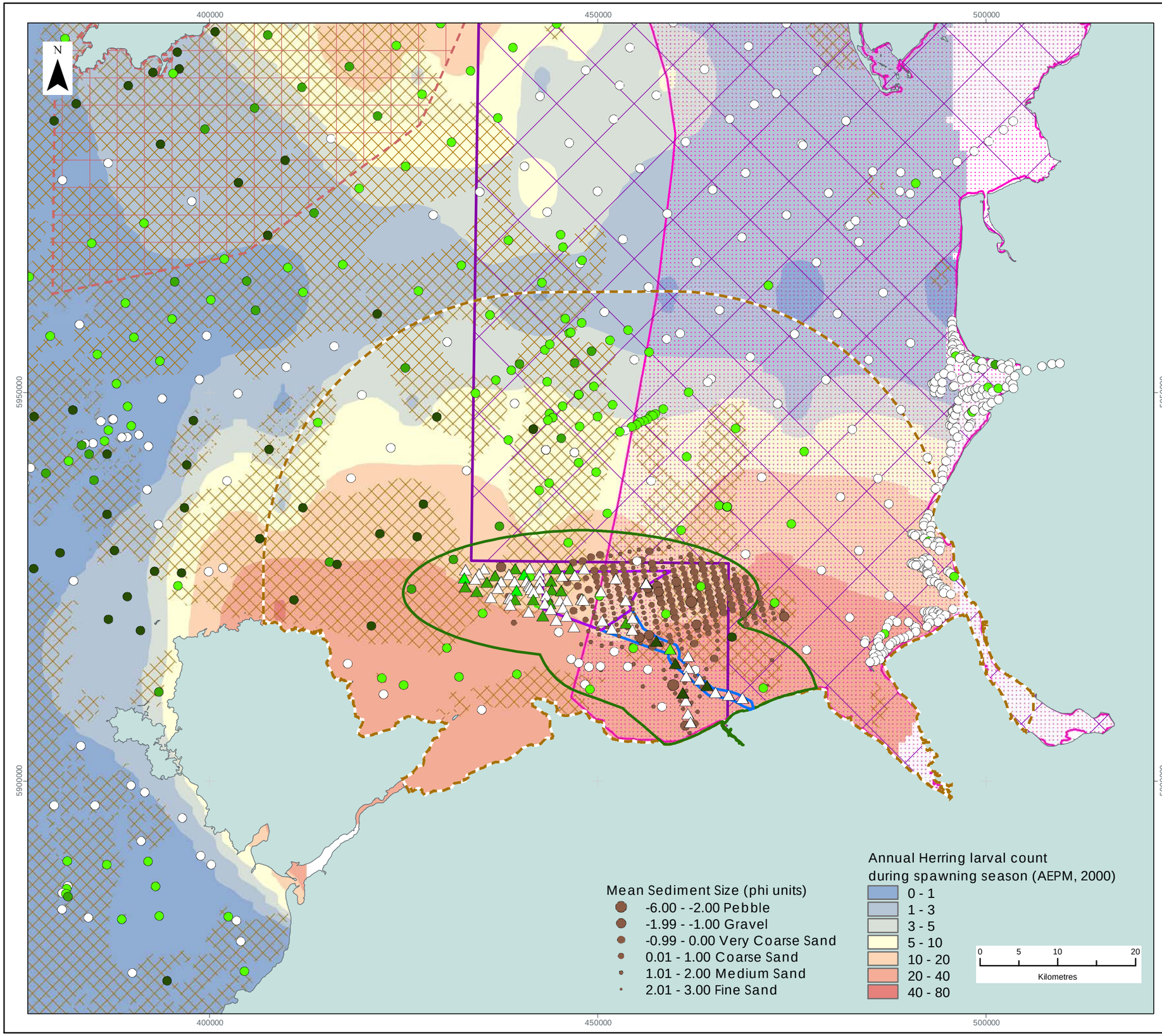

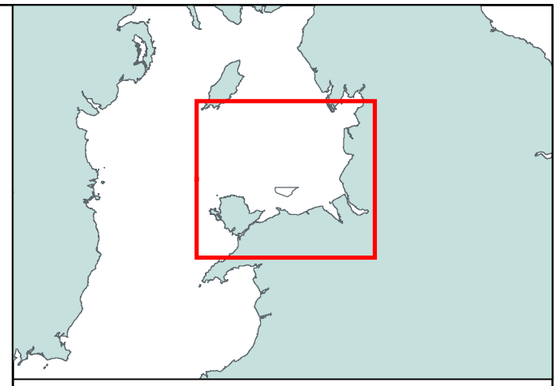

LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence
- Douglas Bank Herring Closure

Nursery Grounds (Coull et al, 1998)

- Herring

Nursery Grounds (Ellis et al, 2010)

- Herring, Higher Intensity

Herring Habitat (UKSeaMap 2018)

- Coarse substrate

Herring Habitat Suitability (Reach *et al.*, 2013) (BGS GeoIndex data)

- Prime, Preferred
- Sub-Prime, Preferred
- Suitable, Marginal
- Unsuitable

Herring Habitat Suitability (Reach *et al.*, 2013) (Awel y Môr baseline survey data (Fugro, 2021))

- Prime
- Sub-Prime
- Suitable
- Unsuitable

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Herring spawning and nursery habitats, and larval density relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	09/02/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 7

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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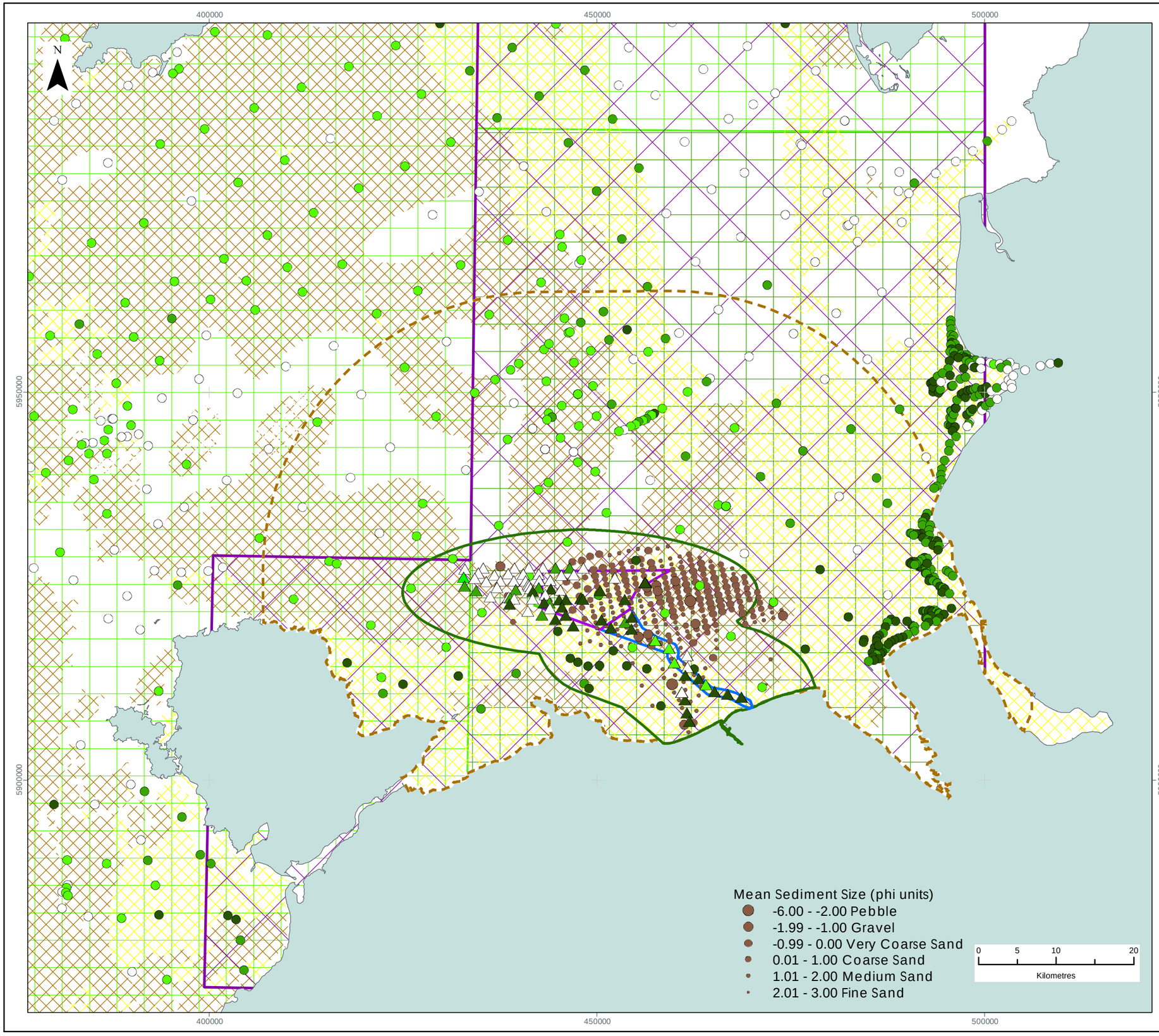

