Appendix 9.1

Fish, Including Recreational and Commercial Fisheries Baseline

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9.0 Introduction

9.0.0.1 This Appendix describes baseline characteristics of marine and migratory fish populations and fisheries in Swansea Bay and environs and is divided into two sections; the first is for marine fisheries in the coastal waters around Swansea and the second for migratory fisheries associated with South Wales' rivers entering the Project area.

9.0.0.2 Information is given on: commercial and recreational fishing activity that depends on rivers and coastal areas, which may be affected by the Project; and on consultations that have been undertaken with relevant stakeholders.

9.1 Legislation, Planning Policy and Guidance

9.1.0.1 This section describes the main legislative and planning policy considerations that relate to marine ecology and fisheries. The legislation and planning policy outlined below control development within the marine environment by setting out the measures and processes that should be implemented to protect designated sites and biodiversity interests, specifically related to fisheries. Other aspects may be scrutinised under more general planning powers.

9.1.0.2 International conventions and European directives are followed by links to relevant UK legislation, by which they are ratified. The designated sites introduced below will be discussed in relation to the proposed development, Tidal Lagoon Swansea Bay, in section 9.2.

9.1.1 International Conventions

The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the Bern Convention)

9.1.1.1 The principle aims of the Bern Convention are the conservation and protection of the wild plant and animal species (and the natural habitats thereof) listed in Appendices I and II of the Convention. It also seeks to increase co-operation between governments and to regulate the exploitation of the species listed in Appendix III, which includes migratory species.

9.1.1.2 The Bern Convention was implemented in Europe via two directives: Council Directive 79/409/EEC on the Conservation of Wild Birds (the EC Birds Directive) in 1979 (which is considered further in Chapter 11, Coastal Birds); and Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EC Habitats Directive) in 1992 (see section 9.1.3).

9.1.1.3 The convention is implemented in UK law by the Wildlife and Countryside Act (1981 and as amended) (see section 9.1.4).

The Convention on Biological Diversity 1992 (Biodiversity Convention or CBD)

9.1.1.4 The CBD was the first treaty to provide a legal framework for biodiversity conservation. It focuses on the conservation of all species and ecosystems and, therefore, provides protection to all biodiversity. The convention requires that national strategies, plans or programmes are developed for the conservation and sustainable use of biodiversity.

9.1.1.5 In the UK, the CBD is implemented via the Post-2010 Biodiversity Framework, which in 2012 replaced the UK Biodiversity Action Plan (see section 9.1.4).

The Convention on the Conservation of Migratory Species of Wild Animals 1979 (the Bonn Convention or CMS)

9.1.1.6 The convention aims to conserve migratory species and their habitats by providing strict protection for endangered migratory species that are listed in Appendix I of the convention. It involves multilateral agreements for conserving and managing those migratory species that would benefit from international co-operation (listed in Appendix II of the Convention) and the undertaking of co-operative research.

9.1.1.7 Within the UK, protection of Appendix I species is carried out through the Wildlife & Countryside Act (1981 as amended) (see section 9.1.4). The Countryside and Rights of Way Act 2000 (CRoW) was also enacted in England and Wales to offer further support by increasing penalties and enforcement powers (see section 9.1.4). It also strengthened the protection of sites from damage caused by third parties.

The Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (the OSPAR Convention)

9.1.1.8 The OSPAR Convention provides a comprehensive approach to addressing sources of maritime pollution and other matters affecting the marine environment. Annex V of the convention provides a framework for governments to develop their own conservation measures. Article 2 requires parties to 'take necessary measures to protect and conserve the ecosystems and the biological diversity of the maritime area, and to restore, where practicable, marine areas which have already been adversely affected'.

9.1.1.9 The most recent OSPAR List of Threatened and/or Declining Species and Habitats lists the following species *inter alia* as being under threat and/or in decline in Region III (the Celtic Seas, which includes Swansea Bay): allis shad (*Alosa alosa*); European eel (*Anguilla anguilla*); Portuguese dogfish (*Centroscymnus coelolepis*); common skate (*Raja batis*); spotted ray (*Raja montagui*); cod (*Gadus morhua*); long-snouted seahorse (*Hippocampus guttalatus*); short-snouted seahorse (*Hippocampus hippocampus*); sea lamprey (*Petromyzon marinus*); white skate (*Rostroraja alba*); salmon (*Salmo salar*) and Northeast Atlantic spurdog (*Squalus acanthias*).

9.1.1.10 Note: Recent evidence suggest that the common skate Dipturus batis is actually a two-species complex with nominal species flapper skate Dipturus intermidia and blue sake Dipturus flossada. Taxonomically the common skate species-complex has noticeable phenotypic differences within the nominal species such as: morphology, genetics and life history (Iglesias et al., 2010).

9.1.1.11 Also included within the Biodiversity Strategy is the programme for identification and selection of marine protected areas (MPAs). In Wales, MPAs include SACs, SPAs and Marine Conservation Zones (MCZs).

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1971 (the Ramsar Convention or Wetlands Convention)

9.1.1.12 The convention has three main pillars of activity: designation of internationally important wetlands as Ramsar sites; promotion of each country's wise-use of all wetlands; and international co-operation to further the wise-use.

9.1.1.13 In order to promote the conservation of Ramsar sites, the UK implements the convention through prior notice of Sites of Special Scientific Interest (SSSIs). In England and Wales, these receive statutory protection under the Wildlife and Countryside Act 1981 (as amended) (see section 9.1.4). Policy statements relating to the status of Ramsar sites have been issued by Government, to extend their level of protection to that of sites designated as part of the EU Natura 2000 network (under the EC Birds and Habitats (see section 9.1.3) Directives).

9.1.2 European Directives

EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (EC Habitats Directive)

9.1.2.1 The Habitats Directive was adopted in 1992 and is the means by which the European Union meets its obligations under the Bern Convention.

9.1.2.2 The directive promotes the maintenance of biodiversity by requiring Member States to maintain or restore natural habitats and wild species that are listed on the directive's annexes. Economic, social and cultural requirements must be considered, alongside regional and local characteristics.

9.1.2.3 To maintain or restore habitats listed in Annex I and species listed in Annex II of the Directive to 'Favourable Conservation Status', a network of Special Areas of Conservation (SACs) have been created.

9.1.2.4 In England and Wales, the directive is implemented under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), which apply to land and territorial waters to the 12 nautical mile limit. The amendments are consolidated by the Conservation of Habitats and Species regulations 2010 out to 12nm from the coast (see section 9.1.4) and by the Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended) between 12nm from the coast and 200nm or the limit of the UK Continental Designated Area.

Shellfish Waters Directive (79/923/EEC)

9.1.2.5 The Shellfish Waters Directive was adopted on 30th October 1979 in order to protect designated shellfish waters, thereby maintaining the high water quality necessary for producing edible shellfish. The directive protects bivalve and gastropod molluscs, including oysters, mussels, cockles and clams. It does not cover crustaceans, such as crabs and lobsters.

9.1.2.6 In the UK, the Shellfish Waters Directive is implemented by the Surface Waters (Shellfish) Classifications Regulations 1997 and the Surface Water (Shellfish) Directions 2010. The directive will be replaced by the EC Water Framework Directive (see following section) by the end of 2013, which must provide equivalent protection of shellfish waters.

The Water Framework Directive (2000/60EC)

9.1.2.7 The EC Water Framework Directive (WFD) requires that all inland and coastal waters within defined river basin districts reach at least 'good status' (or 'good potential', if considering a heavily modified water body) by 2015. The WFD defines how this should be achieved by establishing environmental objectives and ecological targets for surface

waters. Under the requirements of the directive, the present water quality status must be assessed and any significant water quality issues identified. Overall, the aim is to enhance water resource quality, reduce pollution and promote sustainable use of water resources.

9.1.2.8 The WFD is implemented in the UK under The Water Environment Regulations (see section 9.1). It provides a catchment-based approach to managing the UK's ground and surface waters. Five biological components are used to assess ecological status/potential of coastal and estuarine water bodies under the WFD: angiosperms (e.g. eelgrass); macroalgae; phytoplankton; invertebrates; and fish. Establishment of a water body's ecological status/potential can be used to assess how improving water quality would be able to support good ecological status/potential.

9.1.2.9 Swansea Bay falls in the Western Wales River Basin District (Environment Agency & CCW, 2009). At present, 29% of surface waters in this district are at good or better ecological status/potential, on a five-point scale: high-good-moderate-poor-bad. 51% of assessed surface water bodies are at good biological status (from biological assessment results).

EU Marine Strategy Framework Directive (2008/56/EC)

9.1.2.10 The Marine Strategy Framework Directive (MSFD) provides a framework for managing human activities with an ecosystem-based approach to support the sustainable use of marine goods and services. The objective of the EU's Marine Strategy Framework Directive is for EU marine waters to achieve 'good environmental status' (GES) by 2020.

9.1.2.11 For the UK, the co-ordination of strategies for reaching GES is achieved through the OSPAR Convention. Strategies must contain a detailed assessment of the state of the environment, a definition of 'good environmental status' at a regional level and the environmental targets and the establishment of monitoring programmes. A specific programme of measures is not stated, except for the establishment of Marine Protected Areas (MPAs).

9.1.3 National Legislation and Planning Policy

The Wildlife and Countryside Act 1981 (as amended)

9.1.3.1 The Wildlife and Countryside Act (WCA) consolidates and amends existing legislation to implement the Bern Convention and the Birds Directive. The act contains four parts and 17 schedules, covering *inter alia*: protection of wildlife (birds and some animals and plants); the countryside; national parks; and the designation of protected areas.

9.1.3.2 The WCA strengthens provisions under the National Parks and Access to the Countryside Act 1949 to establish national nature reserves (NNRs) in England and Wales. The legislation provides for the designation, protection and management of NNRs, which can be established on land and land covered by water, so it can, therefore, extend into the intertidal zone but not below low. These areas can be designated for their flora, fauna or geological interests. The Act provides for the designation of SSSIs and Marine Nature Reserves.

Countryside and Rights of Way Act 2000

9.1.3.3 The Countryside and Rights of Way Act (CRoW Act) 2000 applies to England and Wales only and contains five Parts and 16 Schedules. It complies with the provisions of the European Convention on Human Rights. Consultation is required where the rights of the individual may be affected.

9.1.3.4 The CRoW Act: provides for public access, on foot, to certain types of land; amends the law for public rights of way; increases protection for SSSIs and strengthens wildlife enforcement legislation; and provides for better management of Areas of Outstanding Natural Beauty (AONB).

The Conservation of Habitats and Species Regulations 2010 (Habitats Regulations)

9.1.3.5 The Conservation of Habitats and Species Regulations 2010 (referred to as the Habitats Regulations) consolidate all the various amendments made to the 1994 Regulations in respect of England and Wales. The Regulations transpose the EC Habitats Directive into national law.

9.1.3.6 The Habitats Regulations provide for the designation of Special Areas of Conservation (SACs). They also require the compilation of a register of European sites in a network called Natura 2000. Natura 2000 sites include SACs and Special Protection Areas (SPAs), the latter of which is classified under the Birds Directive.

9.1.3.7 The regulations protect animal species listed in Schedule 2 from deliberate capture, killing, disturbing or trading, and plant species in Schedule 4 from being picked, collected, cut, uprooted, destroyed or traded without a licence.

The Natural Environment and Rural Communities Act (NERC Act) 2006

9.1.3.8 The NERC Act makes provision about bodies concerned with natural environment and rural communities, and it regulates *inter alia* nature conservation in the UK, wildlife and SSSIs.

9.1.3.9 Public authorities have a duty to conserve biodiversity with regard to the United Nations Environmental Programme Convention on Biological Diversity of 1992. Section 42 of the NERC Act requires that the National Assembly of Wales publishes a list of species and habitats of principle importance, in consultation with the Countryside Council for Wales, for the purpose of conserving biodiversity. The Assembly must further conservation of these species and habitats and encourage other to do so.

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 SI 3242

9.1.3.10 The regulations provide the mechanism to implement river basin districts within England and Wales in accordance with the Water Framework Directive. The regulations require a new strategic planning process to be established for the purpose of managing, protecting and improving the quality of water resources. Swansea Bay is in the Western Wales River Basin District.

Planning Policy Statement 9 (PPS9) Biodiversity and Geological Conservation

9.1.3.11 Planning Policy Statement 9 (PPS9) sets out the Government's national planning policies on the protection of biodiversity and geological conservation through the planning

system. Government objectives in relation to biodiversity and geological conservation aim to conserve, enhance and restore biodiversity, and promote sustainability.

9.1.3.12 PPS9 is accompanied by Office of the Deputy Prime Minister (ODPM) Circular 06/2005, which provides administrative guidance on the application of the law relating to planning and nature conservation.

9.1.3.13 Development should contribute to rural renewal and urban renaissance by enhancing biodiversity in green spaces and among developments so that they are used by wildlife and valued by people. Networks of natural habitats are considered to represent a valuable resource.

The Marine and Coastal Access Act 2009 (Marine Act)

9.1.3.14 The Marine and Coastal Access Act 2009 aims to enable better protection of marine ecosystems and prevent a decline in marine biodiversity. The Act sets out provisions for more coherent planning in the marine environment in terms of issuing consents and permits for activities in the marine and coastal environment. The Act also contains provisions to allow for the designation of Marine Conservation Zones (MCZs) and the creation of a network or Marine Protected Areas (MPAs).

UK Post-2010 Biodiversity Framework (2012)

9.1.3.15 In response to the Convention on Biological Diversity 1992, the UK produced its first national biodiversity action plan. In 2010, parties renewed their commitment to the convention at Nagoya, Japan. The post-2010 framework is designed to identify the activities needed to achieve biodiversity targets. Devolved implementation by the four countries is assisted by the JNCC and Defra for UK-wide co-ordination. In December 2011, the Welsh Government combined the Natural Environment Framework and Single Environment Body into 'Living Wales', which is based on the ecosystem approach and has a strong focus on sustainable land and marine management.

9.1.3.16 In July 2012, the UK Biodiversity Action Plan (UK BAP) was succeeded by the UK Post-2010 Biodiversity Framework. Many of the tools developed under UK BAP remain of use. The lists of priority species and habitats agreed under UK BAP still form the basis of much biodiversity work in the countries.

Salmon and Freshwater Fisheries Act

9.1.3.17 The Salmon and Freshwater Fisheries Act 1975 (SAFFA) applies to salmon, trout (including sea trout), eel and freshwater fish. Section 38 concerns the construction on, over or under tidal lands below high-water mark of ordinary spring tides. In this scenario, construction must be undertaken in accordance with plans and regulations approved in writing by the Secretary of State.

The Eels (England and Wales) Regulations 2009

9.1.3.18 The Eels Regulations came into force in 2010 and implement Council Regulation (EC) No. 1100/2007 of 18 September 2007, which established measures for the recovery of the stock of European eel. The UK submitted 15 Eel Management Plans for approval by the Commission in December 2008. These plans are set at the River Basin District level, as defined under the Water Framework Directive 2000/60/EC, covering England and Wales, Scotland and Northern Ireland. Swansea Bay falls into the Western Wales River Basin District.

9.1.3.19 According to section 17 of the Regulations, diversion structures capable of abstracting at least 20 cubic metres of water through any one point in any 24-hour period and diversion structure**s** returning water to a channel, bed or sea may be served a notice by the Environment Agency requiring an eel screen to be installed. From 1st January 2015, this will be mandatory, unless an exemption is received from the Environment Agency.

The Environment Act 1995

9.1.3.20 The Act makes it a duty of the Environment Agency to maintain, improve and develop salmon fisheries, trout fisheries, freshwater fisheries and eel fisheries in England and Wales and in territorial seas adjacent to these countries from a baseline to a six-mile extent.

9.1.4 Study Area

9.1.4.1 Impacts of the project are assessed in the context of potential 'near-field' of the project development site (PDS) in Swansea Bay and 'far-field' (likely extent of the wider area that may be affected by the lagoon and its effects on tidal flows). Following extensive hydraulic modelling and consultation with statutory bodies, including the Countryside Council for Wales and the Environment Agency, near-field and far-field impact areas have been defined, as described below.

9.1.5 Near-Field

9.1.5.1 The near-field zone of impact (Figure 9.1) comprises Swansea Bay (NGR SS 630910). The Bay is approximately 12km wide (from Mumbles Head to Port Talbot) with an area of 50km^2. The seabed in the Bay is largely composed of muddy sand, with rock outcrops and cobbles occurring mainly on the western side towards Mumbles (Davies, 1998). Bathymetry across the Bay is fairly regular, with a 5m bathymetric contour present ca. 5 km offshore, and deeper areas (> 20 m) south of Mumbles Head. Large areas of intertidal bed become exposed on low tides.

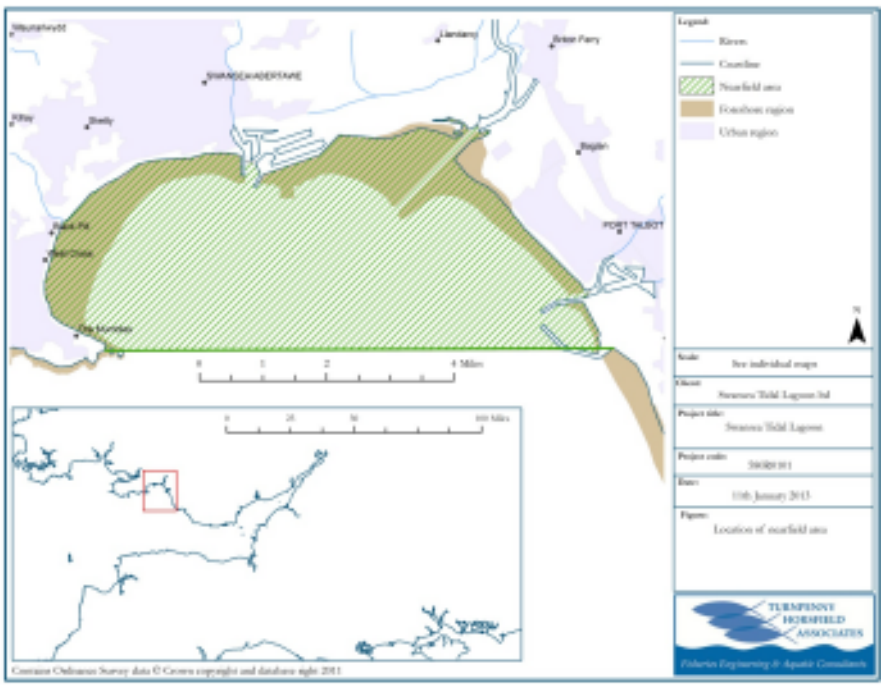

Figure 9.1 Map showing location of the near-field area.

9.1.6 Far-Field

9.1.6.1 As well as encompassing Swansea Bay itself, the far-field zone (Figure 9.2) includes some ten miles of the coastline to the west of Swansea. This section of the Gower Peninsula is made up of a series of bays, alternately rocky and sandy: Langland Bay, Caswell Bay, Oxwich Bay and Port Eynon Bay.

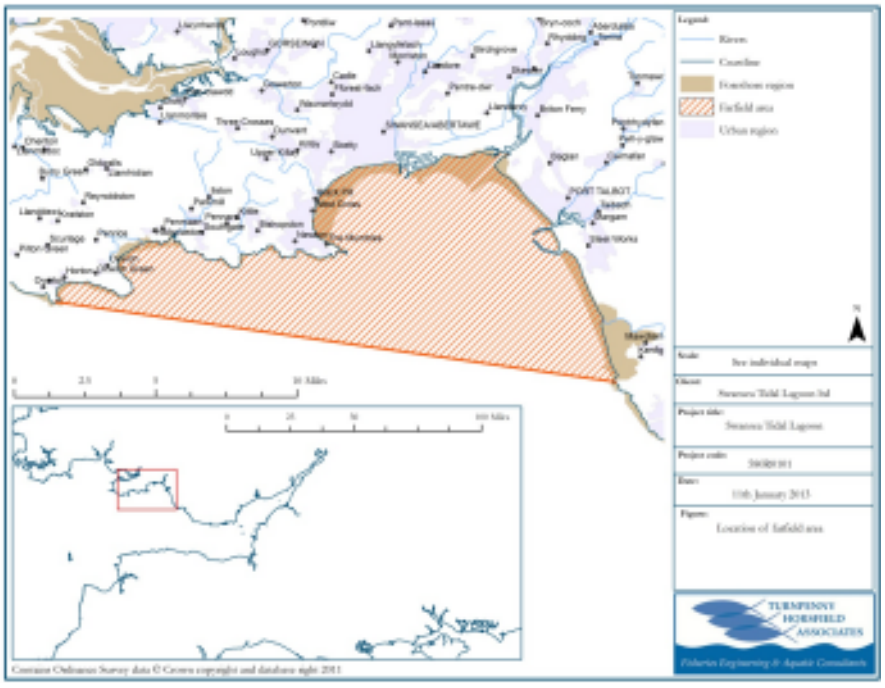

Figure 9.2 Map showing location of the far-field area.