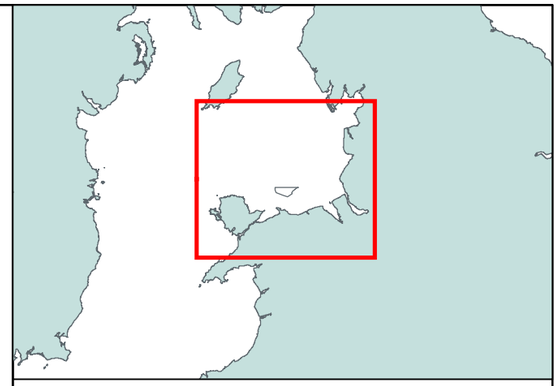

LEGEND

- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence

Nursery Grounds (Ellis et al, 2010)

- Sandeel, Lower Intensity

Spawning Grounds (Ellis et al, 2010)

- Sandeel, Lower Intensity
- Sandeel, Higher Intensity

Sandeel Habitat (UKSeaMap 2018)

- Coarse substrate
- Sand

Sandeel Habitat Suitability (Latto *et al.*, 2013) (BGS GeoIndex data)

- Prime, Preferred
- Sub-Prime, Preferred
- Suitable, Marginal
- Unsuitable

Sandeel Habitat Suitability (Latto *et al.*, 2013) (Awel y Môr baseline survey data (Fugro, 2021))

- Prime, Preferred
- Sub-Prime, Preferred
- Suitable, Marginal
- Unsuitable

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Sandeel habitat relative to the Awel y Môr OWF and spawning and nursery grounds

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	09/02/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 8

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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3.3 Baseline Conditions of the Array

49 The following section describes the fish and shellfish community present within the array study area, followed by the ECC study area. The fish and shellfish community is described through reference to regional trawl surveys, and shellfish surveys, followed by industry specific monitoring undertaken for a number of regional offshore wind farms. Information on the fish and shellfish communities in the area around the proposed AyM OWF have been compiled to inform the fish and shellfish baseline. The baseline description of the array area draws on the GyM ES, as well as on site-specific and regional datasets with coverage of the array. This information adds to the extensive knowledge of the area based on other developments in the region, such as other OWFs.

50 The spatial distribution of the surveys across the AyM study area are shown in Figure 9, with surveys undertaken across the eastern Irish Sea. The data ranges from 1998 to 2019, with various surveys providing robust long-term time series data over a period of 13 years. The data represents both snapshots of the current species composition across the eastern Irish Sea, alongside long-term time series data (groundfish surveys), which show the species composition to have remained consistent, subject to natural variation, overtime. Therefore, the data presented is considered both spatially, and temporally appropriate for the purposes of undertaking an EIA.

3.3.6 Regional Surveys

Trawl Surveys

51 Otter trawls conducted across the Irish Sea, from 2005 to 2020, as part of the North Irish Groundfish Survey (NIGFS) (ICES, 2021), were dominated by herring, sprat, whiting, haddock (*Melanogrammus aeglefinus*) and plaice (**Error! Reference source not found.**).

52 Beam trawls undertaken across the Irish Sea by Cefas in 1998 to inform the North West Groundfish Survey (NWGFS) were dominated by plaice, sole, edible crab (*Cancer pagurus*), whiting, dab (*Limanda limanda*), common dragonet (*Callionymus lyra*), and pogge (*Agonus cataphractus*) (**Error! Reference source not found.**).

53 Acoustic surveys for herring across the Northern Irish Sea undertaken by AFBI in 2019, showed herring to be fairly widely distributed, within mixed schools at low abundances, with a few distinct areas of high abundances identified. The largest herring aggregations were found northeast of the Isle of Man and off the Northern Ireland coast (ICES, 2020a) as described in Section 3.2.3 and in Figure 7, confirmed through reference to the AFBI data.

Shellfish Surveys

54 Data derived from Lockwood (2005) shows two distinct shellfish resources within the Irish Sea; a large scallop ground is located across the whole eastern Irish Sea, and a *Nephrops* resource is located to the north of Liverpool Bay, between the Isle of Man and the Cumbria coast outside of the ZoI for AyM (this finding is supported by similar findings by the more recent NIGFS). Shellfish abundances inshore are dominated by cockles, crabs, lobsters, mussels, shrimp and whelk.

55 Quantitative stock assessments of queen scallop (*Aequipecten opercularis*) have been undertaken in the Isle of Man's territorial sea since 2013. The outputs from these assessments indicate decreasing biomass of queen scallops 2011–2019, a trend which is also mirrored by commercial landings. Similar findings were recorded in annual queen scallop surveys undertaken across the northern Irish Sea (since 2013) by AFBI, which recorded a decreased in estimated abundances in 2019, compared to previous years (ICES, 2019).

56 A juvenile queen scallop survey commissioned by the Scallop Management Board (SMB) was undertaken across four main scallop fishing grounds within the Isle of Man's territorial sea in June 2019. Generally low densities of scallop were recorded across the grounds, with localised hotspots identified at East Douglas (ICES, 2019).

57 Declines in densities of king scallop (*Pecten maximus*) have been recorded in time series surveys undertaken by Bangor University in Welsh waters, with further decline recorded in the 2019 survey. The survey results indicated that there is limited evidence for improvement of mean king scallop densities in any of the areas open to commercial scallop dredging in Welsh waters, although recovery of stocks was observed in areas closed to commercial fishing (ICES, 2019).

58 Annual underwater television (UWTV) surveys undertaken across the eastern and western Irish Sea observed an overall decline in density of *Nephrops* across the Irish Sea grounds in 2019, compared to the previous year, although the distribution of the grounds remained consistent (ICES, 2020b).

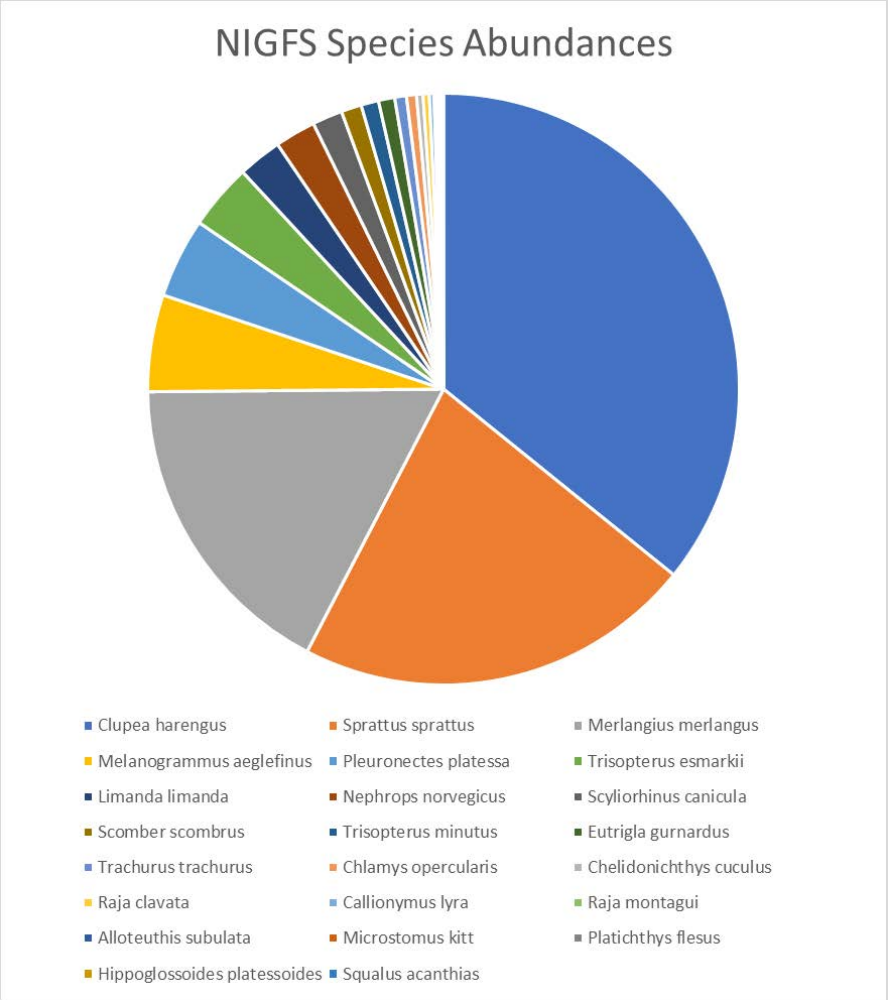


Chart 1: Top 70 percentile fish species by total abundance recorded across the Irish Sea in the NIGFS (ICES, 2010).

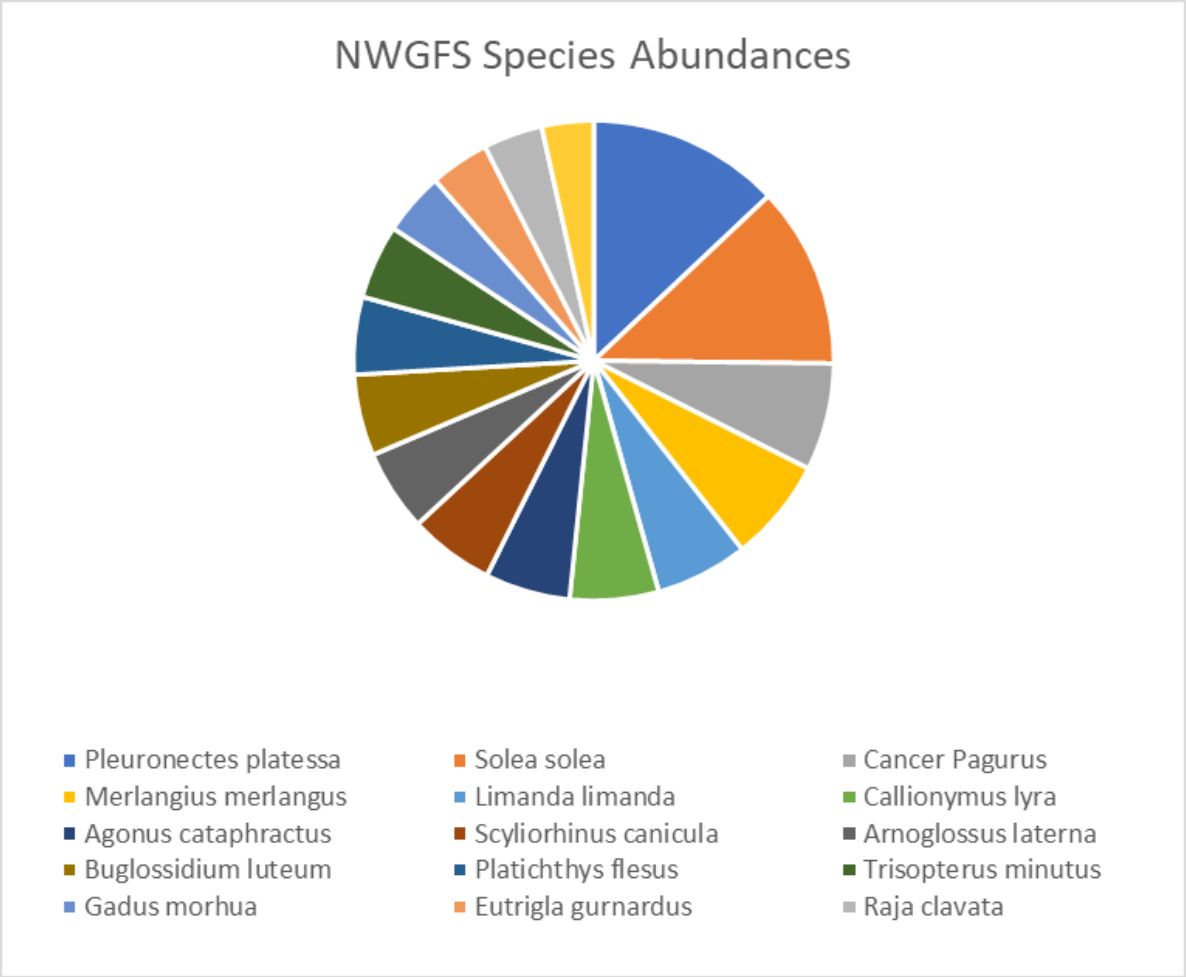


Chart 2: Top 70 percentile fish species by total abundance recorded across the eastern Irish Sea in the NWGFS (2010).

3.3.7 Offshore Wind Development Surveys

59 A number of surveys have been conducted as part of other studies that sampled stations within (or close to) to the AyM study area and were designed to obtain baseline information regarding diversity and abundance of fish and shellfish. Most notably these include the surveys conducted for GyM along with other offshore wind farms within the eastern Irish Sea, Rhyl Flats, Burbo Bank Extension and the cancelled Celtic Array. The trawl surveys for GyM commenced in December 2003 and March and August in 2004. Surveys conducted for the listed offshore wind farms included the use of the following methods:

- Otter trawls
- 2 m beam trawls; and
- 4 m beam trawls.

60 Beam trawl surveys undertaken as part of the benthic characterisation survey for GyM provided semi-qualitative data concerning the fish species and assemblage within the GyM project area. The results of the beam trawl recorded 3,861 individuals from 43 fish species (CMACS, 2005a). The five most abundant fish species recorded during the 2003 survey were; scaldfish (*Arnoglossus laterna*), solenette (*Buglossidium luteum*), dragonet, dab and sand goby (*Pomatoschistus minutus*). In the March 2004 trawl scaldfish, dragonet, dab, poor cod (*Trisopterus minutus*) and pogge were abundant. The August 2004 trawls were dominated by dragonet, dab, solenette, sand goby and poor cod. Overall, elasmobranchs were recorded in small numbers and infrequently with a total of 27 individuals from 5 taxa recorded from all the surveys. The most common was the Thornback ray of which 11 individuals were recorded. It should be noted that this ray species one of the most abundant in the Irish Sea and in UK waters and that these numbers are likely to be under-representative due to the semi-quantitative nature of beam trawls.