9.2 Site Designations

9.2.0.1 This section identifies the international, national and local conservation interests associated with fish and shellfish within the bounds of the proposed Tidal Lagoon Swansea Bay site and surrounding area. Information in relation to species-specific issues is drawn from section 9.3.2, and is presented together with information on designated sites and their qualifying features.

9.2.1 Methodology

Study Area

9.2.1.1 For the purposes of nature conservation, the study area extends between Port Eynon (SS 47179 84273) and Sker Point (SS 79032 279032) for benthic ecology and shellfish, whilst extending over a wider area for more transient species, such as migratory fish.

Data acquisition, information and sensitivities

9.2.1.2 Key data sources include:

a. Individual citations for designated sites from various legislators, regulators and NGOs (e.g. CCW, JNCC, Natural England).
b. The online UK Government interactive mapping tool for environmental information (www.magic.defra.gov.uk).
c. Welsh Government Consultation Portal on Marine Conservation Zones (http://wales.gov.uk/consultations).

9.2.1.3 Additional information from published sources is included in the assessment.

9.2.1.4 A literature search identified international, national and locally designated sites. These included Biosphere Reserves, Local Nature Reserves (LNRs), Marine Conservation Zones (MCZs) National Nature Reserves (NNRs), Sites of Special Scientific Interest (SSSIs) and Special Areas of Conservation (SACs).

9.2.1.5 In addition to the conservation designations listed above, European-designated shellfish waters have also been identified.

9.2.1.6 At time of writing, consultation to establish Marine Conservation Zones (MCZ) for Welsh Inshore waters was on-going. The establishment of MCZs would increase protection for species or habitats for which the Habitats Directive does not provide coverage. There are currently 10 proposed MCZs within Welsh inshore waters, the nearest of which is at Dale (> 80 km from the PDS) and therefore well outside the project far-field limits.

9.2.1.7 Following the initial identification of all relevant sites of nature conservation interest, a Stage-Two process was conducted, whereby sites which were not considered pertinent to the project were screened out. In this context, only sites which had features relating to fish or shellfish, and which directly or indirectly had the potential to be impacted by the PDS were selected.

9.2.1.8 The screening process primarily relied on expert judgement, and was based on the following criteria:

i. The Swansea Bay Tidal Lagoon project was most likely outside of the migratory and foraging range of the mobile species identified within the protected sites

ii. The designated site was outside of the potential zone of influence of the Swansea Bay Tidal Lagoon

iii. Qualifying species for the designated site were absent from the Swansea Bay Tidal Lagoon study area

9.2.1.9 Distances from the PDS to the protected areas have been calculated using centroid coordinates, for both the development and the pertinent protected zone. The designations pertinent to the shortlisted sites are presented in Table 9.1.

Table 9.1 Description of statutory designations for conservation areas that have the potential to be affected by the project.

Origin	Designation	Legislation
European	Special Area of Conservation (SAC)	Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora [1992] OJ L 206/7 (Habitats Directive)

9.2.2 International Statutory Designations

Special Areas of Conservation

9.2.2.1 Special Areas of Conservation (SACs) are designated under the Habitats Directive; their primary purpose is to protect both habitats and species considered to be most in need of conservation at a European level.

9.2.2.2 Each SAC is chosen according to the presence of what are identified as 'Annex I habitats' or 'Annex II species'; these are defined as follows:

i. **Annex I Habitats:** Internationally important natural habitats as identified by the EEC whose conservation requires the designation of SACs

ii. **Annex II Species:** Internationally important species as identified by the EEC whose conservation requires the designation of SACs

9.2.2.3 Annex I habitats and Annex II species can either be a primary or qualifying reason for the selection of a SAC. Qualifying features are secondary reasons for the designation of a site; as with primary features, they are protected and have conservation objectives under the Habitats Regulations (JNCC, 2012).

9.2.2.4 All of the Annex II species which have been identified in this section are diadromous fish which undertake migratory movements between the open sea and rivers to spawn. Migratory patterns and the life-history of these fish are discussed further in section 9.5. Fish species which are not migratory, but are found within Annex II, have not been included, as they would not be affected by the project.

9.2.2.5 SAC sites potentially relevant to the Tidal Lagoon Swansea Bay Project and their qualifying and/or primary features are shown in Table 9.2.

Table 9.2 Special Areas of Conservation (SPAs) in the region local to Swansea Bay.

SPA	Relevant Feature	Distribution
Carmarthen Bay (SS357991)	*Primary feature* Twaite shad *Qualifying features* Allis shad River lamprey Sea lamprey	The Carmarthen Bay SAC is the closest of the identified SACs to the PDS (ca. 33 km). Part of the SAC itself falls within the far-field zone of impact as identified within the scoping report (TLSB, 2012). A primary reason for its designation is the presence of twaite shad which move through Camarthen Bay in order to reach their spawning sites in the River Afon Tywi. Allis shad, river lamprey and sea lamprey are qualifying features which may also pass through.
Cleddau River (SM938249)	*Primary feature* River lamprey *Qualifying features* Sea lamprey	The Cleddau River SAC is located at ca. 81 km from the PDS. A primary reason for the selection of this site is its population of river lamprey.
Pembrokeshire Marine (SM503093)	*Qualifying features* Allis shad River lamprey Sea lamprey Twaite shad	The Pembrokeshire marine SAC is located at ca. 118 km from the PDS. There are no primary features pertaining to migratory fish.
River Usk (SO301113)	*Primary feature* Atlantic salmon River lamprey Sea lamprey Twaite shad *Qualifying features* Allis shad	The River Usk river SAC is located at ca. 66 km from the PDS. A primary reason for the selection of this site is the internationally important populations of Atlantic salmon, river lamprey, sea lamprey and twaite shad, which migrate into the river to spawn.
Severn Estuary (ST321748)	*Primary features* River lamprey Sea lamprey Twaite shad	The Severn Estuary SAC is located at ca. 66 km from the PDS. The primary reasons for the designation of this SAC are river lamprey, sea lamprey and twaite shad. In terms of fish, the importance of this SAC is primarily as a nursery area for juveniles and a route for adults migrating into the tributaries of the River Severn.

9.2.3 National Statutory Designations

9.2.3.1 No SSSIs, LNRs or NNRs within the vicinity of Swansea Bay were found to have significant features associated with fish or shellfish. As a result, these are not discussed further.

Shellfish Waters

9.2.3.2 Shellfish waters are currently designated within and in the vicinity of Swansea Bay. Three designations exist within Swansea Bay itself: Swansea Bay (West); Swansea Bay (East); and Swansea Bay (South) (Figure 9.3a). The proposed legislative changes (see Section 9.1.3) recommend retaining these designations.

9.2.3.3 Further around the coast to the west are two shellfish waters within Burry Inlet: Burry Inlet (North) and Burry Inlet (South) (Figure 9.3b). The proposed legislative changes recommend retaining these designations.

9.2.3.4 Due south-south-east of Swansea Bay lies the designated shellfish water of Porthcawl (Figure 9.3c). This shellfish water has now been de-designated as there is no known commercial interest and future commercial interest is unlikely.

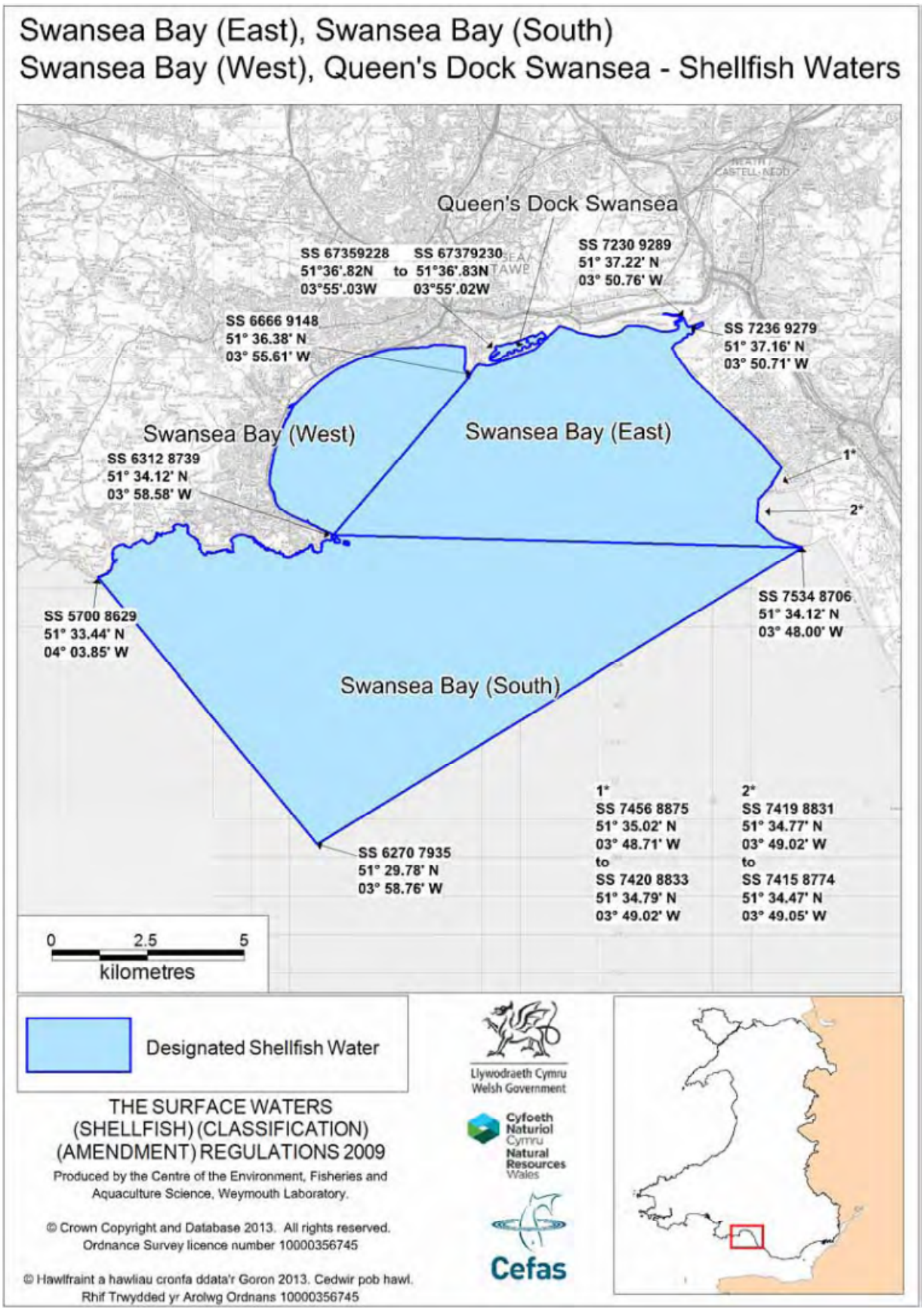

Figure 9.3a Designated shellfish waters within Swansea Bay

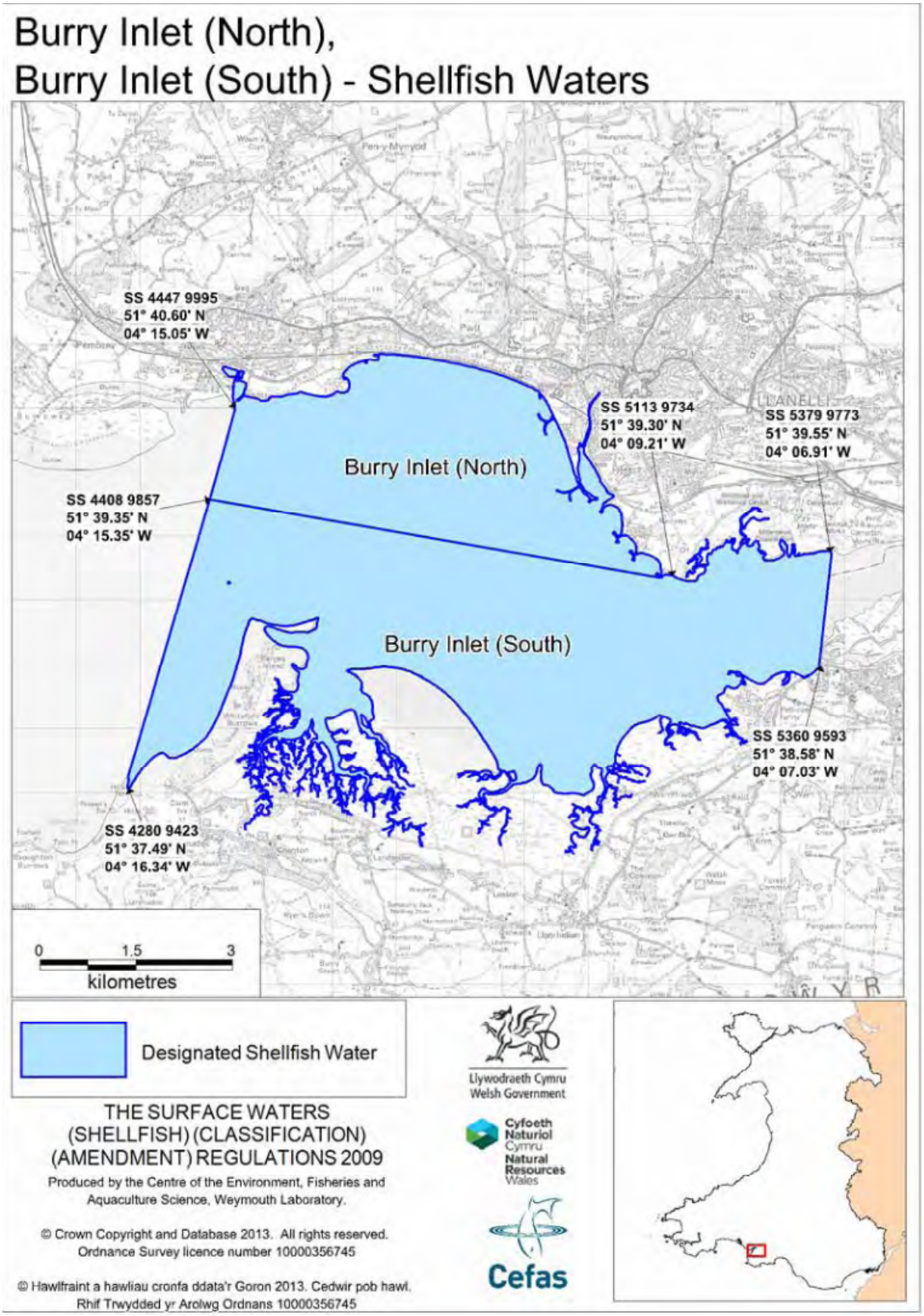

Figure 9.3b Designated shellfish water at Burry Inlet, due west of Swansea Bay.

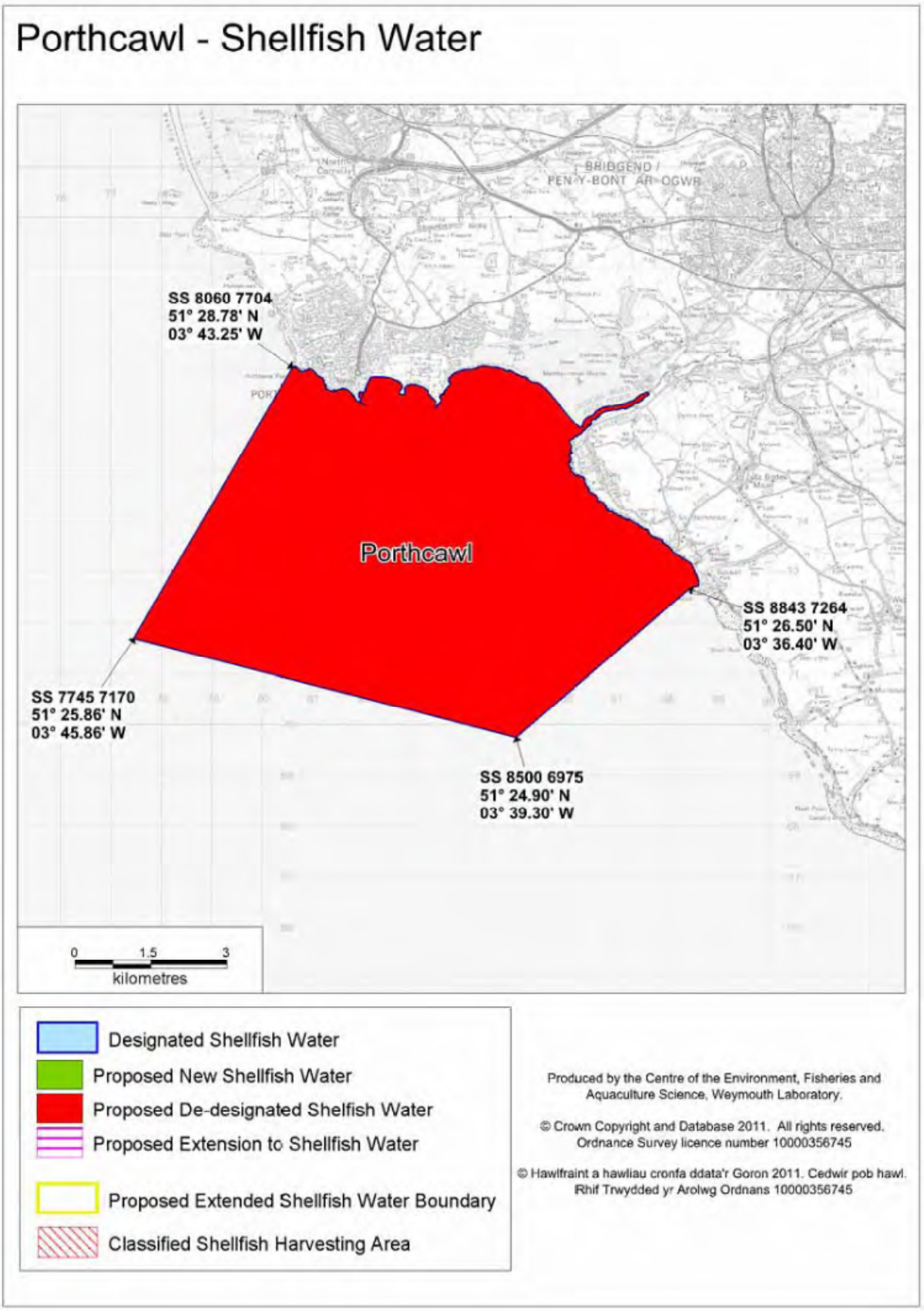

Figure 9.3c De-designated shellfish water due south-east of Swansea Bay in Porthcawl

9.2.3.5 Currently, there is a single, active several order for mussels within the Bay: The Swansea Bay Mussel Fishery (CV and DM Thomas) Order 2012. This order will continue to be valid. The area to which the order refers is shown in Figure 9.3d.

9.2.3.6 Additionally, Queen's Dock is being used to farm mussels. There are also proposed plans for reinstating an oyster fishery (see section 9.6.4). As of July 2013 Cefas updated the designation of the Shellfish Waters, all information is concurrent with the presented data.