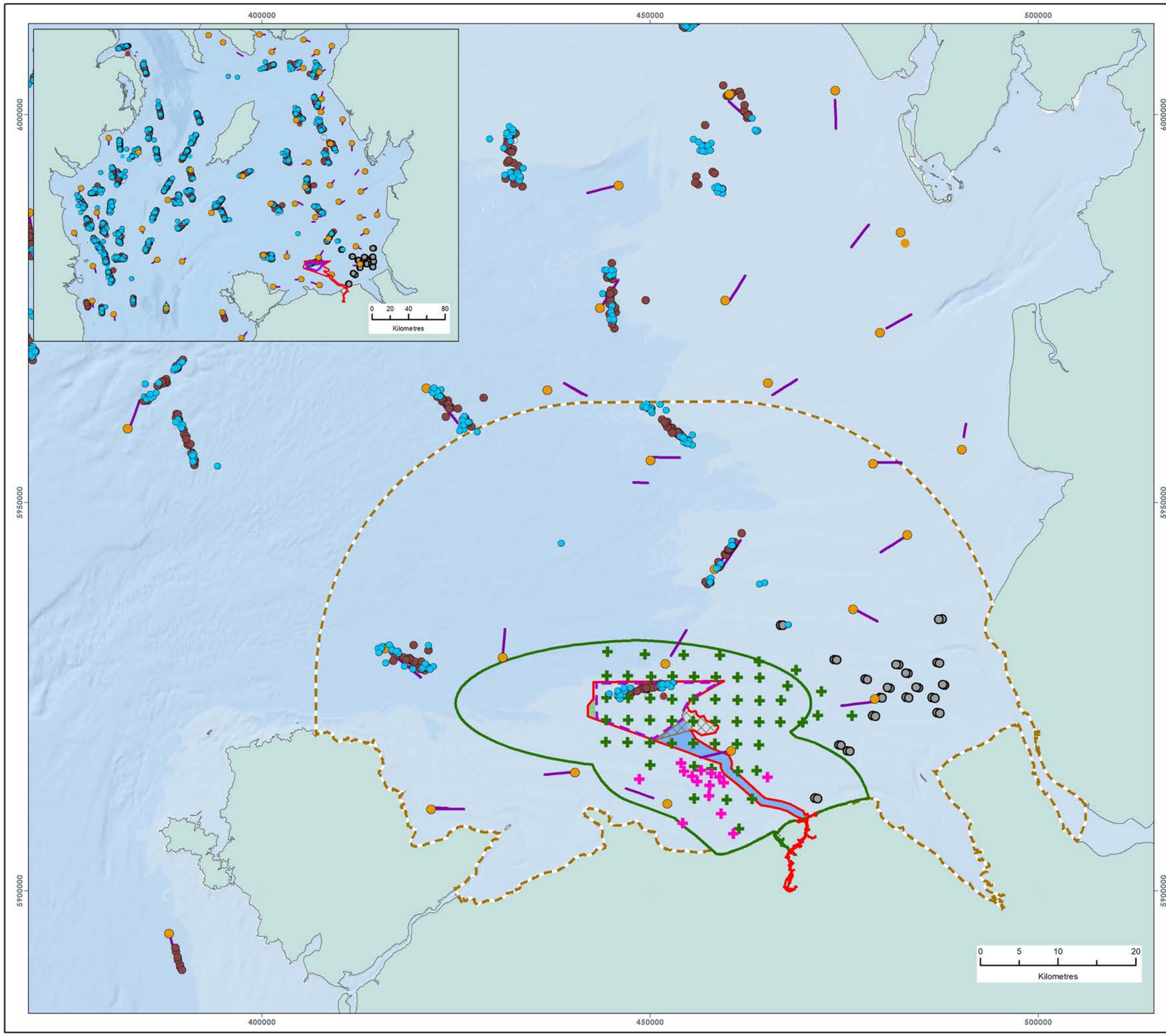
61 Site-specific otter and beam trawl surveys conducted between May and September 2011 to inform the Burbo Bank Extension fish and shellfish baseline (Burbo Bank Extension Adult and Juvenile Fish Characterisation surveys, 2011), were dominated by the teleost species dab, plaice, flounder (*Platichthys flesus*) and whiting, and pelagic species sprat and herring. Thornback ray and small-spotted catshark were the most dominant elasmobranchs recorded in the area.

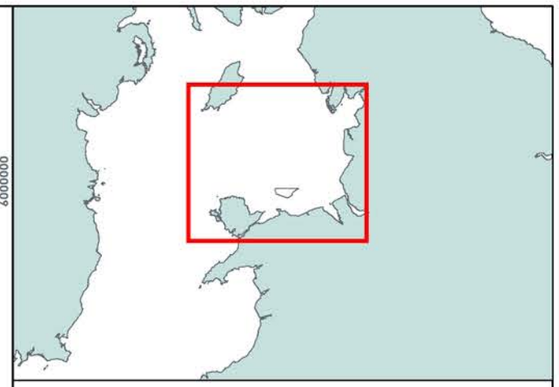
62 Post-construction monitoring beam trawl surveys (Cefas, 2005) undertaken at the North Hoyle were dominated by plaice, dab, sole and dragonet. These surveys showed no changes in the species composition following the development, therefore demonstrating that no significant change occurred as a result of the construction of the offshore wind farm.

63 Beam trawl surveys undertaken at the Rhyl Flats were dominated by sand goby and solenette, with dab and plaice being the most common commercial species surveyed at the site (CMACS, 2005b).

64 The Celtic Array carried out 4 m beam trawl surveys in November 2010 and March 2011 to provide information on fish and epifauna abundance and distribution within the array area. No unusual fish communities or rare fish species were found during the surveys. The most abundant species recorded in the surveys differed for the two seasons in which the surveys were conducted. It was found that there was marginally higher species diversity in spring (47 species) than the autumn (43 species), with the autumn fish community being dominated by poor cod, and spring recording the thickback sole (*Microchirus variegatus*), as the most abundant fish species across the Irish Sea Zone as a whole. Total abundance of fish was very similar between autumn and spring. The results from the site-specific surveys showed a similarity to the assemblages identified in the central Irish Sea by Ellis *et al*. (2000). Furthermore, during these trawl surveys (2010/11), seven species of elasmobranch were recorded, the most abundant was the small-spotted catshark, followed by spotted ray, cuckoo ray (*Raja naevus*), nursehound (*Scyliorhinus stellaris*), thornback ray, blonde ray (*Raja brachyuran*) and smoothhound (*Mustelus asterias*). No rare or endangered elasmobranch species were recorded, however both the thornback ray and nursehound are on the near threatened International Union for Conservation of Nature (IUCN) Red List for the UK (The Wildlife Trusts, 2020).

65 The characterising species identified within the regional industry specific monitoring campaigns remain directly comparable with those identified in more recent regional surveys such as NIGFS. It can therefore be concluded with confidence that the earlier monitoring data from projects such as GyM, Burbo Bank Extension, and North Hoyle remain adequately representative of the receiving environment to be used within the characterisation.





LEGEND

- Order Limits
- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- GyM Interlink Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence
- GyM Beam Trawl Locations (2002-2004)
- Rhyl Flats Beam Trawl Locations (2006)
- Burbo Bank Trawl Locations (2011)
- Celtic Array Benthic Trawl Sites (2010)
- North West Groundfish Survey (2005)
- Northern Ireland Groundfish Survey
- AFBI Acoustic Survey (1992-2016)

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Fish and shellfish surveys within the region

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	09/02/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 9

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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3.3.8 Species of Conservation Importance

66 Several species of conservation importance have been recorded on occasion within the study area. Species are detailed below, alongside information of their designations, and recorded presence of the species within the study area.

Atlantic Salmon (*Salmo salar*)

67 Atlantic salmon are designated under Annex III of the Bern convention and freshwater populations on Annexes II and V of the EC Habitats Directive. Atlantic salmon are also a UK Biodiversity Action Plan (BAP) priority fish species and a Section 7 priority species under the Environment (Wales) Act 2016.

68 Atlantic salmon are anadromous fish, spawning in freshwater and feeding at sea, and are found in virtually all the rivers draining into Liverpool Bay (Apprahamian and Apprahamian, 1999).

69 Regionally the (Welsh) Dee is considered important due to the numbers of salmon it supports, with the River Clwyd and River Conwy also supporting small populations of the species. Salmon are considered to arrive in August/ September and are subject to a number of managed fisheries on the Dee. Trapping and tagging is undertaken at Chester Weir on the Dee, and the 2018 results indicate a general decline in numbers from a peak of 6400 fish in 2002, to 3400 fish in 2018 (3-year average). As noted within the "Salmonid and fisheries statistics for England and Wales 2020" (Environment Agency, 2021) salmon rivers within England and Wales are considered to be predominantly 'at risk' or 'probably at risk'. However, year-on-year catches of salmon (net) have shown an increase from or 2019 to 2020 (453, 900 respectively). Rod catches have correlated, with an increase in year-on-year salmon catches between 2019 and 2020 (9,163, 11,665 respectively). The England and Wales statistics draw on combined rod and net fishing statistics, with the 'rod days' decreasing during this period from 125,297 to 107,776, although the net licences remained consistent (154,154). Within the Dee, Clwyd and Conwy rivers specifically, 287, 14 and 99 salmon were caught by rod in 2020, with salmon only captured by net in the Conwy. This compares with 211, 19 and 119 salmon caught by rod in 2019.

European Eel (*A. anguilla*)

70 European eel is critically endangered on the IUCN Red List and are UK BAP priority fish species and Environment (Wales) Act 2016 Section 7 priority species.

71 European eel is catadromous, feeding in freshwater and spawning at sea, and are found in virtually all the rivers draining into Liverpool Bay (Apprahamian and Apprahamian, 1999). Although within these rivers the status of the eel population is unknown, it can be assumed these is a current downward population trend in abundance. This would reflect the wider European eel stocks and the IUCN Red List.

Sea Trout (*Salmo trutta*)

72 Sea trout are a UK BAP priority fish species and an Environment (Wales) Act 2016 Section 7 priority species.

73 Sea trout are anadromous fish, spawning in freshwater and feeding at sea, and are found in virtually all the rivers draining into Liverpool Bay (Apprahamian and Apprahamian, 1999). The River Dee, located to the south-east of the array area, is considered important due to the numbers of sea trout it supports, with the River Clwyd and River Conwy also supporting small populations of the species.

74 As noted within the "Salmonid and fisheries statistics for England and Wales 2020" (Environment Agency, 2021) sea trout rivers within England and Wales are considered to be predominantly 'at risk' or 'probably at risk', with year-on-year catches of sea trout (net) declining between 2019 and 2020 (14,599 and 12,703 respectively) with an overall decline when compared to the 5-year mean. As with salmon, the total 'rod days' reported in the salmonid fisheries statistics have also reduced during this period from 125,297 to 107,776. During 2020 in the Rivers Dee, Clwyd, and Conwy respectively 252, 482, and 570 sea trout were caught by rod. This compares with 407, 823 and 516 sea trout captured by rod in 2019.

Allis shad (*Alosa alosa*) and Twaite shad (*Alosa fallax*)

75 Allis shad and twaite shad are designated under Appendix III and Appendix II of the Bern Convention respectively, Annexes II and V of the EC Habitats Directive, Schedule 5 of the Wildlife and Countryside Act 1981 and are UK BAP priority fish species and Environment (Wales) Act 2016 Section 7 priority species.

76 Allis shad and twaite are members of the herring family that spend most of their late juvenile and adult life in coastal waters. In spring, the mature adults enter estuaries and move upstream to the lower reaches of freshwater where they lay their eggs before returning (May-June) to the sea. The post-larval fish drift downstream in late summer and young-of-the-year reach the estuaries in autumn where they probably remain over winter. Neither species is abundant nor a regularly recorded species in the Irish Sea but there are records of their capture in all of the major estuaries draining into Liverpool Bay (Potts & Swaby, 1999).

77 The spawning status in rivers draining into Liverpool Bay is not certain but it is noted that the primary rivers considered to be of importance to shad are the Wye, Usk, and Tywi in South Wales, with angling surveys conducted by Natural Resources Wales in 2018 revealing limited records in North Wales.

River Lamprey (*Lampetra fluviatilis*) and Sea Lamprey (*Peteromyzon marinus*)

78 River lamprey and sea lamprey are designated under Appendix III of the Bern Convention, Annex II of the EC Habitats Directive, Schedule 5 of the Wildlife and Countryside Act 1981, UK BAP priority fish species and are Environment (Wales) Act 2016 Section 7 priority species.

79 River and sea lamprey spend most of their life in coastal waters, entering estuaries to spawn in the spring. Sea lampreys spawn in the lower reaches of rivers before returning to sea in early summer, followed by young-of-the-year in the autumn. River lampreys migrate further upstream and the juveniles remain in the river until spring when they emigrate to the lower estuaries or coastal waters where they remain for 1-2 years before returning to spawn.

80 Within the extended area both the sea and river lamprey are Annex II species of the Dee Estuary, present as a qualifying feature but not a primary reason for site designation. River lamprey are noted in the Dee Estuary 2017 Special Area of Conservation condition assessment as in favourable condition within the freshwater populations, but unfavourable within the marine habitat as a result of water quality assessments (moderate Water Framework Directive (WFD) water body status). With regards the sea lamprey it is noted as in unfavourable condition on the basis of water quality issues (moderate WFD water body status).

Smelt (*Osmerus eperlanus*)

81 Smelt are a UK BAP priority fish species and an Environment (Wales) Act 2016 Section 7 priority species.

82 Smelt is a member of the salmon family that spends most of its adult life in coastal waters but enters estuaries to spawn in the spring. The adults return to sea once they have spawned; the post-larvae drift downstream and the young-of-the-year reach the lower estuary in autumn. Their distribution and status in Liverpool Bay is not known with any certainty but a small spawning population does run into the River Conwy (English Nature, 2003).

Basking Shark (*Cetorhinus maximus*)

83 Basking shark are designated under Appendix III of the Bern Convention, Appendix II of CITES, Schedule 5 of the Wildlife and Countryside Act 1981, endangered on the IUCN Red List, UK BAP priority marine species and is an Environment (Wales) Act 2016 Section 7 priority species.

84 Basking shark are a regular summer migrant to the coastal waters of the Isle of Man and the western Irish Sea, although it is rarely recorded in Liverpool Bay.

85 During visual and acoustic surveys of the Irish Sea Zone undertaken for the Celtic Array between March 2010 and September 2011, a single basking shark individual was recorded (Celtic Array, 2012).

Angel Shark (*Squatina squatina*)

86 Designated under Schedule 5 of the Wildlife and Countryside Act 1981, critically endangered on the IUCN Red List and is a UK BAP priority marine species and an Environment (Wales) Act 2016 Section 7 priority species. Angel shark have been identified through consultation as a species of concern due to its inclusion as a Section 7 priority species. Following a literature review it is noted that there have been limited recorded catches of angel shark by scientific surveys in the Irish Sea, and 2 records of angel shark within the study area from fishermen during the period 1958-2017, and two individual angel shark caught in >40 years of trawl surveys with in excess of 25000 hauls recorded (ices.dk; Hiddink et al 2019).

The Isle of Man Marine Nature Reserves (MNRs)

87 The Isle of Man Marine Nature Reserves (MNRs) are located to the north of the AyM array area. The Manx Marine Nature Reserves Byelaws (2018) under Section 33 of the Wildlife Act (1990) states that the following fish and shellfish features cannot be extracted or damaged within the MNR's.