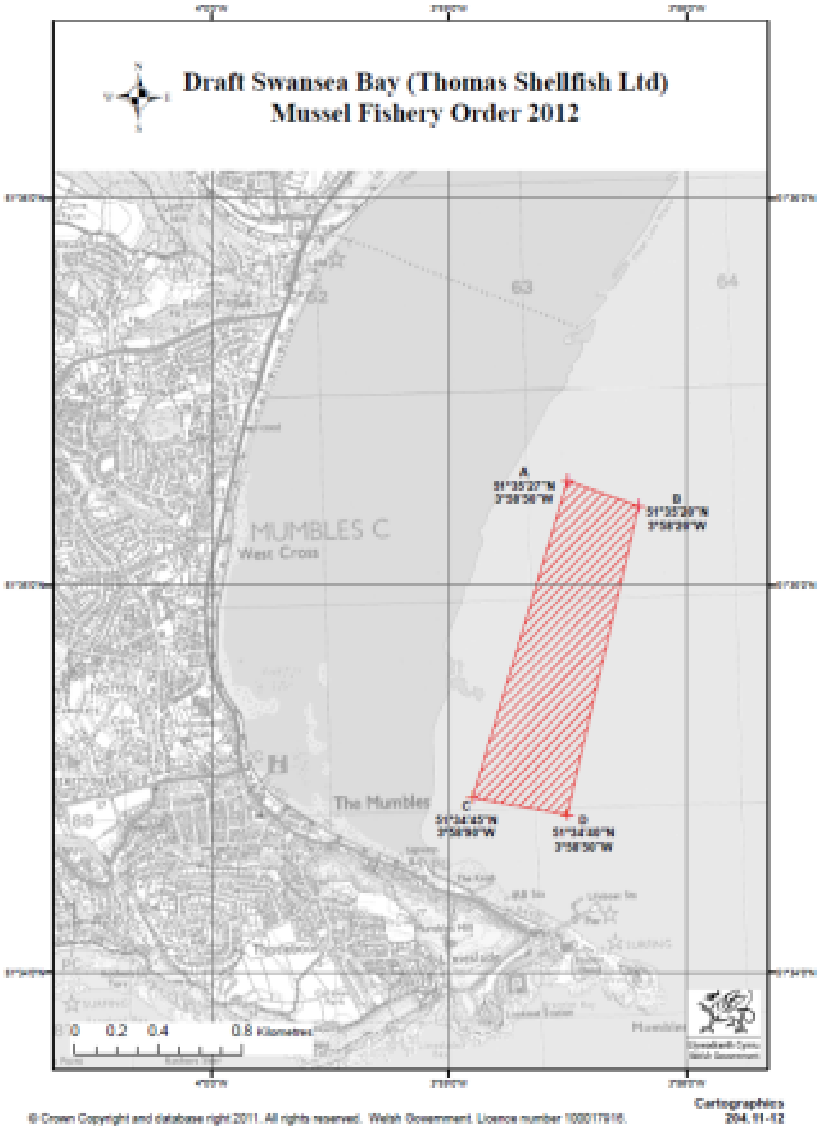

Figure 9.3d Area map relating to The Swansea Bay Mussel Fishery (CV and DM Thomas) Order 2012.

9.3 Marine Fish Populations and Fisheries

9.3.1 Data Acquisition and Presentation

9.3.1.1 To characterise the existing fish populations and associated fisheries, data have been gathered from published and unpublished literature and from consultation with regulators, including the Countryside Council for Wales (CCW), the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the Marine Management Organisation (MMO), as well as with local commercial and recreational fishing bodies. The main sources of regional information on fish stocks include:

I. Cefas's fisheries data archive centre (FishDAC); including:
   a. Research survey data available from the DATRAS database;
   b. Cefas's spawning and nursery map datasets;

II. MMO fisheries landings data;

III. DASSH, the Archive for Marine Species and Habitats Data[1]; and

IV. Site-specific surveys.

9.3.1.2 The DATRAS database yielded relevant EVHOE French survey datasets, of which only a proportion was identified as having sufficient spatial resolution to be included in this baseline assessment. Data was in the form of catch per unit effort (CPUE) (number of fish caught per hour). Lack of seasonality in the dataset meant that only summary graphs for 2011 and 2012 have been produced.

9.3.1.3 Two key literature sources (Coull et al., 1998; Ellis et al., 2012) were used to identify the importance of Swansea Bay and the local environment in terms of fish spawning and nursery habitat. Species-specific scientific literature was also consulted.

9.3.1.4 A series of maps was produced using available GIS datasets for some of the species found within the vicinity of the PDS. The maps (Figure 9.8 to Figure 9.33) use the same data as Ellis et al. (2012), though they are reproduced at a smaller spatial scale.

9.3.1.5 The accuracy of the Cefas data reflecting spawning and juvenile areas is limited, owing to difficulties in taxonomic identification and limitations due to survey design (Ellis et al., 2012). Overall, Cefas judges the information on spawning and nursery areas to have a low-to-medium confidence, based on data availability and quality. As a result, the data are to be interpreted with caution and supplemented by local knowledge.

9.3.2 Characterisation of the Swansea Bay Marine Fish Community

9.3.2.1 The Severn Estuary and Bristol Channel, as a whole, hold a wide variety of marine fish taxa, with estimates ranging between 97 and 111 species (Potts & Swaby, 1993; Claridge et al., 1986). A number of fish species are recognised as being transient or occasional visitors to the area. The number of core species, present throughout the year, is most likely less than 50% of the total recorded.

[1] DASSH provides digital archive facilities for biodiversity datasets and a digital repository for biodiversity images and video. It is an initiative of the Marine Biological Association (MBA), funded by Defra and the Scottish Government.

9.3.2.2 Table 9.3 gives a list of fish that are commonly thought to occur within the Swansea Bay area, the list is based on a combination of commercial fisheries data, site-specific survey data, literature and DATRAS datasets.

Table 9.3 Marine fish species commonly found or of conservation interest within the Swansea Bay area. ++ Denotes species of primary commercial importance (ranking in top 10 species captured commercially, by weight) within Swansea Bay.

Common name	Scientific name
Bass++	*Dicentrarchus labrax*
Black sea bream	*Spondyliosoma cantharus*
Brill	*Scophthalmus rhombus*
Cod++	*Gadus morhua*
Conger eel	*Conger conger*
Corkwing wrasse	*Crenilabrus melops*
Dab	*Limanda limanda*
Dragonet	*Callionymus lyra*
Flounder++	*Platichthys flesus*
Garfish	*Belonidae spp.*
Gobies	*Pomatoschistus* spp.
Golden grey mullet++	*Liza aurata*
Greater pipefish	*Syngnathus acus*
Gurnards	*Triglidae spp.*
Herring	*Clupea harengus*
Hook nose	*Agonus cataphractus*
Horse mackerel	*Trachurus trachurus*
Lesser sandeel	*Ammodytes tobianus*
Lesser spotted dogfish++	*Scyliorhinus canicula*
Mackerel	*Scomber scombrus*
Plaice++	*Pleuronectes platessa*
Pollack	*Pollachius pollachius*
Poor cod	*Trisopterus minutus*
Pouting	*Trisopterus luscus*
Rays++	*Raja* spp.
Red mullet	*Mullus surmuletus*
Saithe	*Pollachius virens*
Sandeel	*Ammodytes* spp.
Sand smelt	*Atherina presbyter*
Smoothound++	*Mustelus mustelus*
Snake pipefish	*Entelurus aequoreus*
Sole++	*Solea solea*
Sprat	*Sprattus sprattus*
Starry smoothound	*Mustelus asterias*
Thick-lipped grey mullet++	*Chelon labrosus*
Thin-lipped grey mullet++	*Liza ramada*
Turbot	*Scophthalmus maximus*
Whiting++	*Merlangius merlangus*

9.3.2.3 Further data from EVHOE surveys indicated that the population of fish in the outer Bristol channel (ICES rectangle 32E5) is consistent with species found in Swansea Bay, with additional deep water species (Figure 9.4). Conditions where the surveys were conducted vary significantly from Swansea Bay (e.g. depth of water), to an extent this is reflected in the species assemblages (e.g. haddock typically like deep water and are not regularly caught in Swansea Bay).

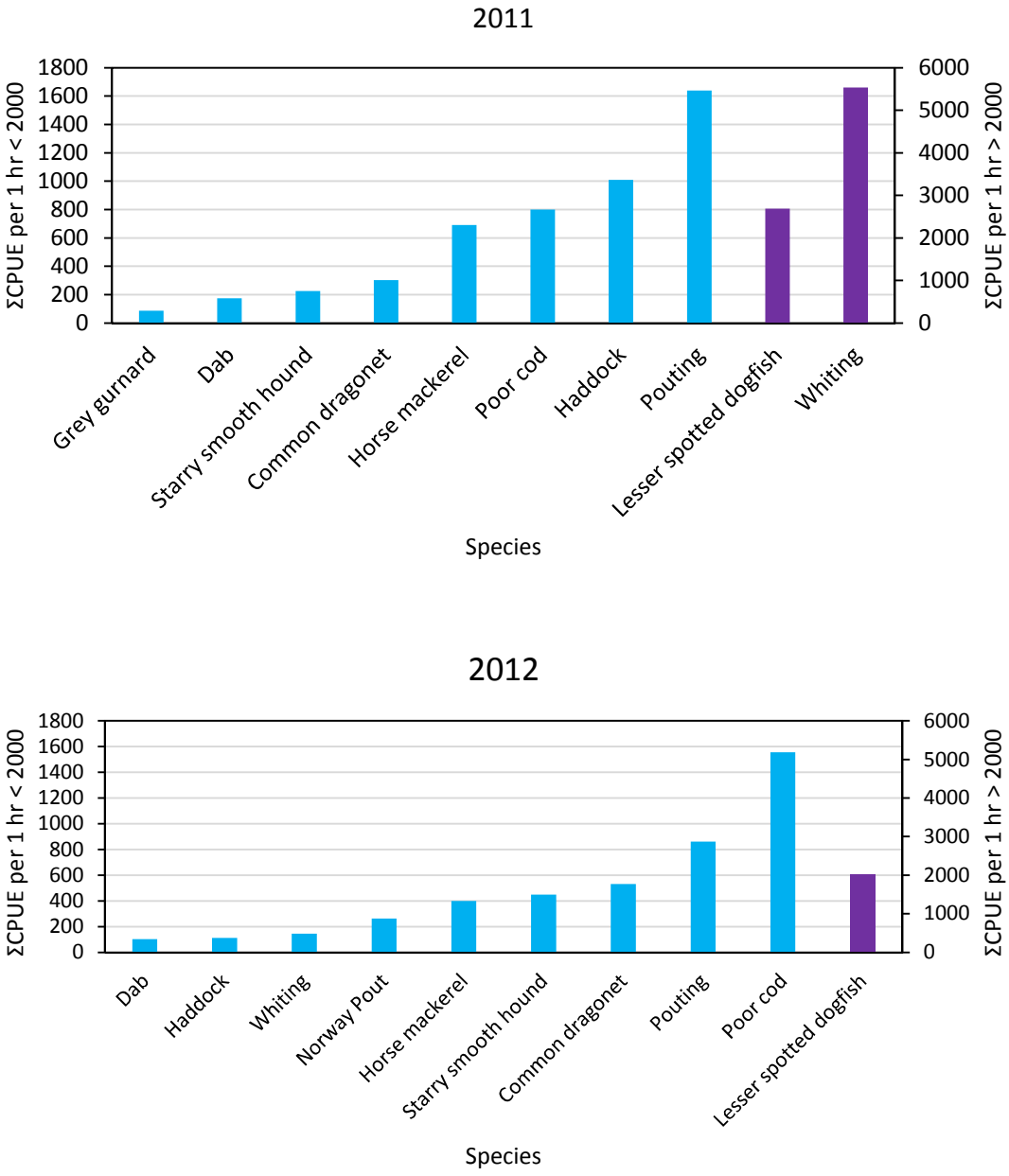

Figure 9.4 Ten most abundant species (fish caught per hour) caught in 2011 – 2012 EVHOE surveys. Blue bars identify species with abundances < 2000 fish h^{-1} and purple bars species with abundance's greater than (>) 2000 fish h^{-1}.

9.3.2.4 In 2011 lesser spotted dogfish was the second most abundant species with Whiting (*Merlangius merlangus*) the most abundant. Between 2011 and 2012 catches of haddock (*Merlangrammus aeglefinus*), horse mackerel (*Trachurus trachurus*), and pouting (*Trisopterus luscus*) decreased; while, starry smooth hound (*Mustelus asterias*), common dragonet (*Callionymus lyra*) and poor cod (*Trisopterus minutus*) increased.

9.3.3 Site-specific surveys

Methodology

9.3.3.1 Further to the desktop study, data has being gathered through a series of ongoing seasonal fisheries surveys, based on standardised EU Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy) survey protocols. Four quarterly surveys were completed in 2013.

9.3.3.2 For a detailed account of survey methodologies, please refer to Appendix 9.2 Quarterly survey reports (Volume 3). A summary of the methods used in site-specific surveys is provided below:

iii. Four surveys involving intertidal and subtidal techniques were conducted: Quarter one (winter 2012); Quarter two (spring 2013); Quarter three (summer 2013) and Quarter four (autumn 2013).

a) Intertidal surveys involved two surveying methods: a beach seine net (43 m long by 4 m deep, with 6.5mm knotless mesh) set from a small rigid vessel; and a Riley push-net (1.5 m wide by 30 cm deep with 1 mm fry mesh) used from the shore.

b) The subtidal surveys were carried out from a 12.1m mono-hull trawler using both otter and beam trawls. The specification of the nets deployed during these surveys is detailed in Appendix 9.2 (Quarterly surveys). For each survey the catch was identified to species level and measured to the nearest millimetre; fish were sub-sampled when > 50 specimens of the same species were captured.

9.3.3.3 The aim of the surveys was to provide an up-to-date characterisation of fish resources in the study area.

9.3.3.4 Mobile species such as fish exhibit varying spatial and temporal patterns. The seasonal surveys (both intertidal and subtidal) only provide a ‘snapshot’ of the variability in communities. The surveys were not designed to specifically target pelagic fish; nevertheless surveys reported high numbers of pelagic fish species.

9.3.3.5 Migratory fish were not targeted during surveys owing to the difficulty in the sampling of transient diadromous populations, primarily as their habitat use in coastal waters is very localised and their movements are seasonal in nature.

Characterisation of the Swansea Bay fish community from site-specific surveys

9.3.3.6 Site specific surveys of the area carried out in 2013 as part of the Project suggest that fish populations identified reflect that of the wider region, as described by Claridge et al. (1986). A total of 55 species were captured during the site-specific intertidal and subtidal surveys (see Appendix 9.2, Volume 3). The fish population has an abundant pelagic fish community with relatively high numbers of sprat (42.5%), herring (12.2%) and sand smelt (4%); these account annually for approximately 57% of fish in Swansea Bay. The most abundant demersal species (whiting, bass, pouting, lesser spotted dogfish and poor cod) make up 14 % of the fish population; whilst benthic species (Goby spp., plaice, grey gurnard, common sole, thornback ray, lesser sandeel, dab, sand goby, hooknose, solenette, turbot and flounder) make up 24 % of the annual distribution of

fish. The remaining 5 % of the annual fish population in Swansea Bay is composed of 37 species, each with an abundance of less than 0.1 %. The numbers of these fishes are inflated by the appearance of juveniles during the summer months.

9.3.3.7 The Swansea Bay fish community showed seasonal fluctuations relating to movements of species between feeding, spawning and nursery areas. During summer a variety of species moved into shallow inshore (intertidal) areas to feed, whilst during winter fish migrated further offshore into deeper (subtidal) waters. These changes are as a direct consequence of temperature, ontogenic development and prey availability.

9.3.3.8 Quarter 1 (winter 2013) catches in the intertidal zone were minimal as fish moved into deeper water to avoid potentially lethal or sub-optimal low temperatures (temperature ± S.D. = 5.2 ± 1.49 °C). Subtidal communities were dominated by cold-water species, notably adult gadoids, flatfish and gobies (Figure 9.5 and Figure 9.6a).

9.3.3.9 During Quarter 2 (spring 2013) warm waters (temperature ± S.D. = 12.8 ± 1.34 C °) led to intertidal sampling yielding greater numbers of fish than winter surveys. Abundance in intertidal zones was dominated by juveniles of several species (e.g. bass, turbot and herring); whilst the adult population was typically composed of sand smelt, lesser sandeel and mullet. Subtidal surveys were dominated by catches of adult plaice, sole, and elasmobranchs such as thornback rays (Figure 9.6a (A and B)).

9.3.3.10 The summer survey (2013, Quarter 3) yielded the greatest abundance of fish. This is to be expected as spring and summer spawners typically inflate fish numbers during this period. Abundance was dominated by pelagic fish such as sprat and herring. Similarly to spring surveys, bass were only captured in intertidal habitats. Large plaice were captured in deeper (subtidal) waters and juveniles were principally caught in shallow (intertidal) waters. A large number of juvenile gobies were found in Riley push-net samples in intertidal zones (Figure 9.6 a, b and c).

9.3.3.11 In the autumn survey (2013, Quarter 4) the subtidal community was dominated by high numbers of gadoids, namely whiting, pouting and poor cod. Other species that showed an increase in the subtidal areas of the Bay compared with the summer survey included solenette, dab (increasing both in numbers and size), hooknose and lesser spotted dogfish. The fish population in Intertidal areas was dominated by sprat (significantly less than in summer), sand smelt, turbot, golden grey mullet and common goby. The autumnal abundance of common goby is linked with the fact that by autumn specimens are developed enough to allow precise identification in the field.

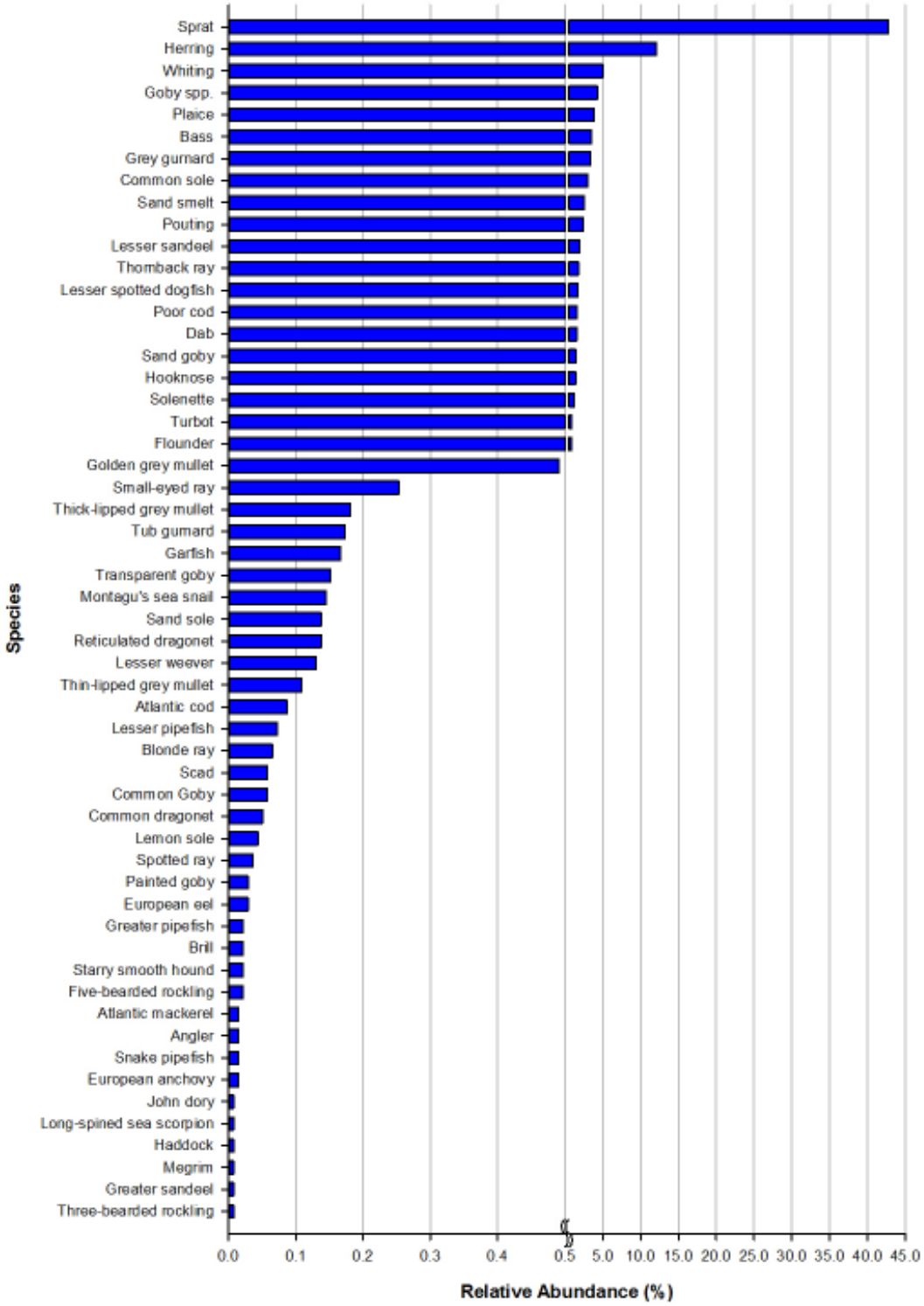

Figure 9.5 Relative abundance of all fish species caught across the survey season. The axis has been broken at 0.5 % such that the left hand side represents values from 0 to 0.5 % and the right hand side represents values from 0.5 to 45 %.

A

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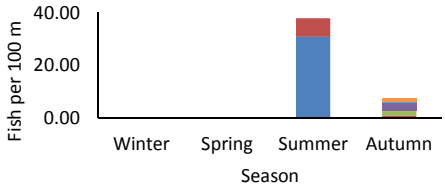

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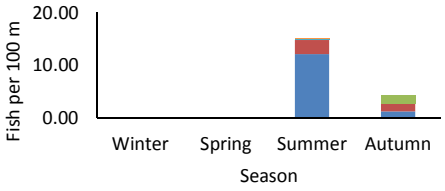

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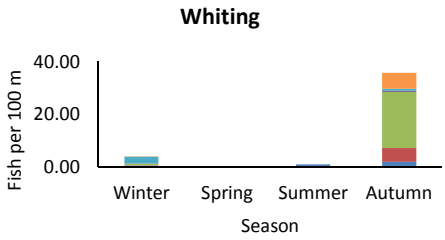

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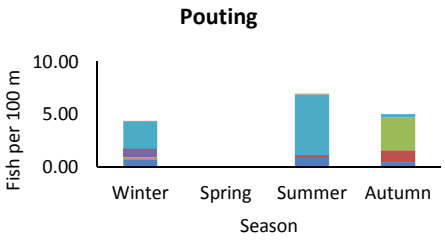

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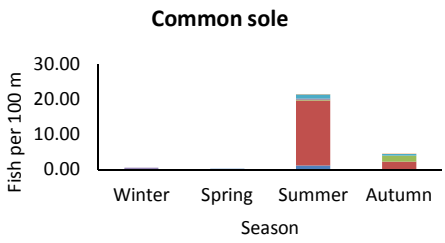

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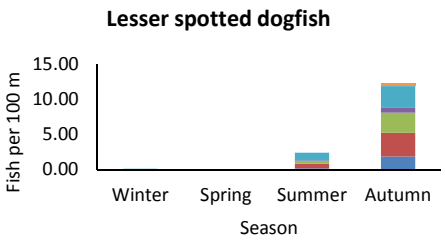

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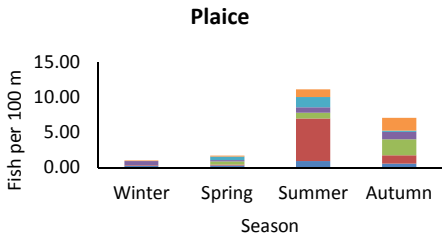

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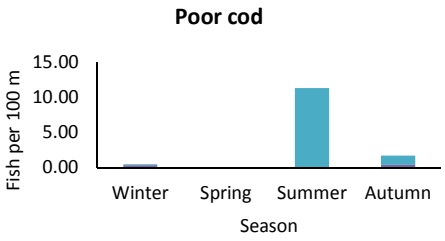

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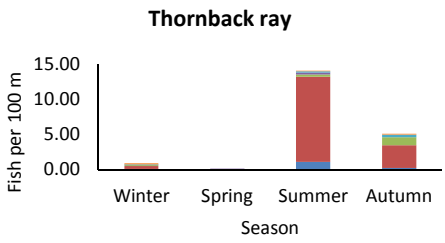

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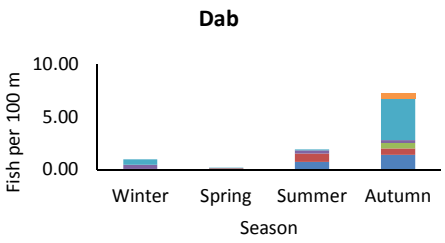

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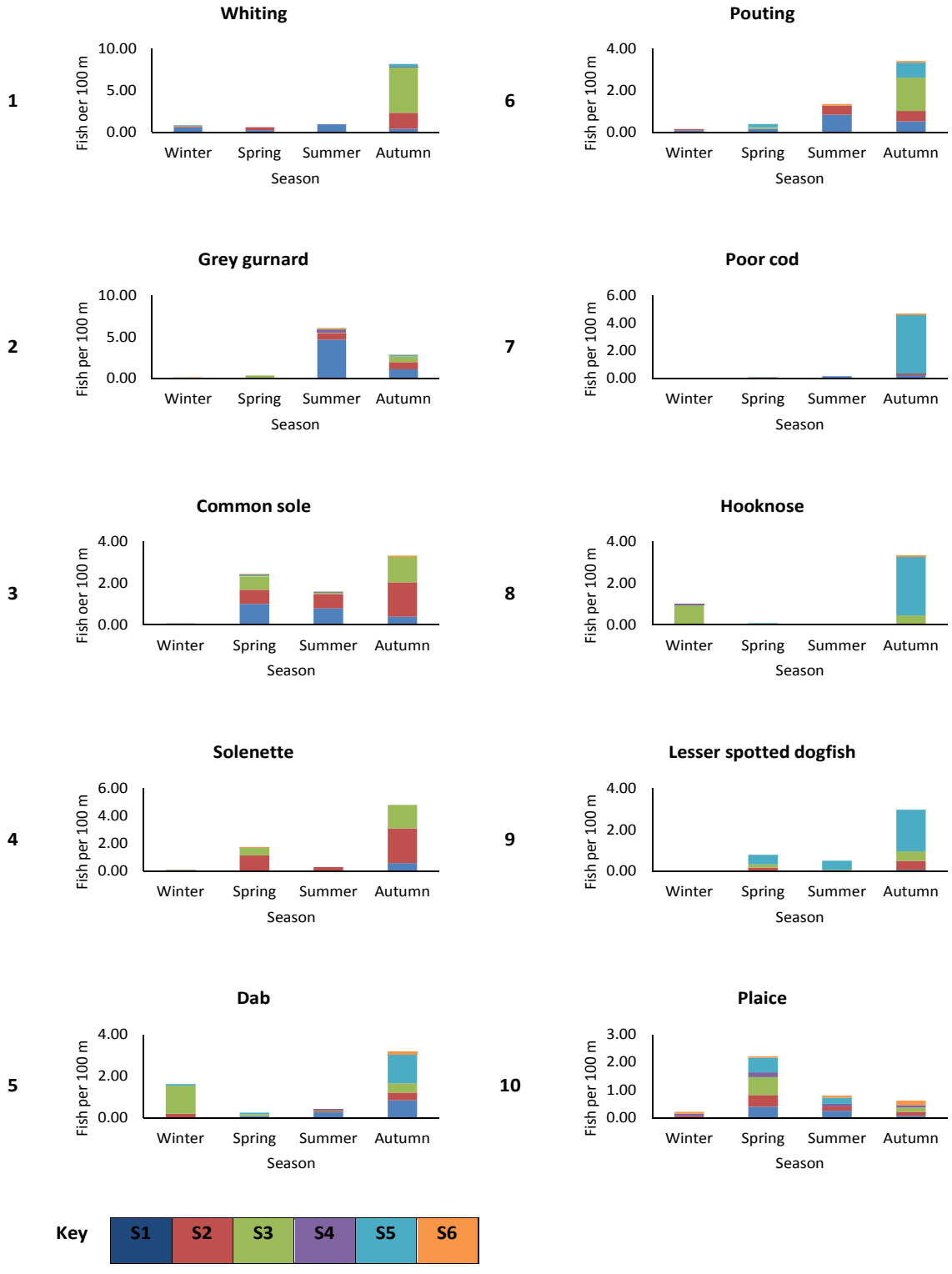

Figure 9.6a Abundance of the ten most common fish species per 100 m trawled in Swansea Bay; otter trawl surveys (A) and beam trawl surveys (B) are represented separately, whilst colours in stacked bars are representative of each site sampled.

A

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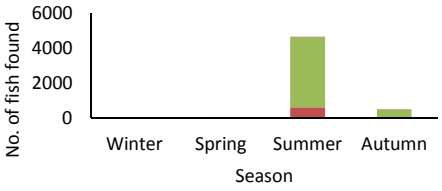

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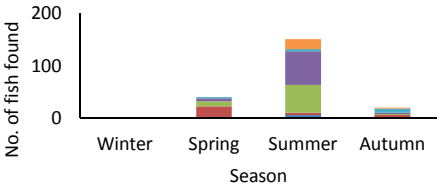

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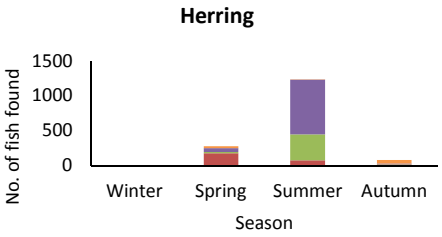

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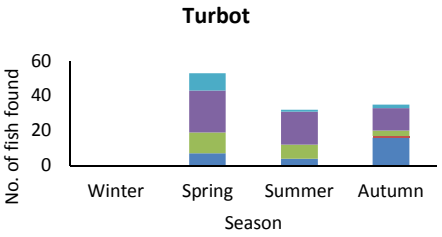

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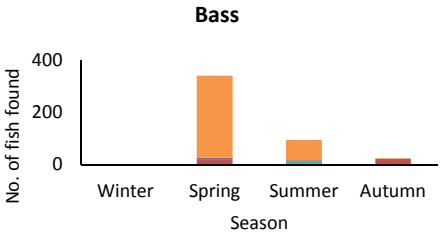

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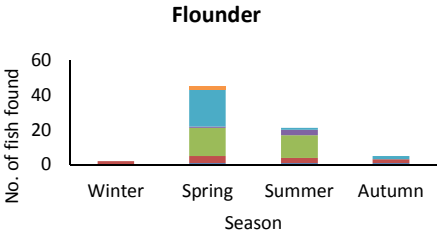

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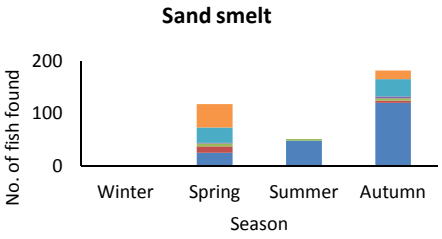

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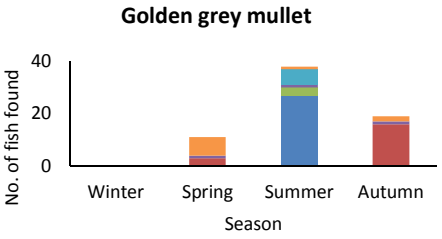

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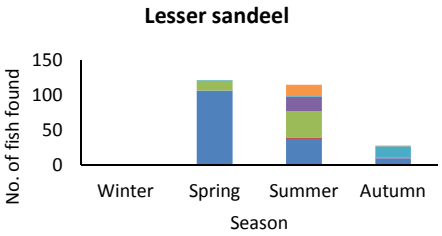

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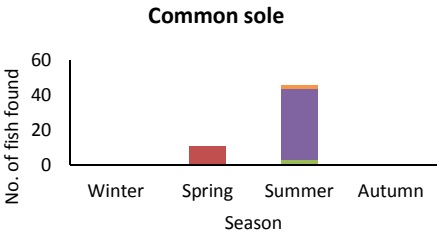

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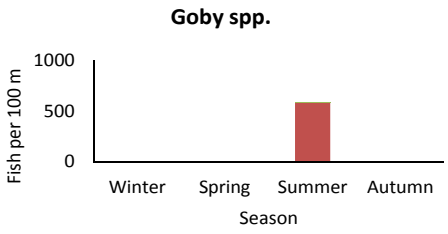

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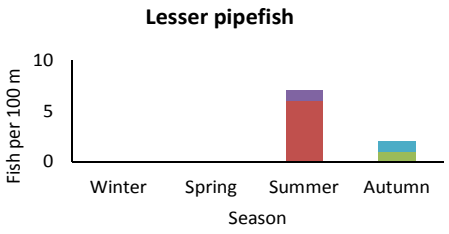

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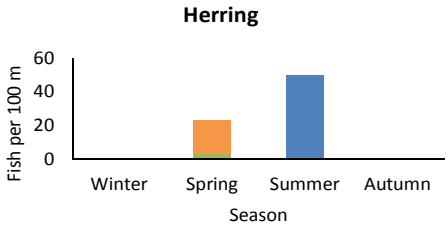

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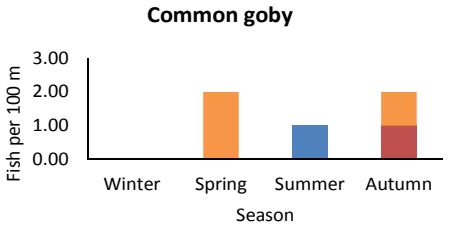

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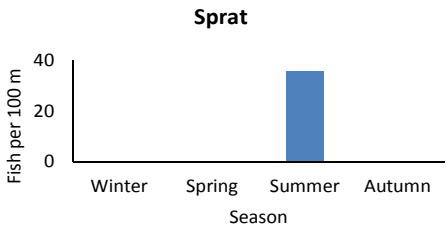

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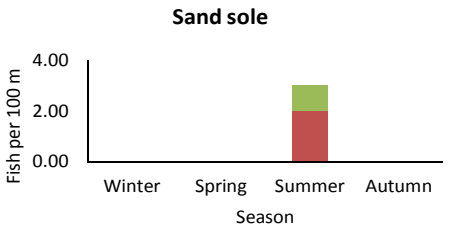

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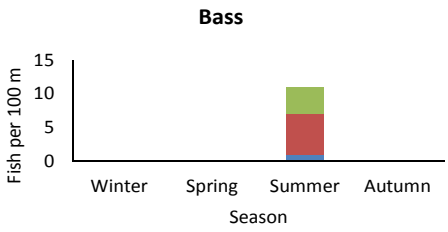

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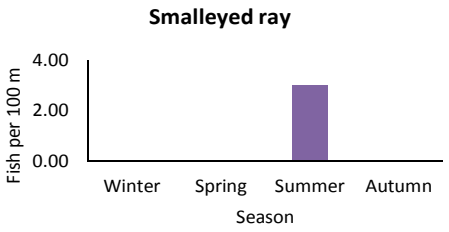

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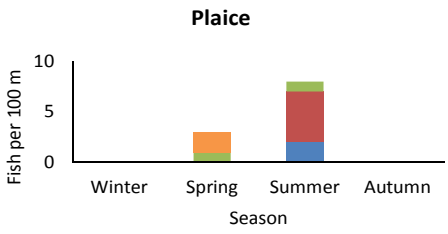

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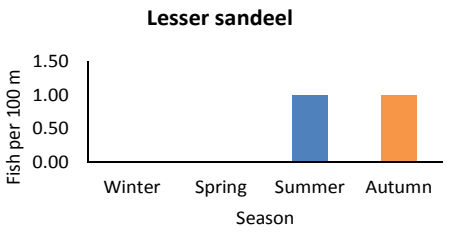


Figure 9.6b Abundance of the ten most common fish species during intertidal surveys for each of the techniques used; seine surveys (A) and Riley net surveys (B) are represented separately, whilst colours in stacked bars are representative of each site sampled.

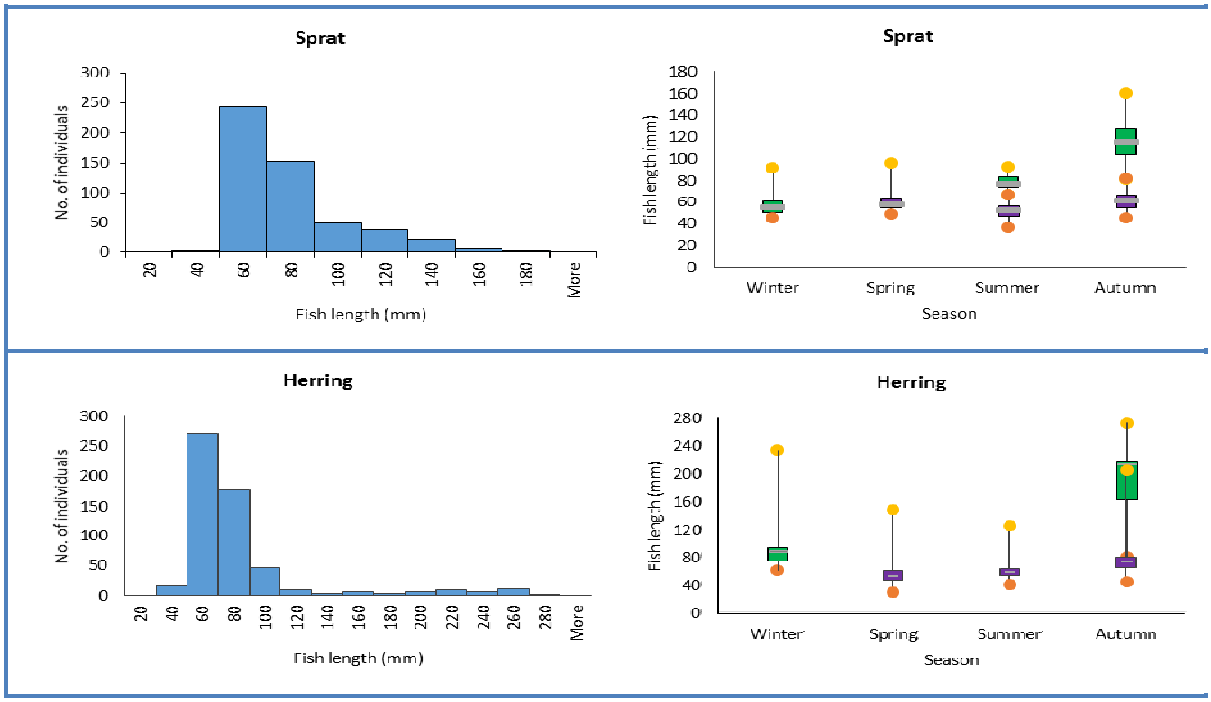
Commercially important fish identified from site-specific surveys

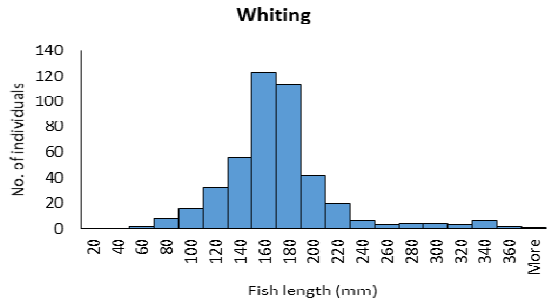
9.3.3.12 Several fish species of commercial and conservation importance are present in the Swansea Bay region, these include sole, plaice, bass and rays (e.g. thornback ray). Several of these commercially important species, as well as important prey species for larger fish, such as sandeel and sprat, have spawning and/or nursery grounds in the region. These species were selected for further analysis to investigate the size structure of the populations based on the findings of the 2013 surveys carried out as part of this Project (Figure 9.4).

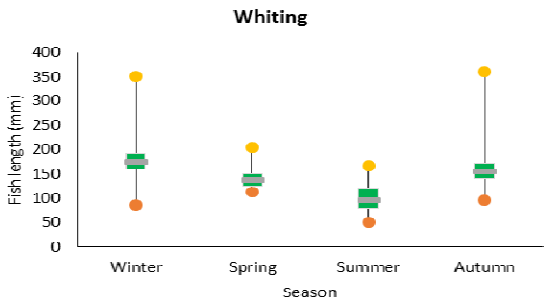
9.3.3.13 Herring spawn early in the year. This is reflected by an intertidal abundance of juveniles during the spring survey, with a slight increase in size during the summer survey. Few adult herring were caught during the surveys: adults typically migrate offshore following spawning.

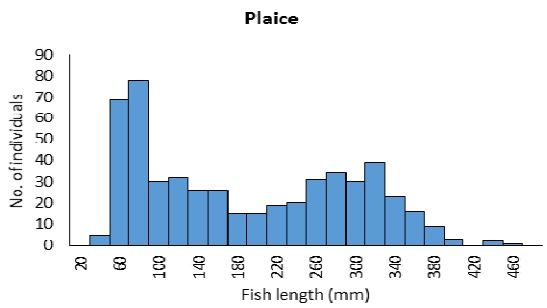
9.3.3.14 Flatfish juveniles, including plaice, sole and turbot, were abundant in intertidal areas during spring and summer. Whilst adult plaice and sole were caught in numbers during subtidal surveys, only a single adult turbot was caught. Typically turbot move further offshore than plaice and sole.

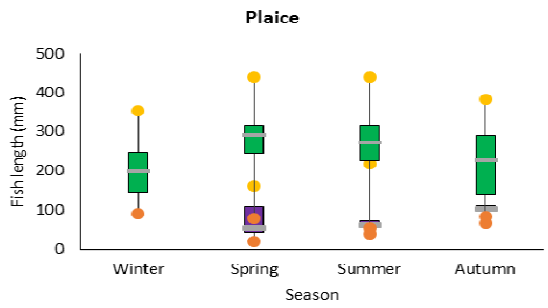
9.3.3.15 Although turbot were found to be relatively abundant, they are not regarded as a commercially important species in the study area, most likely owing to the presence of juveniles but the lack of adults.