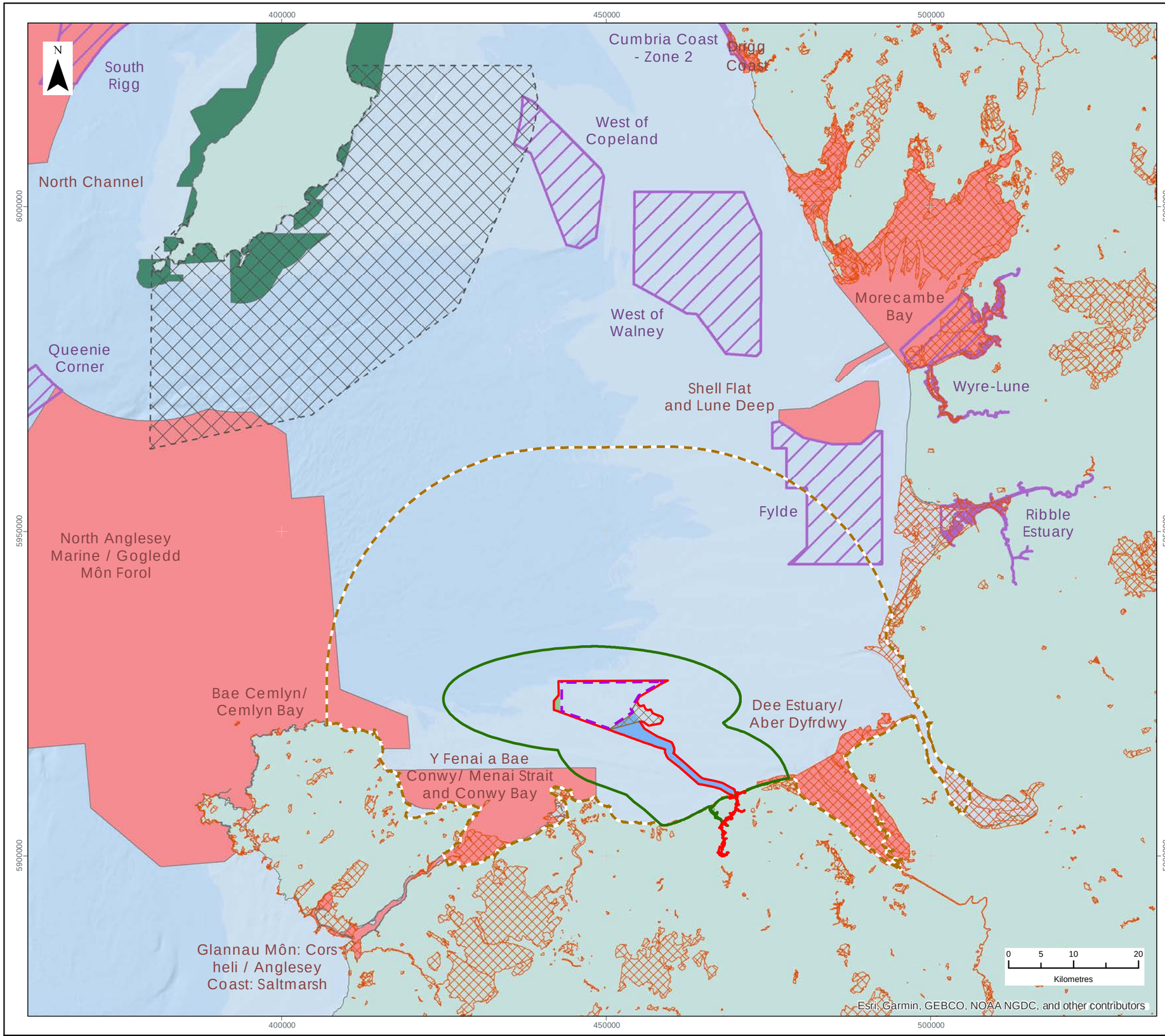
- European eel;
- Flame shell;
- Horse mussels;
- Iceland clam;
- Spiny lobster (except within the Douglas Bay MNR; the Laxey Bay MNR, the Niarbyl Bay MNR and the Port Erin MNR); and
- King and queen scallops.

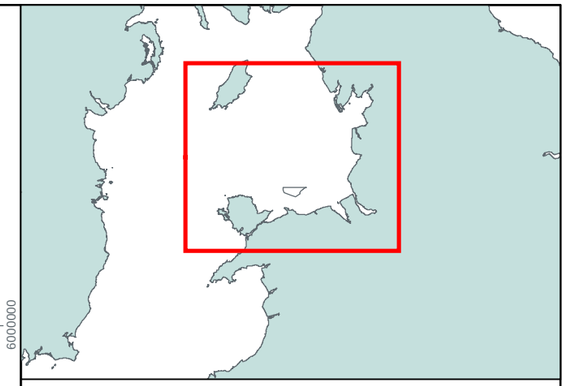
88 The Isle of Man MNRs have been considered in this report for completeness in response to stakeholder feedback, however, as illustrated in Figure 10, they are considered well beyond the likely ZoI from the development at a distance of >60km. Given the evidenced lack of a meaningful effect-receptor pathway due to the distance between the receptor(s) and proposed project, there is not considered to be any potential for a significant effect to occur. The Isle of Man MNRs will not therefore be considered further within the assessment for the AyM project.

Isle of Man Herring Closure Area

89 The Isle of Man also has an annual area closure (21st September to 15th November) for herring (as originally defined by Council Regulation (EC) No 850/98, amended by EC 2723/1999, and current within Sea-Fisheries By-Laws 2000). This area is located to the east of the island, off Douglas Bank, across key herring spawning and nursery grounds.

90 The Isle of Man herring closure area has been considered in this report for completeness in response to stakeholder feedback, however, as illustrated in Figure 10, the area is well beyond the likely ZoI from the development at a distance of >60km. Given the evidenced lack of a meaningful effect-receptor pathway due to the distance between the receptor and proposed project, there is not considered to be any potential for a significant effect to occur. The Isle of Man herring closure area will not therefore be considered further within the assessment for the AyM project.





LEGEND

- Order Limits
- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- GyM Interlink Zone
- Sedimentary Zone of Influence
- Underwater Noise Zone of Influence
- Special Area of Conservation
- Marine Conservation Zone
- Sites of Special Scientific Interest
- Marine Nature Reserve (Isle of Man)
- Douglas Bank Herring Closure

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Designated sites relative to the Awel y Môr OWF

VER	DATE	REMARKS	Drawn	Checked
1	21/10/2020	For Issue For PEIR	BPHB	PN
2	03/03/2022	For Issue For ES	BPHB	AL

FIGURE NUMBER:

Figure 10

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

G:\GIS\GIS_Projects\0141 AyM\GIS\Figures\ES\Fish and Shellfish Technical Report\AYM_F&S_TR_Fig10_Designations.mxd

3.3.9 Migratory Species

92 Migratory species potentially passing through the AyM fish and shellfish study area are considered primarily sensitive to disturbance from underwater noise from piling during construction, as well as electromagnetic field (EMF) emissions from cable operation, and disturbance along the nearshore near estuaries. Therefore, these species are considered fully in Section 3.4.13 of the Baseline Conditions of ECC in this report.

3.3.10 Species of Commercial Importance

93 Species such as cod, plaice, sole are listed under a commercial marine fish group UK Species Action Group (UK BAP, 2007), and their presence has been described previously in this report.

94 The AyM array area is characterised primarily by UK vessels targeting demersal and shellfish species, with landings from the project area dominated by shellfish in terms of both weight and value. Although a small quantity of cod is reported from Rectangle 36E6, most Irish Sea cod landings are from areas north of Liverpool Bay.

95 A large king and queen scallop resource is located within the eastern Irish Sea, overlapping with the AyM array area (CORDAH, 2003), and dredging for scallop accounts for one of the primary fishing activities across the proposed array area. Additionally, there are eight queen scallop beds located off of the Isle of Man (Brand & Prudden, 1997), to the north of the AyM array area, with a scallop fishery in the nearshore waters surrounding the island (management zones and closure areas are also implemented for the scallop fishery).