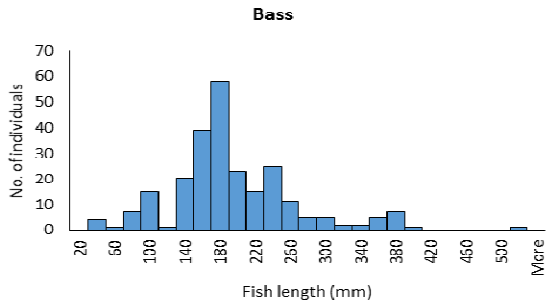


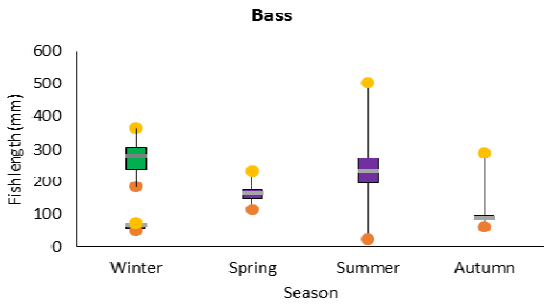

Whiting
No. of individuals
Fish length (mm)

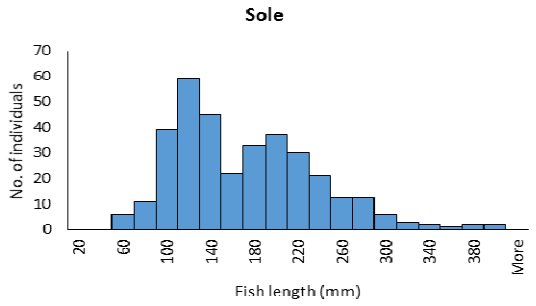

Whiting
Fish length (mm)
Winter
Spring
Summer
Autumn
Season

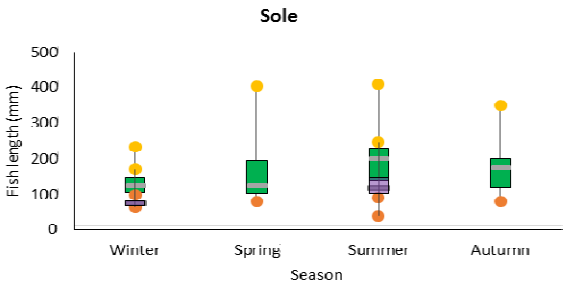

Plaice
No. of individuals
Fish length (mm)

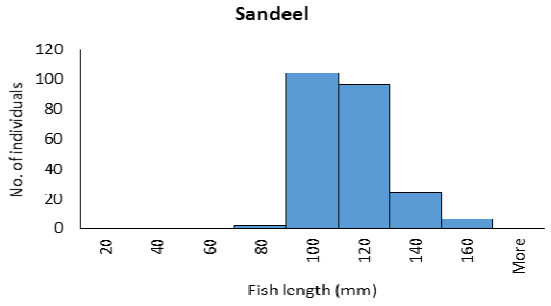

Plaice
Fish length (mm)
Winter
Spring
Summer
Autumn
Season

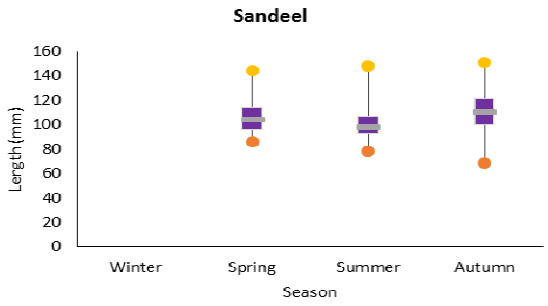

Bass
No. of individuals
Fish length (mm)


Bass
Fish length (mm)
Winter
Spring
Summer
Autumn
Season


Sole
No. of individuals
Fish length (mm)


Sole
Fish length (mm)
Winter
Spring
Summer
Autumn
Season


Sandeel
No. of individuals
Fish length (mm)


Sandeel
Length (mm)
Winter
Spring
Summer
Autumn
Season

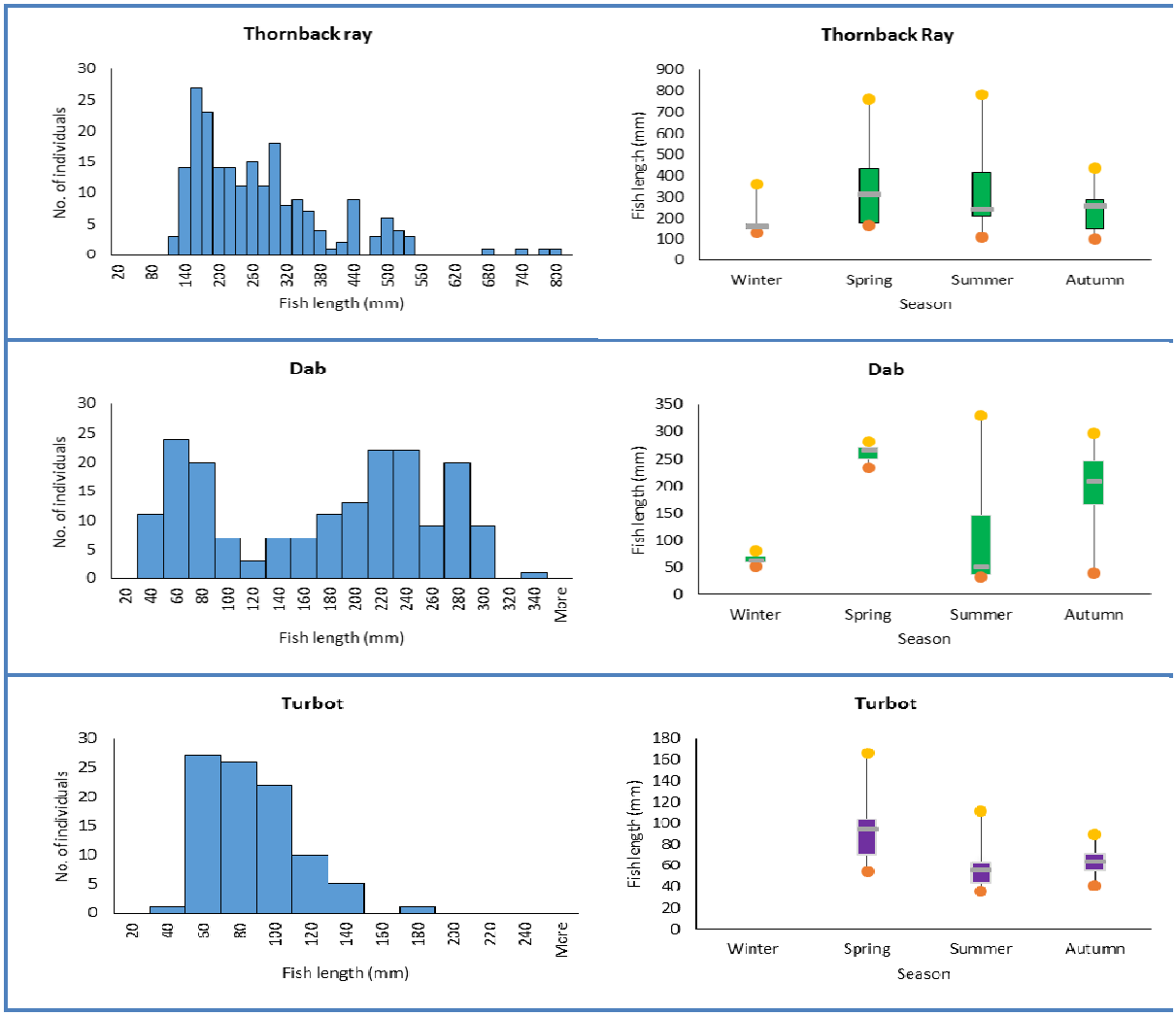


Figure 9.6c Length frequency histograms (both subtidal and intertidal) and box plots for several species caught during the 2013 surveys. Subtidal (green) and intertidal (purple) boxplots show significant variation in size.

Migratory fish identified in site-specific surveys

9.3.3.16 Four European eel were caught during the spring season surveys during intertidal seine netting. No other migratory fishes were caught in intertidal or subtidal surveys. It should be noted that, whilst these surveys were not designed specifically to sample migratory species, based on current evidence and consultations, they regularly occur within the study area. These species are protected through both UK and (when associated with a SAC) European legislation, and are therefore of high conservation value.

Fish spawning and nursery areas identified from site-specific surveys

9.3.3.17 The Swansea Bay region provides a spawning and nursery area for a number of marine fish species, but many are offshore broadcast spawners, and do not lay eggs within the Bay.

9.3.3.18 A deep water area off Trevose Head (Cornwall), and the outer Bristol Channel, are thought to be important spawning grounds for many demersal and pelagic species

including plaice, sole, lemon sole, dab, bass, whiting, cod, sprat, sandeel, mackerel, horse mackerel, hake, turbot, and gurnard. It is likely that recruitment to nursery areas within Swansea Bay occurs in part from these sites.

9.3.3.19 Sandeel, an important keystone species, are substrate spawners, laying eggs on the seabed. Typically there is little movement of post-settled sandeel between spawning and nursery areas, it is assumed that the location in which adult are found is broadly similar to their spawning ground. The seasonal surveys undertaken as part of the project indicated relatively low numbers present in the study area as a whole and low numbers on Crymlyn Burrows (the intertidal area adjacent to the lagoon (site i6)), most were found west of Mumbles head in the sandy bays of Caswell and Pwlldu. During the surveys none were present at i6 in the winter and spring surveys, and 16 were caught during the summer survey. At the remaining 5 intertidal sites in the wider bay, no sandeel were found in winter, 132 during the spring survey (131 were at Caswell Bay) and 99 in the summer. Notwithstanding this it should be assumed that any sandeel present within Swansea Bay would also spawn here.

9.3.3.20 During February and March herring spawn within Swansea Bay. Their spawning is concentrated in three locations across the Bay (Chapter 9, Figure 9.12, Volume 1).

9.3.3.21 Juvenile fish belonging to several species were caught during the 2013 surveys, these included: dab, turbot, plaice, flounder, bass, sprat, blonde ray (*Raja branchyura*), small-eyed ray (*Raja microocellata*), spotted ray (*Raja montagui*), thornback ray, grey gurnard, golden grey mullet, poor cod, pouting and whiting. Sheltered conditions and abundance of food sources within Swansea Bay give rise to suitable habitats for juvenile fish.

9.3.4 Marine Fish Spawning and Nursery Areas

9.3.4.1 Species with known spawning and/or nursery locations within the Swansea Bay area are shown in Table 9.4.

9.3.4.2 Eleven taxa with known spawning and nursery habitats in or offshore of the Swansea Bay area are presented. Additionally, fragmentary evidence was found for several other species; this is presented in Section 9.3.7. Seasonality in spawning and nursery periods for fish is presented in Table 9.5.

9.3.4.3 The key conclusion is that, while the Swansea Bay environs and its offshore waters provide some spawning and nursery habitat for these species, they are of local rather than regional or national importance.

Table 9.4 Species for which information on spawning and nursery grounds within the Swansea Bay area is available.

Common Name	Scientific Name
Anglerfish	*Lophius piscatorius*
Bass	*Dicentrarchus labrax*
Cod	*Gadus morhua*
Dab	*Limanda limanda*
Herring	*Clupea harengus*
Ling	*Molva molva*
Lesser spotted dogfish	*Scyliorhinus canicula*

Common Name	Scientific Name
Plaice	*Pleuronectes platessa*
Sandeel	*Ammodytes tobianus*
Sole	*Solea solea*
Whiting	*Merlangius merlangus*

Table 9.5 Summary of spawning periods for fish species of local commercial or recreational importance.

Common Name	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish				■	■	■	■					
Bass		■	■	■								
Cod		■	■	■								
Dab		■	■	■								
Herring		■	■	■					■	■	■	
Lesser spotted dogfish						■	■					
Plaice	■	■	■									
Sandeel		■	■	■					■	■	■	
Sole			■	■	■							
Whiting		■	■	■	■	■						

9.3.5 Fish Spawning Areas, by Species

Anglerfish

9.3.5.1 There is very limited information on the spawning habits of anglerfish. They are known to spawn offshore, most likely along the edge of the continental slope (Maitland & Herdson, 2009). As a result, the Swansea Bay area does not play a direct role as a spawning site. It does, however, have an important role for the juvenile stages, which move inshore to grow.

Bass

9.3.5.2 Bass spawn offshore in deep water between February and April. They are pelagic spawners and their eggs drift passively through the water column (Pawson, 1995). Once hatched, juvenile fish will congregate and move inshore into their nursery habitat. It is likely that any bass spawning activity occurs outside of the zone of impact of the project. However, there are several areas within Swansea Bay and the surrounding coastline which offer suitable habitat for juvenile bass. The majority of bass recruiting to the Swansea Bay area is thought to originate from an offshore spawning site at Trevose Head, Cornwall (Reynolds et al., 2003).

Cod

9.3.5.3 Cod are not thought to spawn within the vicinity of Swansea Bay. The nearest area in which they are known to spawn in significant numbers is Trevose Head, Cornwall (Ellis et al., 2012). Other sources (Potts & Swaby, 1993) suggest that the main contributing spawning ground to juvenile cod found within the Severn Estuary is located west of Hartland Point, in the Bristol Channel. As can be seen from Figure 9.7, some larvae have been recovered in the nearby Carmarthen Bay, though at very low densities. These are larvae which have passively drifted into inshore waters from offshore spawning areas.

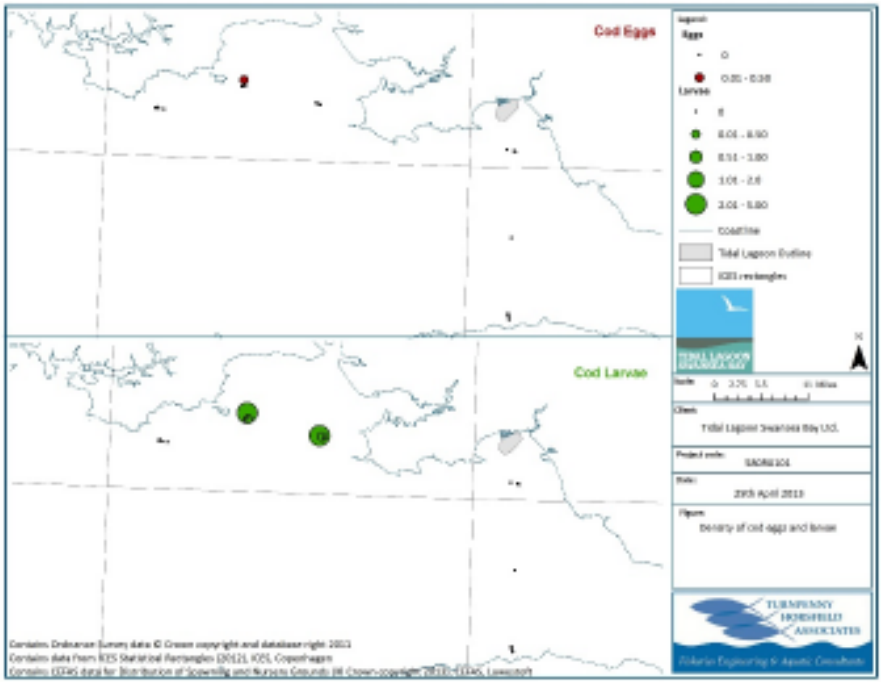


Figure 9.7 Density of cod eggs and larvae in the Swansea Bay area (Cefas, 2013).

Dab

9.3.5.4 No primary publications were found describing the distribution of dab spawning and nursery areas in South Wales. As a result, no maps for the Swansea region have been created. Dabs are known to spawn in certain locations in North Wales, namely Anglesey and Conwy Bay (Bakhsh, 1982). There is no evidence to indicate the provenance of dabs found in Swansea Bay.

Herring

9.3.5.5 Herring are benthic spawners, depositing eggs on gravel patches in shallow coastal waters. Consultation with members of South West Wales Fishing Communities (SWWFC) and Swansea University has indicated that there is an active herring spawning ground within Swansea Bay, with spawning occurring directly within the bounds of the PDS. The stock is not currently exploited commercially, but in the past Swansea University have collected fish for brood stock. Herring typically are divided into either spring or autumn spawning stocks. Within Swansea Bay, the majority of spawning activity is known to occur during the spring period.

9.3.5.6 In a wider context, evidence for the West Coast of the UK points to a major spawning area only within the Irish Sea (Coull et al., 1998). Few data are available and the irregularity of targeted surveys makes it difficult to establish the size of the herring spawning stock within Swansea Bay. Site specific surveys have indicated an abundance of juvenile herring (see section 9.3.3).

Ling

9.3.5.7 Data surrounding ling spawning is scarce. Some ling larvae have been recovered in Camarthen Bay, but no ling juveniles or eggs have been recovered in Swansea Bay (Figure 9.8). Ling are known to spawn in deep waters and adults are typically found in depths greater than 50m. Given the morphology of Swansea Bay, it is unlikely to offer a suitable habitat to this species.

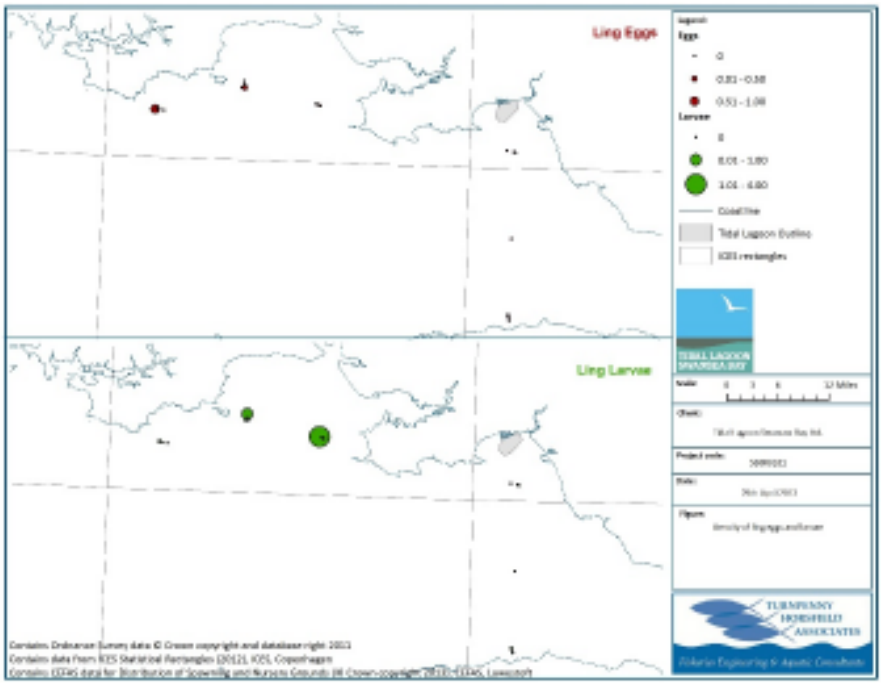


Figure 9.8 Density of ling eggs and larvae in the Swansea Bay area (Cefas, 2013).

Lesser spotted dogfish

9.3.5.8 Lesser spotted dogfish are known to lay eggs in Swansea Bay and around the surrounding coastline. Ellis & Shackley, 1997, indicate the peak spawning period for this fish in the Swansea area to be between June and July, and eggs are commonly found adhering to sessile invertebrates. Swansea Bay seems to play a lesser role than the coastline to the west (west of Mumbles Head), given its morphology and relative absence of intertidal structures.

Plaice

9.3.5.9 The ICES area VIIf, in which the PDS is located, holds a significant population of plaice. Recruitment to Swansea Bay occurs from a number of different spawning grounds, with the most likely being located offshore at Trevose Head, Cornwall but with limited additional local spawning near Carmarthen Bay. Plaice eggs have been found in plankton surveys within Carmarthen Bay (Coull et al., 1998) (Figure 9.9). However, no eggs or larvae have been recovered in Swansea Bay. By the time they reach Swansea Bay the fish have developed into their juvenile demersal stages, using the area as nursery habitat.