96 Potting for whelk, crab and lobster is also commonplace across the array area, undertaken predominantly by Welsh vessels in the northernmost portion of the AyM array area.

97 Further information on species of commercial importance has been outlined in the Commercial Fisheries Technical Report.

3.3.11 Valued Ecological Receptors for the Purpose of Assessment

98 The value of ecological features is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (CIEEM, 2016). The most straightforward context for assessing ecological value is to identify those species and habitats that have a specific biodiversity importance recognised through international or national legislation or through local, regional or national conservation plans (e.g. Annex II species under the Habitats Directive, UK BAP species or species of principal importance listed under the NERC Act 2006, and species listed as features of existing or recommended Marine Conservation Zones (MCZs)). However, only a very small proportion of marine habitats and species are afforded protection under the existing legislative or policy framework and therefore evaluation must also assess value according to the functional role of the habitat or species. For example, some features may not have a specific conservation value in themselves but may be functionally linked to a feature of high conservation value (e.g. fish as prey species for protected bird or marine mammal species).

99 The following table shows the criteria applied to determining the ecological value of Valued Ecological Receptors (VERs) within the geographic frame of reference applicable to the AyM fish and shellfish study area (Table 3.1) and have been derived using guidelines published by the CIEEM (2016).

Table 3.1: Criteria used to inform the valuation of ecological receptors in the AyM fish and shellfish study area.

Value of VER	Criteria to define value
International	Internationally designated sites. Species protected under international law (i.e. Annex II species listed as features of Special Areas of Conservation (SACs)).
National	Nationally designated sites. Species protected under national law. Annex II species which are not listed as features of SACs in the AyM fish and shellfish study area. UK BAP priority species (including grouped action plans) that continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework, MCZ/rMCZ features (species classified as features of conservation importance and broad scale habitats), species of principal importance and NIMF that have nationally important populations within the AyM fish and shellfish study area, particularly in the context of species/habitat that may be rare or threatened in the UK*. Species that have spawning or nursery areas within the AyM fish and shellfish study area that are important nationally (e.g. may be primary spawning/nursery area for that species).

Regional	UK BAP priority species (including grouped action plans) that continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework, MCZ/rMCZ features (species classified as features of conservation importance and broad scale habitats), species of principal importance or NIMF that have regionally important populations within the AyM fish and shellfish study area (i.e. are locally widespread and/or abundant). Species that are of commercial value to the fisheries which operate within the Irish Sea. Species that form an important prey item for other species of conservation or commercial value and that are key components of the fish assemblages within the AyM fish and shellfish study area. Species that have spawning or nursery areas within the AyM fish and shellfish study area that are important regionally (i.e. species may spawn in other parts of the UK but that this is key spawning/nursery area within the Irish Sea as the region of interest).
Local	Species that are of commercial importance but do not form a key component of the fish assemblages within the AyM fish and shellfish study area (e.g. they may be exploited in deeper waters outside the AyM fish and shellfish study area). The spawning/nursery area for the species are outside the AyM fish and shellfish study area. The species is common throughout the UK but forms a component of the fish assemblages in the AyM fish and shellfish study area.

*Measured against criteria such as OSPAR threatened/declining species and IUCN Red List of threatened species.

100 The VERs listed below in Table 3.2 relate specifically to impacts anticipated to arise during the construction, operation and maintenance, and decommissioning of the array. Justification for the potential sensitivity to effects from the array is provided alongside each species in Table 3.2 below.

Table 3.2: Summary of fish and shellfish Valued Ecological Receptors (VERs) and their value/importance within the AyM array.

VER	Valuation	Justification
Demersal Fish VERs		
Cod	Regional	High to low intensity spawning grounds, and high intensity nursery ground across the array. Commercially important species. UK BAP species listed by OSPAR as threatened and/or declining and listed as vulnerable on the IUCN Red List. Considered a key sensitive receptor to noise impacts from piling in the array.
Plaice	Regional	Recorded at high abundances throughout the AyM fish and shellfish study area and one of the key characterising species. High to low intensity spawning habitats across the array. Commercially important species to the region. UK BAP species.

		Considered a key sensitive receptor to noise impacts from piling in the array.
Common Sole	Local	Recorded at high abundances throughout the AyM fish and shellfish study area and one of the key characterising species. Commercially important species to the region. Considered a key sensitive receptor to noise impacts from piling in the array.
Whiting	Regional	Forms a key component of the fish assemblages across the AyM array area. Low intensity spawning ground and high intensity nursery grounds present across the region. Considered sensitive to noise impacts from piling in the array.
Dab	Local	Recorded in high abundances across the AyM study area. Fished commercially, though usually as by-catch.
Other demersal species	Local	Includes thickback sole, flounder, solenette, scaldfish, common dragonet, anglerfish, pogge, sand goby and poor cod. No information on spawning or nursery habitats. Little or no commercial importance. Not listed under nature conservation legislation. Likely prey items for fish, bird and marine mammal species.
Conservation Fish VERs		
Atlantic Salmon	International	Annex III of the Bern convention and freshwater populations on Annexes II and V of the EC Habitats Directive, and it a UK BAP priority fish species and an Environment (Wales) Act 2016 Section 7 priority species. Considered a key sensitive receptor to EMF impacts from cable operation.
Sea trout	Regional	UK BAP priority fish species and an Environment (Wales) Act 2016 Section 7 priority species. Considered a key sensitive receptor to EMF impacts from cable operation and maintenance.
Allis Shad	Regional	Appendix III of the Bern Convention respectively, Annexes II and V of the EC Habitats Directive, Schedule 5 of the Wildlife and Countryside Act 1981 and are UK BAP priority fish species and Environment (Wales) Act 2016 Section 7 priority species.
Twaite shad	Regional	Appendix II of the Bern Convention respectively, Annexes II and V of the EC Habitats Directive, Schedule 5 of the Wildlife and Countryside Act 1981 and are UK BAP priority fish species and Environment (Wales) Act 2016 Section 7 priority species.
River lamprey	International	Appendix III of the Bern Convention, Annex II of the EC Habitats Directive, Schedule 5 of the Wildlife and Countryside Act 1981, UK BAP priority fish species and are Environment (Wales) Act 2016 Section 7 priority species.
Sea lamprey	International	Appendix III of the Bern Convention, Annex II of the EC Habitats Directive, Schedule 5 of the Wildlife and

		Countryside Act 1981, UK BAP priority fish species and are Environment (Wales) Act 2016 Section 7 priority species.
Smelt	Regional	UK BAP priority fish species and an Environment (Wales) Act 2016 Section 7 Priority Species.
Pelagic Fish VERs		
Sprat	Regional	Recorded in moderate abundances across the AyM study area. Important prey species for bird and marine mammal species. Commercially important species.
Mackerel	Local	Low intensity spawning and nursery habitats across the AyM study area. UK BAP species. Commercially important species.
Herring	Regional	Recorded at high abundances across the AyM study area. High intensity nursery grounds present across the study area. UK BAP species. Prey species for birds and marine mammals. Species of high sensitivity to noise impacts, and substrate loss and disturbance although spawning grounds are located outside of the ZoI for all impacts.
Other pelagic species	Local	Includes hake, horse mackerel and haddock. No information on spawning or nursery habitats. Little or no commercial importance. Not listed under nature conservation legislation. Likely prey items for fish, bird and marine mammal species
Benthopelagic Fish VERs		
Sandeel	Regional	High intensity spawning ground and low intensity nursery ground across the AyM study area. Important prey species for fish, birds and marine mammals. Commercially important species. UK BAP species. Sandeel are substrate dependent spawners and are therefore considered sensitive to habitat loss and disturbance within the array.
Shellfish VERs		
King scallop	Regional	Large scallop ground is located across the whole eastern Irish Sea. Commercially important to the region.
Queen scallop	Regional	Large scallop ground is located across the whole eastern Irish Sea. Commercially important to the region.
Common whelk	Regional	Recorded in high abundances across the study area. Commercially important to the region.
Edible Crab	Regional	Recorded in high abundances across the study area. Commercially important to the region.
Lobster	Regional	Recorded in high abundances across the study area. Commercially important to the region.

3.4 Baseline Conditions of the ECC Search Area

3.4.12 Site-specific Data

101 The fish and shellfish communities discussed in Section 3.3 of this report are considered reflective of the communities across the AyM ECC, and therefore all species recorded across the region are listed In the Baseline Conditions of the Array section of the report.

102 Key species recorded in high abundances in regional surveys and characterisation surveys for nearby offshore wind developments that are considered key sensitive receptors to the construction, operation and maintenance, and decommissioning of the ECC area are listed below under their respective surveys:

NIGFS

103 High abundances of small spotted catshark were recorded in the NIGFS across the AyM study area. Elasmobranch species are considered of increased sensitivity to electromagnetic field changes, as a result of cables. Additionally, high abundances of herring were also recorded; these species are considered sensitive to loss of habitat and habitat disturbance.

Burbo Bank Extension OWF Fish and Shellfish Characterisation Surveys

104 High abundances of thornback ray and lesser spotted dogfish were recorded across the AyM study area. Additionally, high abundances of herring were also recorded.

Celtic Array Fish and Shellfish Characterisation Surveys

105 Surveys across the proposed site for the Celtic Array OWF recorded seven species of elasmobranch. The most abundant was the small-spotted catshark, followed by spotted ray, cuckoo ray, nursehound, thornback ray, blonde ray and smoothhound.

3.4.13 Species of Conservation Importance

106 Species of conservation importance to the region, are considered the same across the array area and the ECC search area. Therefore, to avoid repetition, these species are detailed above in Section 3.3.8 of this report.

3.4.14 Migratory Species

107 Migratory species are diadromous fish, either they spawn in freshwater and feed at sea such as the anadromous salmon and sea trout, or feed in freshwater and spawn at sea such as the catadromous European eel. Both sea lamprey and river lamprey are migratory species and have been recorded throughout the region.

108 The following species are all found in, or pass through, the eastern Irish Sea and Liverpool Bay at some stage during their life cycle and are predominately in inshore/estuarine waters. These include the following species:

- Atlantic salmon;
- Sea trout; and
- European eel.

109 The migratory routes followed by Atlantic salmon across the Irish Sea in search of their natal rivers to spawn is not known, however it is generally acknowledged that they swim along the coast seeking olfactory clues that help identify the correct river. Locally, on the North Wales coast, commercial fishermen take the view that the salmon approach from the west, through the Menai Strait, moving on the flood tide over the intertidal areas rather than further offshore.

110 Sea trout do not appear to take the same sea migration as salmon, but remain in coastal waters, likely close to their natal river. In addition to this, they are considered more likely to enter an estuary and wait there in the pools for conditions to be right for the run upriver rather than remaining at sea off the estuary mouth as salmon tend to do. Taking this into consideration, is it considered unlikely that sea trout will have any interaction with the proposed AyM site.

111 European eels spawn in an area of the west-central Atlantic, east of the Caribbean known as the Sargasso Sea. The eggs and larvae drift with the North Atlantic Drift and arrive in European coastal waters 2-4 years after spawning. Once in coastal waters, the eggs and larvae undergo metamorphosis to become elvers or 'glass' eels and these young fish enter the estuaries of most UK rivers. The main elver run occurs each spring and although the numbers may never be as great as are found in the Severn Estuary, it is reasonable to assume that elvers will run up all the rivers entering Liverpool Bay. When the eels are ready to return to the spawning grounds they move downstream, re-entering an estuary in late summer to early autumn, and then commence the return sea migration. Once the eels are at sea it is assumed that they leave coastal waters relatively rapidly. Taking this into consideration, is it considered that European eel have the potential to cross the site, however due to their migratory nature, any interaction with the proposed AyM site is anticipated to be temporary.

3.4.15 Species of Commercial Importance

112 The primary species of commercial importance within the ECC area, was identified within the Conwy Estuary, where blue mussels (*Mytilus edulis*) are gathered using traditional hand-raking methods between September and April each year. Given the lack of any project proposal that interacts with the Conwy Estuary it is proposed to not consider blue mussels further.

113 Commercial aquaculture in Wales is dominated by the managed cultivation of blue mussels, although no potential development locations have been identified within the commercial fisheries study area.

3.4.16 Valued Ecological Receptors for the Purpose of Assessment

114 The methodology for determining VERs is discussed above in Section 3.3.11 of this report, and the criteria applied to determining the ecological value of the VERs are detailed in Table 3.1.

115 The VERs listed below in Table 3.3 relate specifically to impacts anticipated to arise during the construction, operation and maintenance, and decommissioning of AyM. Justification for the potential sensitivity to effects from the ECC are provided alongside each species where applicable.

116 In order to avoid repetition, several VER species such as herring, Atlantic salmon and sea trout have the potential to be impacted by the construction and operation of both the array and offshore ECC, however those VERs are not duplicated in this section by virtue of their inclusion in the previous section.

Table 3.3: Summary of fish and shellfish VERs and their value/ importance within the AyM ECC Search Area.

VER	Valuation	Justification
Conservation Fish VERs		
European Eel	Regional	IUCN Red List and are UK BAP priority fish species and Environment (Wales) Act 2016 Section 7 priority species. Considered a key sensitive receptor to EMF impacts from cable operation.
Elasmobranch VERs		
Spurdog	Regional	High intensity nursery ground. UK BAP species, and Species of Principle Importance in Wales. Considered sensitive to EMF impacts from cable operation.
Thornback ray	Regional	Recorded in high abundances across the study area. Low intensity spawning area. Species of Principle Importance in Wales. Considered sensitive to EMF impacts from cable operation.
Spotted ray	Local	Recorded in high abundances across the study area. Low intensity spawning area. Considered sensitive to EMF impacts from cable operation.
Small spotted catshark	Local	Recorded in high abundances across the study area. Considered sensitive to EMF impacts from cable operation.
Cuckoo ray	Local	Recorded in high abundances across the study area. Considered sensitive to EMF impacts from cable operation.
Nursehound	Regional	Recorded in high abundances across the study area. Listed as near threatened by the IUCN. Considered sensitive to EMF impacts from cable operation.
Blonde ray	Local	Recorded in high abundances across the study area. Considered sensitive to EMF impacts from cable operation.

VER	Valuation	Justification
Smoothhound	Local	Recorded in high abundances across the study area. Considered sensitive to EMF impacts from cable operation.
Basking Shark	International	Appendix III of the Bern Convention, Appendix II of CITES, Schedule 5 of the Wildlife and Countryside Act 1981, endangered on the IUCN Red List, UK BAP priority marine species and is an Environment (Wales) Act 2016 Section 7 priority species. Considered sensitive to EMF impacts from cable operation.

4 Conclusions

117 After consideration of the range of existing site-specific and regional information over a broad time series, it is concluded that the level of information available is adequate for the purposes of characterising the existing environment in terms of fish and shellfish ecology. The information and analysis presented within this report provides a robust evidence base to justify the use of existing data to describe the likely spawning and nursery grounds present. The analysis also describes appropriately the fish community with regards migratory species, commercial species, and species of conservation importance, such that it is considered a further survey will not identify any additional receptors that may constitute valued ecological receptors for the purposes of undertaking an EIA.

118 The information presented within this technical annex is therefore considered to be an appropriate characterisation of the receiving environment with regards fish and shellfish receptors. It is concluded that the presence of a combination of site specific and regional data sets across a range of temporal scales precludes the need for further site-specific surveys.

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