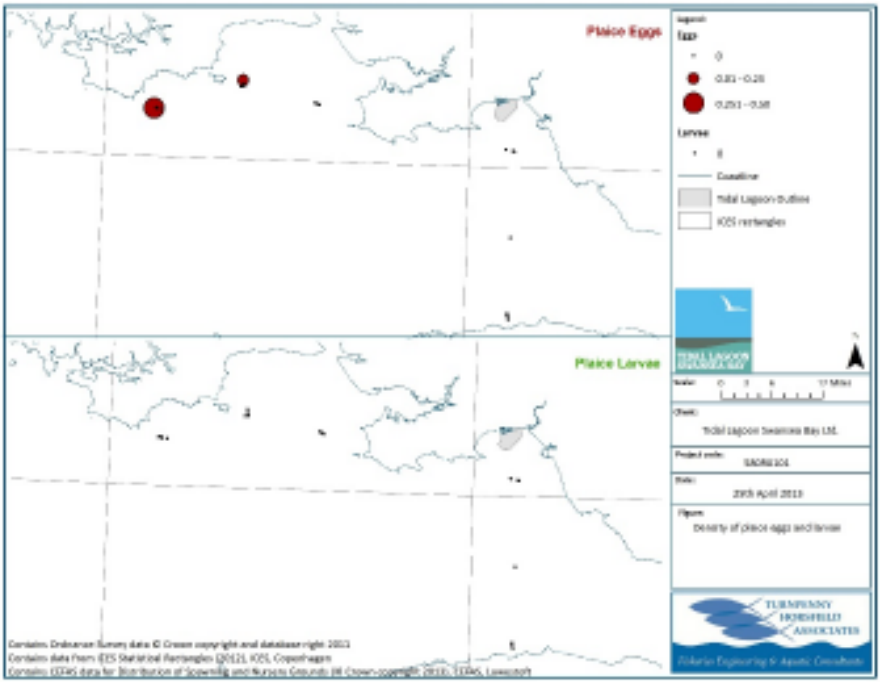


Figure 9.9 Density of plaice eggs and larvae in the Swansea Bay area (Cefas, 2013).

Sandeel

9.3.5.10 Sandeel are not a commercially exploited fish within Swansea Bay. They are recognised as being a keystone species, and thus are very important as a prey item to many other commercially important fish (Fisheries Research Services, 2003). The Bristol Channel as a whole is considered a good spawning area for sandeel (Figure 9.10), although no eggs or larvae have been recovered within Swansea Bay itself.

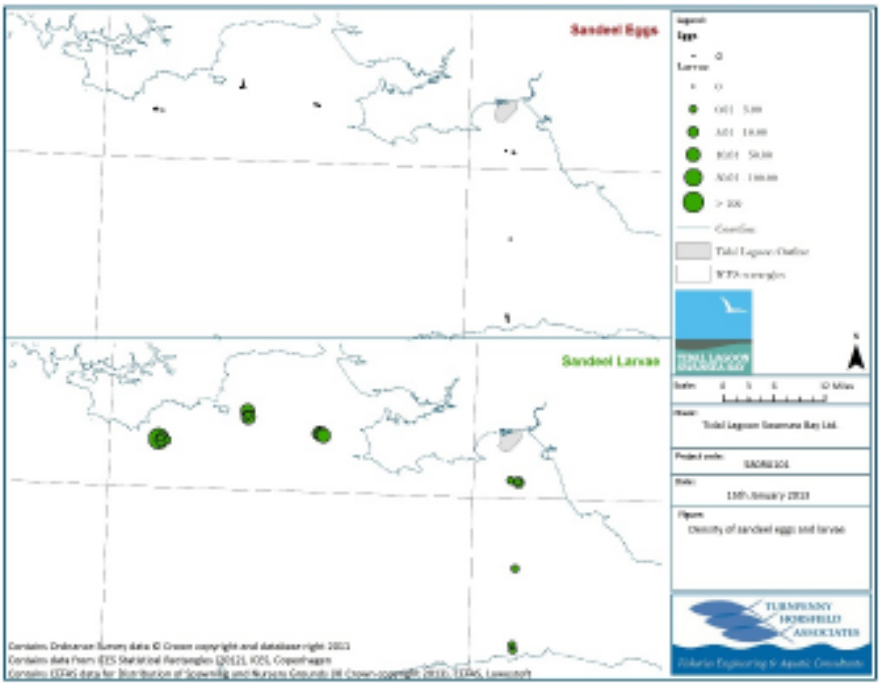


Figure 9.10 Density of sandeel eggs and larvae in the Swansea Bay area (Cefas, 2013).

Sole

9.3.5.11 There is a recognised Bristol Channel spawning population of sole (Henderson & Seaby, 2005), which has a fidelity to local spawning and nursery areas. No sole eggs or larvae have been recovered within Swansea Bay (Figure 9.11). Evidence, however, indicates that information is sparse for the Bristol Channel, especially in shallow, littoral areas, and the last targeted work was conducted in 1990 with large offshore trawls (Ellis et al., 2012).

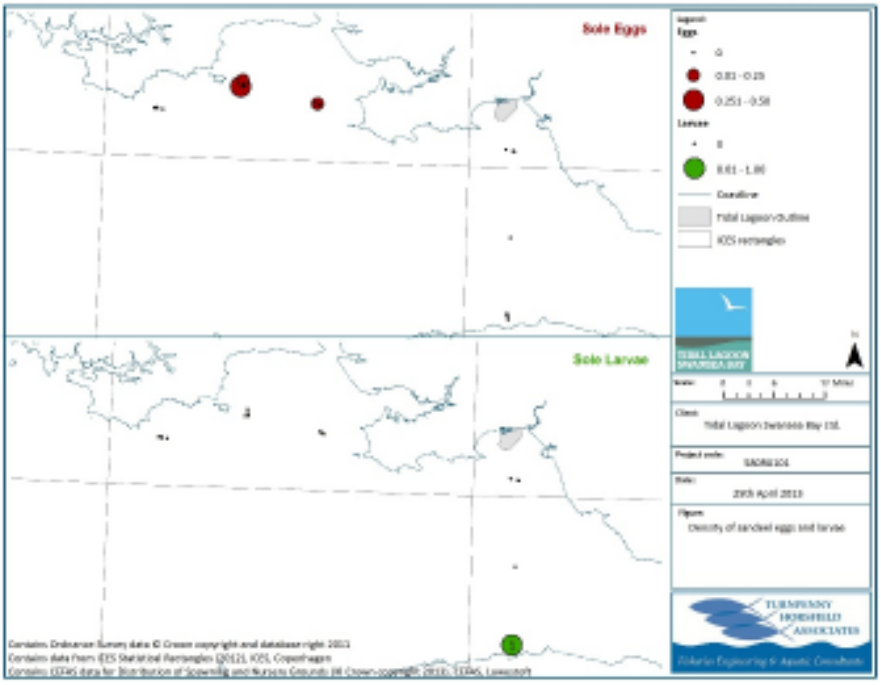


Figure 9.11 Density of sole eggs and larvae in the Swansea Bay area (Cefas, 2013).

Whiting

9.3.5.12 No evidence has been found indicating that whiting spawn in Swansea Bay. An area in the vicinity of Trevose Head, Cornwall, provides a significant spawning ground for the species, with another distinct spawning area off the north coast of Devon (Lee & Ramster, 1981; Ellis et al., 2012).

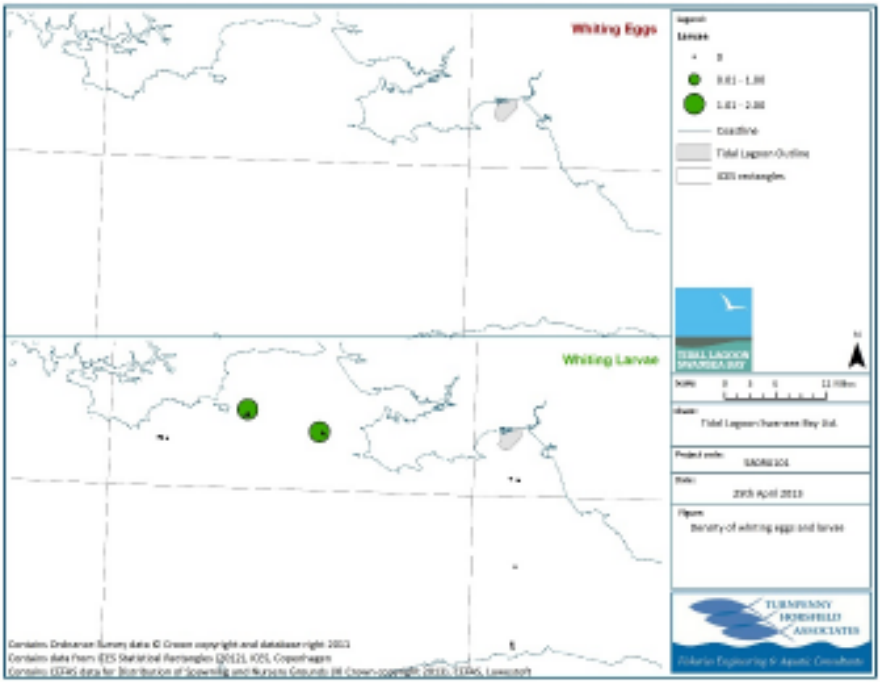


Figure 9.12 Density of whiting eggs and larvae in the Swansea Bay area (Cefas, 2013).

9.3.6 Fish Nursery Areas, by Species

9.3.6.1 A variety of flatfish, including plaice, dab, turbot, brill and Dover sole use Swansea Bay as nursery habitat. This includes the area within the bounds of the proposed PDS. The area is also used by juvenile rays and significant numbers of young-of-the-year (YOY) bass.

Anglerfish

9.3.6.2 Juvenile anglerfish occur within the offshore area, and the region has been identified through published literature as a low-intensity nursery zone for the species (Figure 9.13). Specimens have not been picked up directly within the bounds of the Bay.

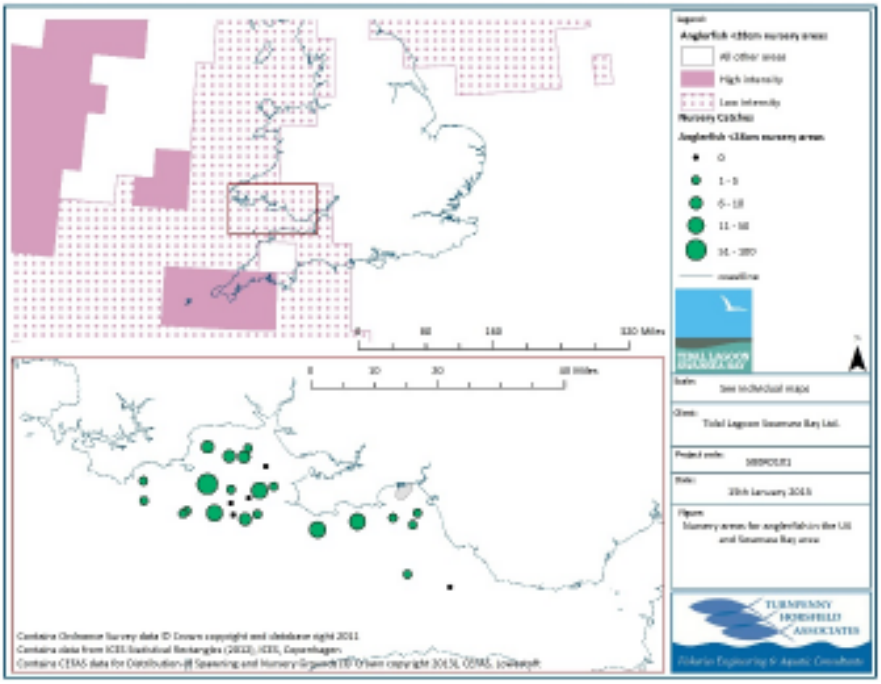


Figure 9.13 Nursery areas for anglerfish in the UK and Swansea Bay area (Cefas, 2013).

Bass

9.3.6.3 Young of Year (YOY) bass, measuring between 15 and 20 mm, arrive in inshore nursery areas on the south coast of Wales from late June onwards (Reynolds et al., 2003). Jennings et al. (1991) indicated that significant numbers of juvenile bass were captured in the vicinity of Oxwich Bay. All of the estuaries within the region are known to hold significant numbers of juvenile bass.

Cod

9.3.6.4 Data on juvenile cod, aged between 1 and 6 years, have been taken from surveys within the Swansea Bay area (Cefas, 2005). The likely origin of these fish is the spawning grounds near Trevose Head, Cornwall. There is no evidence to suggest that Swansea Bay is an important nursery area for juvenile cod Figure 9.14).

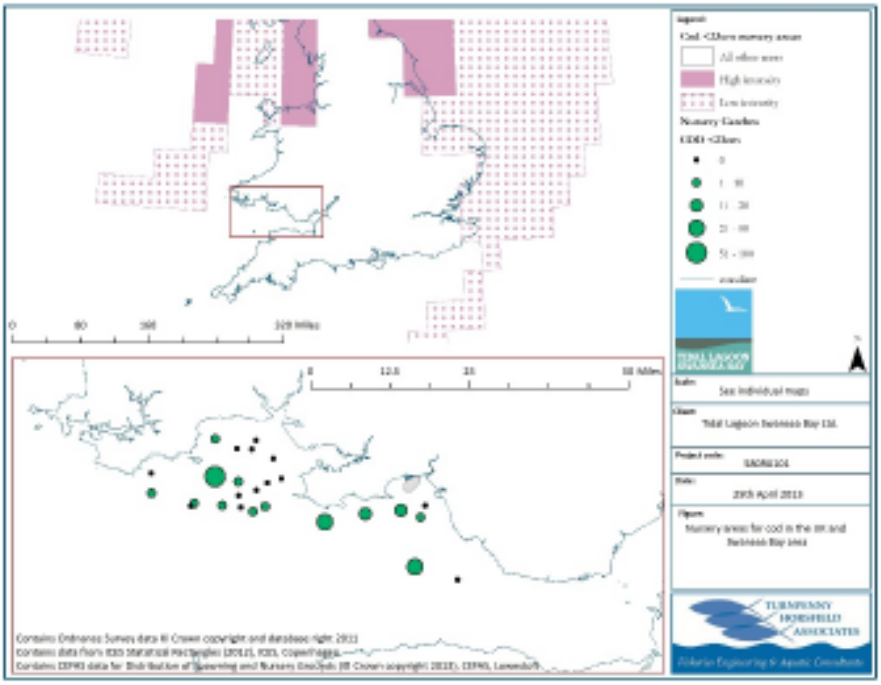


Figure 9.14 Nursery areas for cod in the UK and Swansea Bay area (Cefas, 2013).

Dab

9.3.6.5 Dab are widely distributed in coastal waters of England and Wales. Henderson and Holmes (1991) indicate that significant numbers of juvenile dab are found in Bridgwater Bay, Somerset (ca. 55 km from Swansea Bay). Habitat characteristics at Bridgwater Bay are similar to those found at Swansea, with the site being primarily composed of mixed mudflat and sandflat habitat. Both of these sites are typical of biotopes used by juvenile dab (Gregory & Rowden, 2001). It is likely that YOY dab migrate into the Swansea Bay area following spawning, from February to April, and that Swansea Bay is a good nursery area for the species.

Herring

9.3.6.6 Few juvenile herring have been recovered in targeted surveys near Swansea Bay (Figure 9.15 though this is more likely due to a lack of surveys rather than an absence of herring. The area has been identified as a low-intensity nursery zone (Cefas, 2013) and, given the evidence of a local Swansea Bay autumn-spawning stock (Lancaster, J., pers. comm., 2013), it is likely that significant numbers of herring juveniles are to be found within the area.

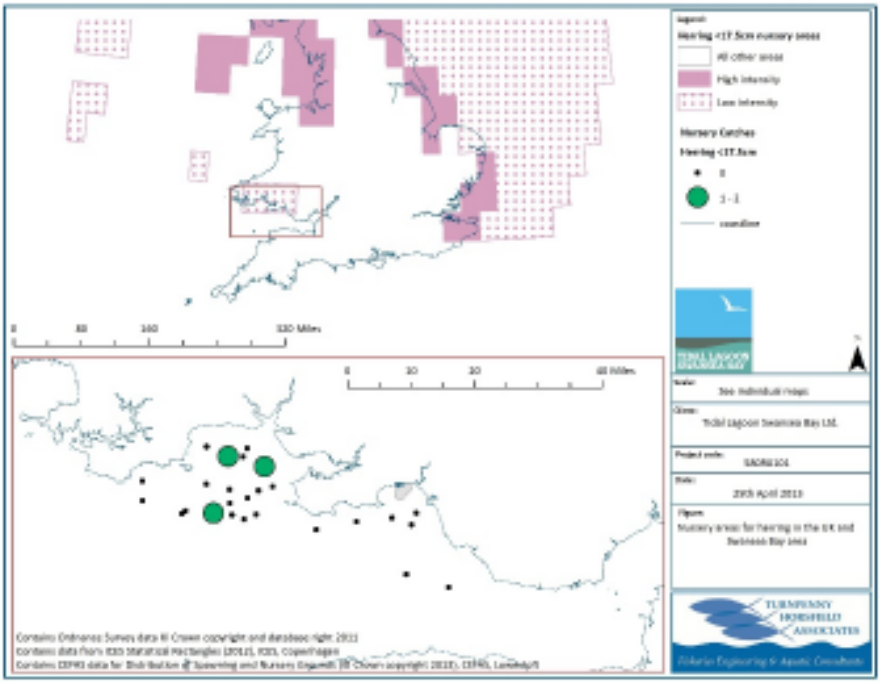


Figure 9.15 Nursery areas for herring in the UK and Swansea Bay area (Cefas, 2013).

Ling

9.3.6.7 Historically, ling have not been considered an important commercial fish and, as a result, the species has not been the target of routine biological sampling (Cefas, 2013). While YOY ling occur within the Swansea Bay area (Figure 9.16), it is unlikely that significant numbers exist within the proximity of the PDS. The scarcity of juvenile ling within the Severn Estuary is further emphasised by surveys from Hinkley Point Power Station; over a period stretching 23 years, an average of 3 per year were recovered (Henderson, 2007).

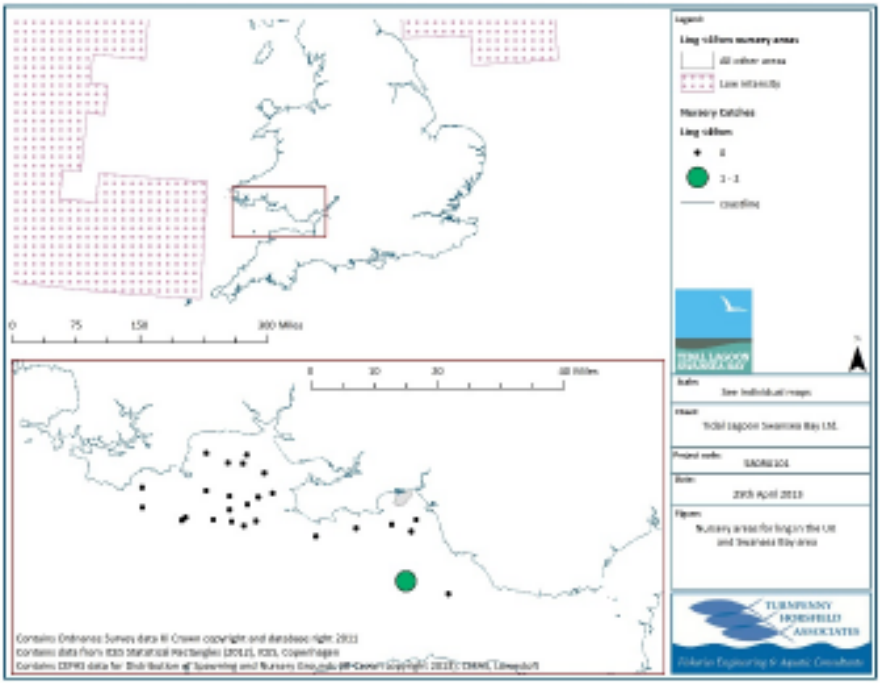


Figure 9.16 Nursery areas for ling in the UK and Swansea Bay area (Cefas, 2013).

Lesser spotted dogfish

9.3.6.8 Although no formal distributions map exists for lesser spotted dogfish, the species is common in the whole of Swansea Bay and the surrounding waters. Juveniles typically feed on bottom-dwelling invertebrates, such as shrimp, which are plentiful within the Swansea Bay region.

Plaice

9.3.6.9 During spring, YOY plaice start to colonise Swansea Bay and nearby Carmarthen Bay (Figure 9.17). The whole of the south coast of Wales, where sandy substrates are found, provides ideal habitat for juveniles of this species. Published fish spawning data (Ellis et al., 2012) indicate Swansea Bay to be a low-intensity, plaice nursery ground, and significant numbers of juvenile fish have been found in the area through targeted trawl surveys.

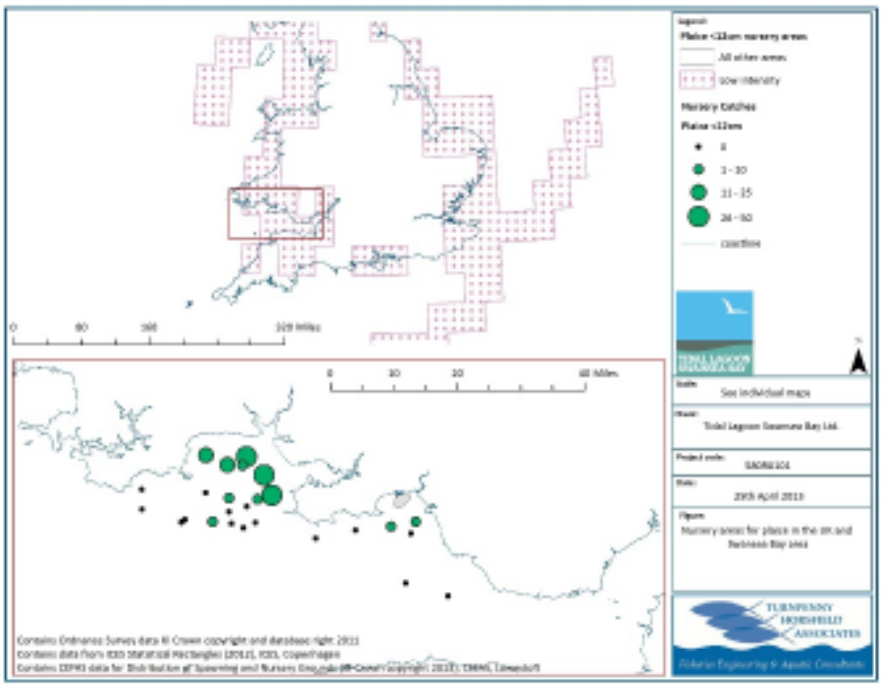


Figure 9.17 Nursery areas for plaice in the UK and Swansea Bay area (Cefas, 2013).

Sandeel

9.3.6.10 Juvenile sandeel have been recovered just outside the bounds of Swansea Bay (Figure 9.18). There is a lack of high resolution survey data for this species (Ellis et al., 2012) but it is likely that, given the environmental preferences of sandeel (especially *Ammodytes tobianus*), large numbers of juveniles are to be found within Swansea Bay itself.

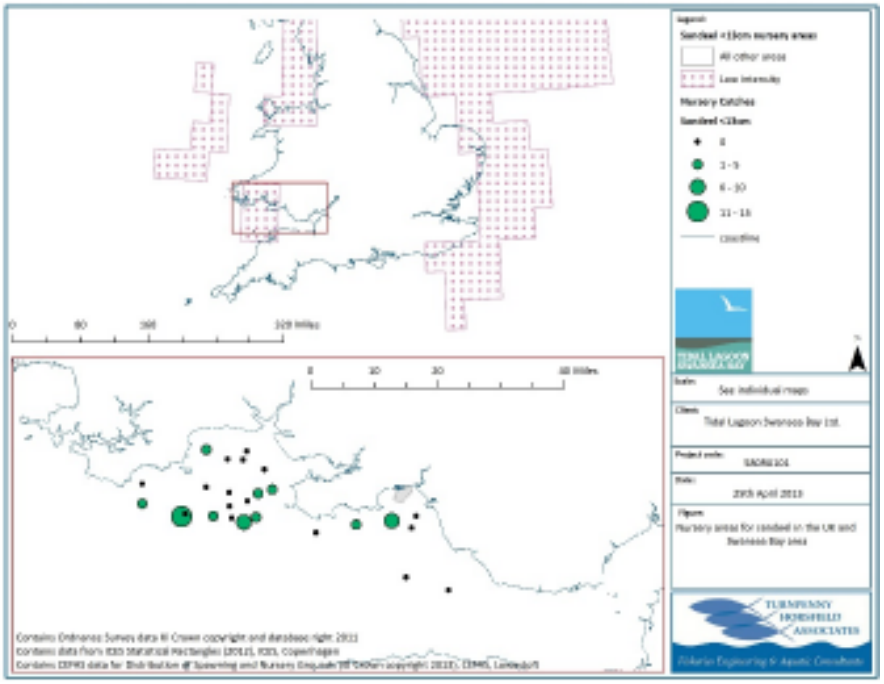


Figure 9.18 Nursery areas for sandeel in the UK and Swansea Bay area (Cefas, 2013).

Sole

9.3.6.11 Swansea Bay is a known nursery area for sole (Figure 9.19) and the Bristol Channel as a whole has been identified in several key publications as an important nursery ground for sole (Potts & Swaby, 1993; Coull et al., 1998). Sole juveniles have been caught through surveys just outside Swansea Bay, and further accounts have indicated an abundance of juvenile sole using the muddy sand areas within the Bay itself (Lancaster, J., pers. comm., 2013).

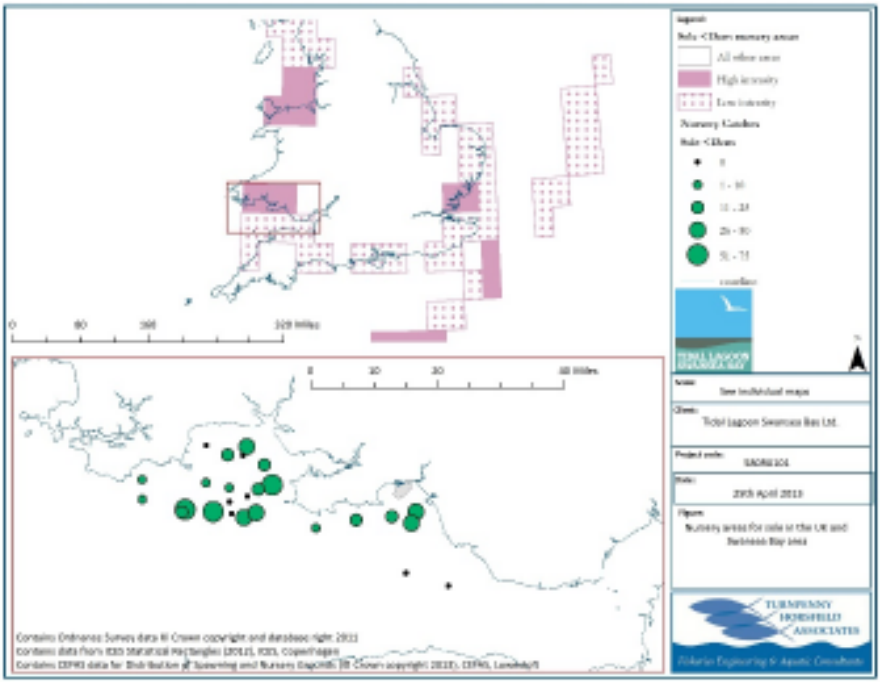


Figure 9.19 Nursery areas for sole in the UK and Swansea Bay area (Cefas, 2013).

Whiting

9.3.6.12 Whiting juveniles are extremely common in the Bristol Channel (Potts & Swaby, 1993). Swansea Bay itself has been identified as a nursery ground for whiting (Ellis et al., 2012) and significant numbers of juveniles are to be found within the Bay area (Figure 9.20).

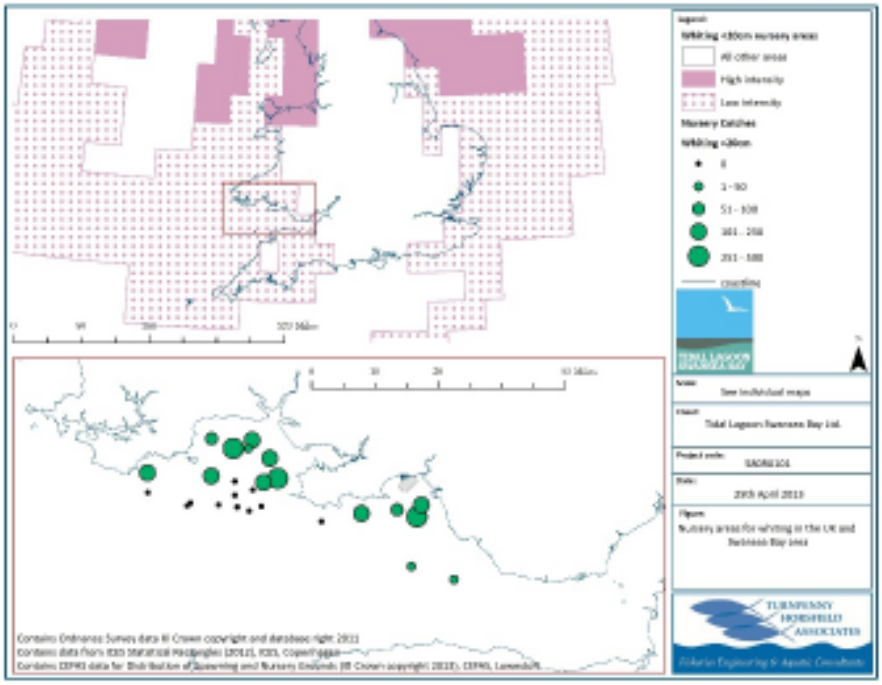


Figure 9.20 Nursery areas for whiting in the UK and Swansea Bay area (Cefas, 2013).

9.3.7 Additional spawning and nursery information

9.3.7.1 Several fish species are known to have either spawning or nursery areas in the vicinity of Swansea Bay, which have not been formally mapped, or for which information is scarce. Some of the species, for which fragmentary information was available, are presented below.

Hake

9.3.7.2 There was no evidence to indicate hake spawning in the Swansea Bay area. As for many other species in the VIIf ICES region, one of the main spawning areas is the region off Trevose Head. Typically, hake are a deep water spawning species, normally found spawning in waters between 200 and 1000 m (Alvarez et al., 2004).

9.3.7.3 Juvenile hake have been found across the Celtic Sea, including areas around Swansea Bay (Figure 9.21). However, the main nursery areas are thought to be in the North Sea, around Scotland, on the western seaboard of the British Isles (Ellis et al., 2012). Swansea Bay is most likely of low importance as a nursery area, though few scientific data are available.

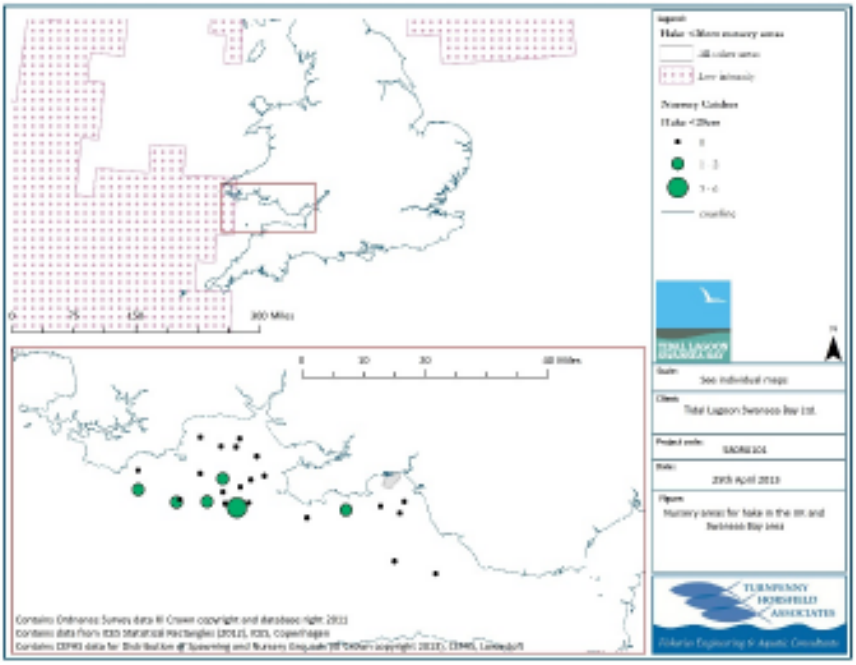


Figure 9.21 Nursery areas for hake in the UK and Swansea Bay area (Cefas, 2013).

Horse Mackerel

9.3.7.4 The outer continental shelf is the main region used by horse mackerel to spawn (Abaunza et al., 2003). Similarly to mackerel, Trevose Head plays an important role as a spawning area. No evidence was found that horse mackerel spawn within Swansea Bay or the surrounding coastline.

9.3.7.5 Horse mackerel juveniles have been caught in targeted surveys in the vicinity of Swansea Bay (Carmarthen Bay) and within the Bristol Channel (Figure 9.22). Nursery grounds for the species have not been mapped due to limited data (Ellis et al., 2012). Most of the UK coastline is thought to provide suitable habitat.

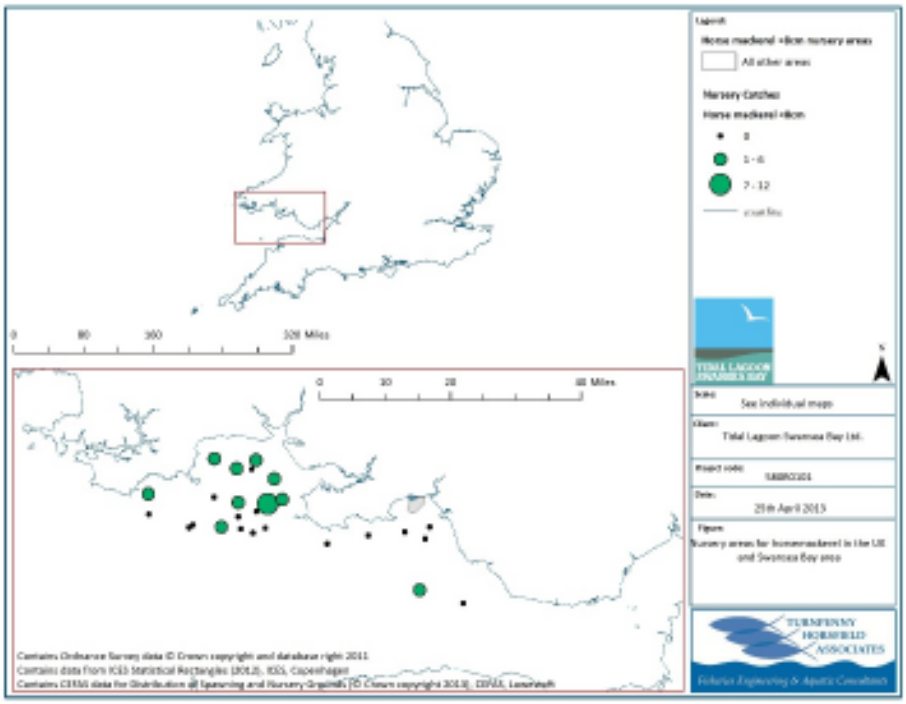


Figure 9.22 Nursery areas for horse mackerel in the UK and Swansea Bay area (Cefas, 2013).

Mackerel

9.3.7.6 Most mackerel spawning occurs on the edges of the outer continental shelf, west and south-west of Ireland (J. M. Fives et al., 2001). Secondary spawning areas located in the vicinity of Trevose head (Ellis et al., 2012), whilst no spawning evidence exists for the area around Swansea Bay.

9.3.7.7 On a national scale, the highest numbers of juvenile mackerel are encountered on the south west coast of the UK. Nursery maps for the species indicate juvenile mackerel in the Swansea Bay area, though at fairly low numbers (Figure 9.23). The Bristol Channel is currently not recognised as a mackerel nursery zone.

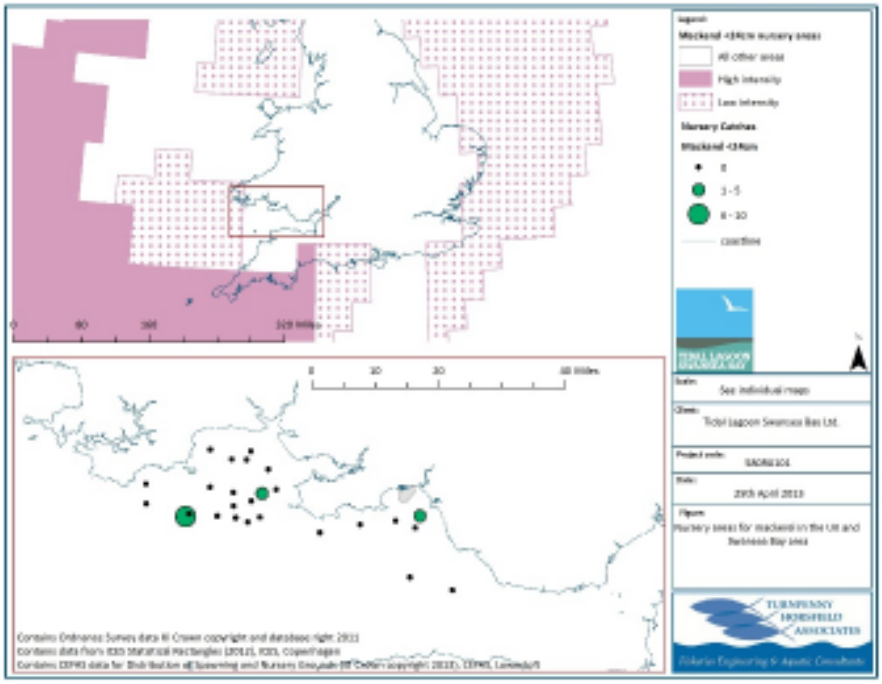


Figure 9.23 Nursery areas for mackerel in the UK and Swansea Bay area (Cefas, 2013).

Rays and Skate

9.3.7.8 No fisheries sensitivity maps exist for spawning areas of rays around the British coast, due to a paucity of data on egg cases or gravid females (Ellis et al., 2012). Egg-bearing females (*Raja clavata*, *R. microocellata* and *R. montagui*) have been found in relatively low numbers within Carmarthen Bay (Ryland & Ajayi, 1984). However, no evidence has been found for Swansea Bay itself.

9.3.7.9 The area is, however, considered to be relatively important as a nursery ground for several species of ray. Significant numbers of juveniles have been captured just outside the bounds of Swansea Bay (see Figure 9.24 for thornback ray and Figure 9.25 for spotted ray). It is likely that the Bay itself offers good habitat for YOY rays.

9.3.7.10 Most of the Bristol Channel is considered a low-intensity nursery area for several ray species. Less evidence exists for skate (Figure 9.26). This is probably related to their relative rarity within UK seas.

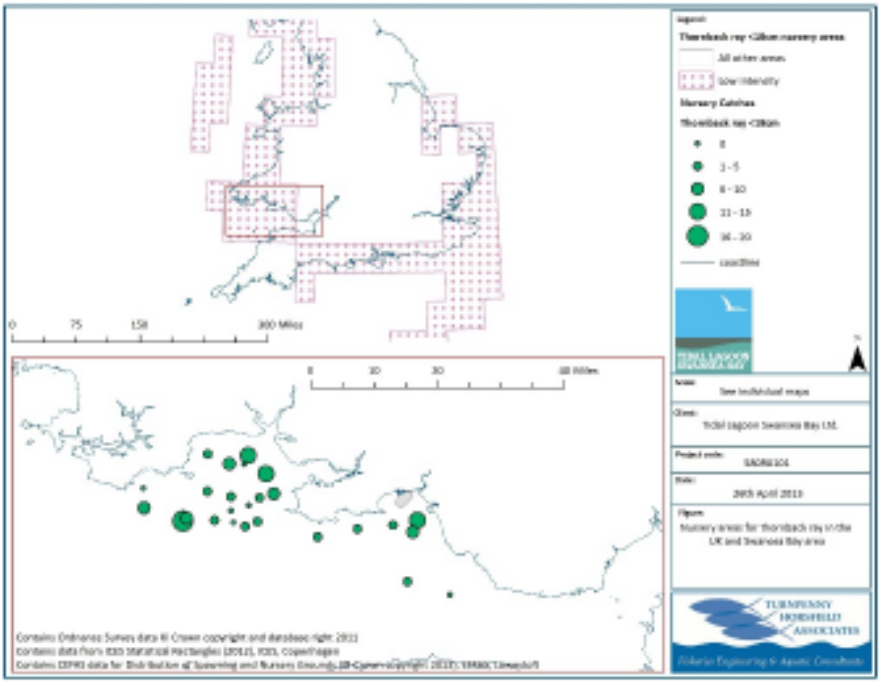


Figure 9.24 Nursery areas for thornback ray in the UK and Swansea Bay area (Cefas, 2013).

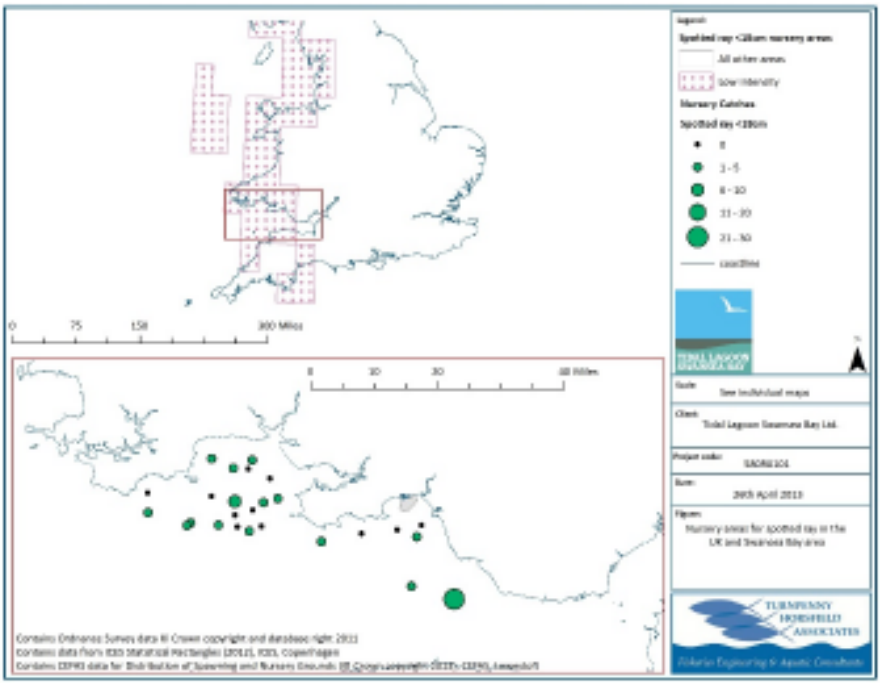


Figure 9.25 Nursery areas for spotted ray in the UK and Swansea Bay area (Cefas, 2013).

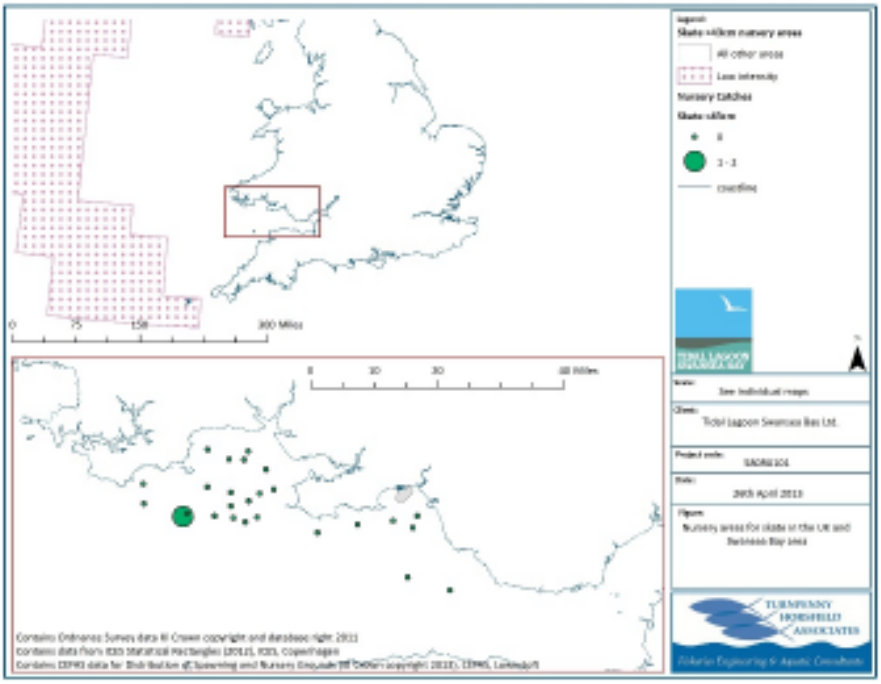


Figure 9.26 Nursery areas for skate in the UK and Swansea Bay area (Cefas, 2013).

Tope

9.3.7.11 The extent of spawning areas for this species around the British Isles is unknown.

9.3.7.12 Juvenile tope favour zones of low salinity, such as the Bristol Channel, Thames Estuary and Solent (Ellis et al., 2012). Surveys conducted by Cefas have shown low densities of juvenile tope within the Swansea Bay area (Figure 9.27).

9.3.7.13 Tope are less abundant than other elasmobranch species within Swansea Bay. However, habitat conditions within the area are suitable for the juveniles of this species.

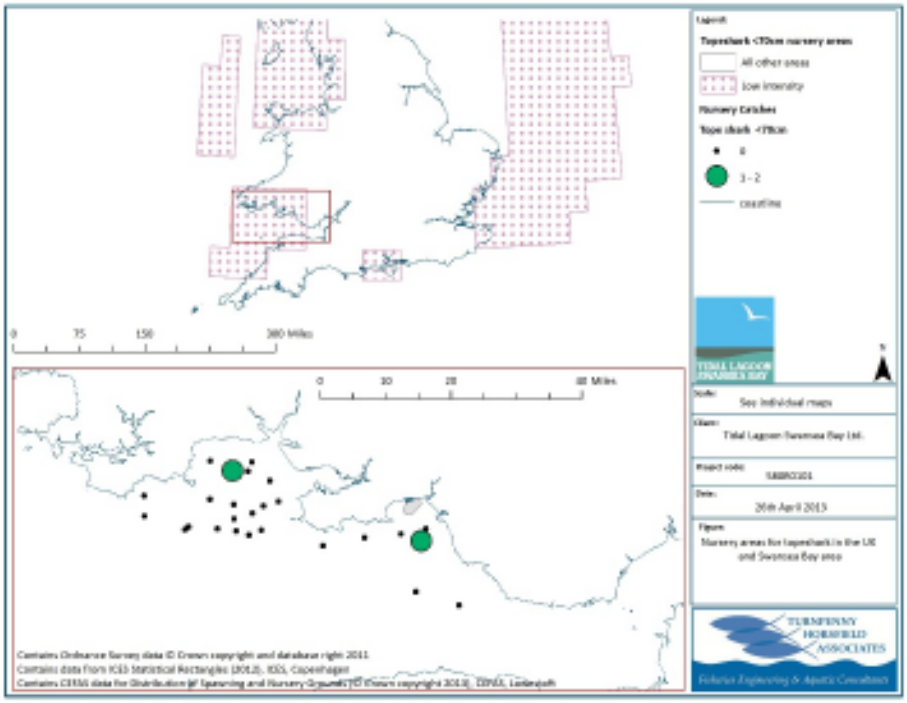


Figure 9.27 Nursery areas for tope in the UK and Swansea Bay area (Cefas, 2013).

9.4 Shellfish Populations

9.4.1 Characterisation of the Swansea Bay Shellfish Community

9.4.1.1 Table 9.6a gives a list of shellfish species that are thought to occur commonly within the Swansea Bay area.

Table 9.6a Shellfish species commonly found or of conservation interest within the Swansea Bay area.

Common Name	Scientific Name
Cockle	*Cerastoderma edule*
Common shore crab[++]	*Carcinus maenas*
Edible crab	*Cancer pagurus*
Lobster[++]	*Homarus gammarus*
Mussel	*Mytilus edulis*
Native oyster	*Ostrea edulis*
Periwinkle	*Littorina littorea*
Prawn	*Palaemon* spp.
Scallop	*Pectinidae spp.*
Shrimp	*Crangon* spp.
Spider crab[++]	*Maja* spp.
Velvet swimming crab[+]	*Necora puber*
Whelk[++]	*Buccinum undatum*

[++] Denotes species of primary commercial importance (ranking in top 10 species captured commercially, by weight) within Swansea Bay.

[+] Denotes species of secondary commercial importance (ranking in top 20 species captured commercially, by weight) within Swansea Bay.

Site-specific surveys

9.4.1.2 The shellfish community within Swansea Bay includes molluscs, crustaceans, echinoderms and cephalopods. A total of 38 species were captured during the 4 Quarterly site-specific intertidal and subtidal surveys (see Appendix 9.2, Volume 3). The ten most frequently caught species across the 4 quarterly surveys were:

1) Brittle Star *Ophiura ophiura* found in the winter, spring and autumn surveys;
2) White furrow shell *Abra alba* found in the autumn survey with high abundance;
3) Moon Jellyfish *Aurelia aurita* found in the summer survey with high abundance;
4) Common starfish *Asterias rubens* found across all seasonal surveys;
5) Shrimp *Crangon spp.* found across all seasonal surveys;
6) Prawn *Palaemon spp.* found across all seasonal surveys;
7) Common cockle *Cerastoderma edule* found in the autumn survey with high abundance;
8) Sea mouse *Aphrodita aculeata* found across all seasonal surveys;
9) Common hermit crab *Pagurus bernhardus* found across all seasonal surveys;
10) Dog whelk *Nucella lapillus* found in the spring, summer and autumn surveys.

9.4.1.3 Ten of the 38 species of macro-invertebrates identified from the quarterly surveys are recognised as having some commercial importance within Swansea Bay. Table 9.6b ranks these species by observations (recorded as log abundance). Cockle *Cerastoderma edule*, were found in high numbers during Q4, principally in intertidal areas around Blackpill. Whilst Brown crab *Cancer pagurus* and lobster were captured. The overall assemblage is consistent with information gathered through the desktop study and consultation. It should be noted that survey methodologies were not directly targeting shellfish.

Table 9.6b No. of observations of commercially important shellfish (recorded as log abundance) for all quarters and survey methods.

			Observations				
Rank	**Scientific name**	**Common name**	**1 - 10**	**10 - 100**	**100 - 1000**	**1000 +**	**Quarter present**
1	*Cerastoderme edule*	Cockle	1		2		Q4
2	*Buccinum undatum*	Whelk	8	2			Q1, Q2, and Q4
3	*Cancer pagurus, Macropodia spp., Necora puber*	Crabs	8				Q1 - Q4
4	*Aequipecten opercularis, Chlamys varias*	Scallop	2				Q4
4	*Mytilus edulis*	Mussel	2				Q1
4	*Sepia officinalis*	Cuttlefish	2				Q1
5	*Homarus gammarus*	Lobster	1				Q2

9.5 Migratory Fish

9.5.1 Introduction

9.5.1.1 Six diadromous fish species regularly visit the Swansea Bay area. These are shown in Table 9.7.

Table 9.7 Diadromous fish species regularly present within the Swansea Bay area.

Common name	Scientific name
Atlantic salmon	*Salmo salar*
Sea trout (sewin)	*Salmo trutta*
European eel	*Anguilla anguilla*
River lamprey	*Lampetra fluviatilis*
Sea lamprey	*Petromyzon marinus*
Twaite shad	*Alosa fallax*

9.5.1.2 Historically, large commercial fisheries were present for several migratory species, such as salmon, sea trout, lamprey and shad (Potts & Swaby, 1993). However, as a result of declining stocks, these are no longer exploited commercially.

9.5.2 Methodology

Study area

9.5.2.1 For the purposes of the migratory fish section, the study area encompasses all major river catchments entering Swansea Bay (Figure 9.28). There are four primary rivers

draining into the embayment: the Rivers Tawe, Neath, Afan and Kenfig. Within all of these rivers, migratory fish species have been found. Evidence for the presence of migratory fish within Swansea Bay is presented, below.

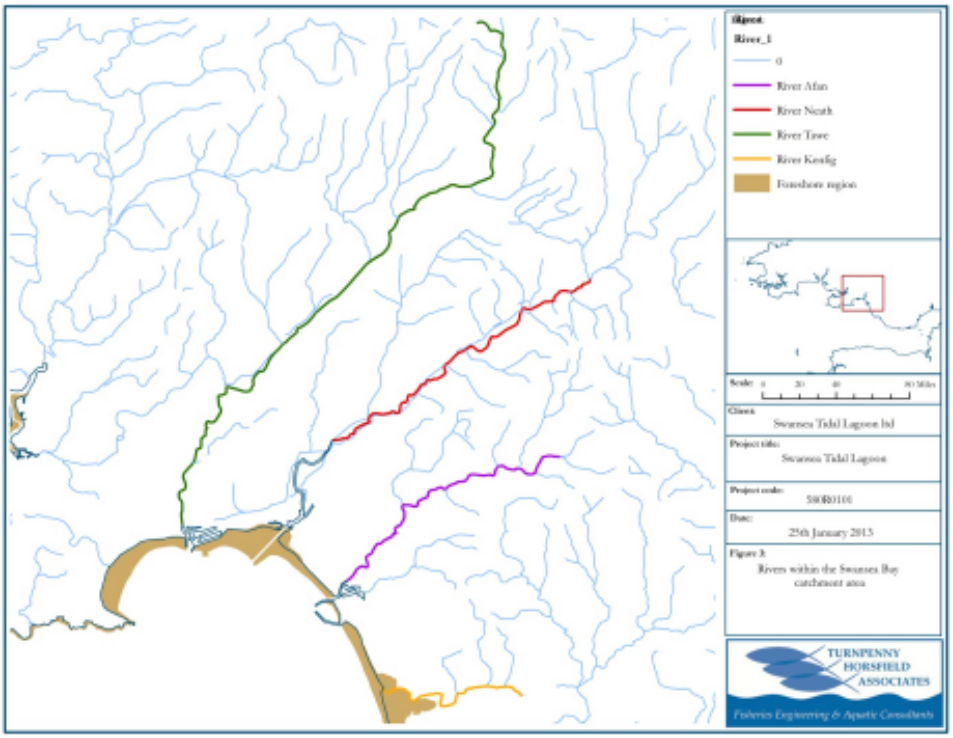


Figure 9.28 Rivers within the Swansea Bay catchment area.

Data acquisition, information and sensitivities

9.5.2.2 Most evidence on migratory fish populations in the Swansea Bay area was sourced from the Environment Agency and Countryside Council for Wales.

9.5.2.3 Rod catch data for rivers within the bounds of the far-field zone was requested from the Environment Agency. This comprised all historical rod catch data between 2001 and 2011 for the Rivers Afan, Neath and Tawe. It is likely that a certain portion of rod-caught salmon and sea trout will not be reported in official figures.

9.5.2.4 Historical electric fishing datasets (2001-2012) for the Rivers Afan, Neath, Tawe and Kenfig were also analysed for non-salmonid fish. Datasets recorded eel and lamprey catches but did not discriminate between sea and river lamprey. This is common within fisheries datasets, as ammocoetes (juvenile lamprey) are difficult to distinguish on site. Data were quantitative and semi-quantitative.

9.5.2.5 The Environment Agency National Fisheries Classification (NFC) scheme indices for the available sections of river catchment have been provided to allow a comparison of salmon and trout fishery status; sites were surveyed in 2012. Additionally, Water Framework Directive ecological indices have been presented for each of the rivers in question. These scores represent the ecological condition of water, based on a number of 'biological quality elements': phytoplankton; macrophytes and phytobenthos; benthic invertebrate fauna; and fish fauna.

9.5.3 Migratory Fish Populations and River Quality Status

9.5.3.1 This section uses the National Fisheries Classification (NFC) scheme to outline the migratory fish population and river quality status of the main catchment areas (Afan, Kenfig and Neath) that flow into the Swansea Bay embayment. The NFC scheme has been used as it allow comparison of grades across these sites compared with the national dataset, Table 9.8a defines the key to this scheme which has been used in subsequent tables (9.8b to 9.12).

Table 9.8a NFC scheme class boundaries

Grade	Class boundaries (%)	Descriptor	Meaning
A	80 – 100	Excellent	In the top 20 % for a fishery of this type.
B	60 – 80	Good	In the top 40 % for a fishery of this type.
C	40 – 60	Fair	In the middle 20 % of fisheries.
D	20 – 40	Fair	In the bottom 40 % for a fishery of this type.
E	0 – 20	Poor	In the bottom 20 % for a fishery of this type.
F	Not present	Fishless	No fish of this type present.

Note: use this table as a key to the following tables.

Afan Catchment

9.5.3.2 Three sites were surveyed on the Afan catchment in 2012. National Fisheries Classification indices for these are presented in Table 9.8b. In 2012, the salmon fishery in the Afan was classified as 'fair', whilst all of its tributaries had poorer results. Conversely, the trout fishery scored consistently 'fair' or above on all sections of the river.

9.5.3.3 No eel or lamprey were caught in 2012 in any of the surveys undertaken by the Environment Agency. However, additional data from other studies in the same year showed a relatively significant number of eels present on the River Afan (n= 92 (Turnpenny Horsfield Associates, 2012)).

Table 9.8b Summary of National Fisheries Classification indices for the Afan catchment, together with fisheries data for lamprey and eel (Environment Agency, 2012).

River Name	Overall Salmon Grade	Overall Trout Grade	Eel	Lamprey
Afan	D	C	0	0
Blaen Pelenna	F	D	0	0
Cregan	F	C	0	0

9.5.3.4 Within Water Framework Directive standards, the ecological status of the River Afan and its tributaries ranges from 'poor' status to 'good' status. The lower section of the river is recognised as a heavily modified water body, and thus is lower in quality.

Kenfig Catchment

9.5.3.5 Three surveys were conducted on the Kenfig catchment in 2012. National Fisheries Classification indices for these are presented in Table 9.9. No salmon have been caught on the Kenfig in the last 10 years. As a result, the NFC index has consistently scored an 'F'. Trout numbers have historically been fair or above. However, in 2012 the catchment scored fairly low. Both lamprey and eel were caught in the 2012 survey season in fairly low densities.

9.5.3.6 Within Water Framework Directive standards, the ecological status of the River Kenfig and its tributaries ranges from 'moderate' status to 'good' status.

Table 9.9 Summary of National Fisheries Classification indices for the Kenfig catchment together with fisheries data for lamprey and eel.

River Name	Overall Salmon Grade	Overall Trout Grade	Eel	Lamprey
Cwm Philip 1	F	C	2	1 to 9
Cwm Philip 2	F	F	5	10 to 99
Kenfig	F	F	1	1 to 9

Neath Catchment

9.5.3.7 Six surveys were conducted on the Neath catchment in 2012. National Fisheries Classification indices for these are presented in Table 9.10. In 2012, the salmon fishery on the River Neath and its tributaries were judged as ranging from fishless to fair. Conversely, the trout fishery scored consistently fair or above at all sites, with the exception of the River Dulais. Some eel were caught in 2012 but in very low densities. No lamprey have been recorded within the catchment since 2007.

9.5.3.8 Within Water Framework Directive standards, the ecological status of the River Neath and its tributaries ranges from 'poor' status to 'good' status.

Table 9.10 Summary of National Fisheries Classification indices for the Neath catchment, together with fisheries data for lamprey and eel.

River Name	Overall Salmon Grade	Overall Trout Grade	Eel	Lamprey
Gwrelych	E	D	2	0
Dulais	F	E	0	0
Clydach Brook 1	F	D	2	0
Clydach Brook 2	D	D	1	0
Sychryd	F	B	2	0
Clwyd	E	B	0	0

Tawe Catchment

9.5.3.9 Two surveys were conducted on the Tawe catchment in 2012. National Fisheries Classification indices for these are presented in Table 9.11.

9.5.3.10 The overall salmon grade for the River Tawe in 2012 suggests that the river has the best salmon fishery within the Swansea Bay area. This is supported by rod-catch data presented in Table 9.12. Similarly, trout stocks are recognised as being fair across the catchment.

9.5.3.11 No lamprey were recorded in survey data in 2012, whilst low numbers were recorded in 2011 (n=5). Eel records varied greatly by tributary, e.g. 26 eels on the Lower Clydach versus six on the River Geidd in 2011 (both tributaries of the Tawe).

Table 9.11 Summary of National Fisheries Classification indices for the Tawe catchment, together with fisheries data for lamprey and eel.

River Name	Overall Salmon Grade	Overall Trout Grade	Eel	Lamprey
Nant Ddu	C	D	4	0
Tawe	D	D	2	0

9.5.3.12 Within Water Framework Directive standards, the most of the Tawe is recognised as being of 'good' ecological status, while tributaries vary greatly in ecological quality, with the majority ranking as 'moderate' or higher.

9.5.3.13 Over a ten-year period, a total of 2,509 salmon and 9,837 sea trout were caught from the Rivers Afan, Neath and Tawe (Table 9.12).

Table 9.12 Salmon and sea trout catches, as derived from Environment Agency rod-catch data (2001-2011)

Year	River Afan		River Neath		River Tawe	
	Salmon	Sea Trout	Salmon	Sea Trout	Salmon	Sea Trout
2001	8	166	70	673	113	373
2002	7	103	90	782	148	424
2003	5	162	35	400	61	272
2004	10	168	73	532	155	173
2005	6	153	37	393	164	372
2006	5	63	85	298	184	153
2007	3	158	53	487	183	243
2008	9	161	99	317	195	144
2009	15	120	62	492	114	242
2010	18	112	76	493	230	426
2011	10	142	77	444	109	196
Total	**96**	**1,508**	**757**	**5,311**	**1,656**	**3,018**

Salmon

9.5.3.14 Salmon catches were fairly stable within the Rivers Afan, Neath and Tawe (Figure 9.29). The highest recorded catches were on the River Tawe, which yielded an average of 150 fish per season, followed by the River Neath (n = 68) and the River Afan (n = 8).

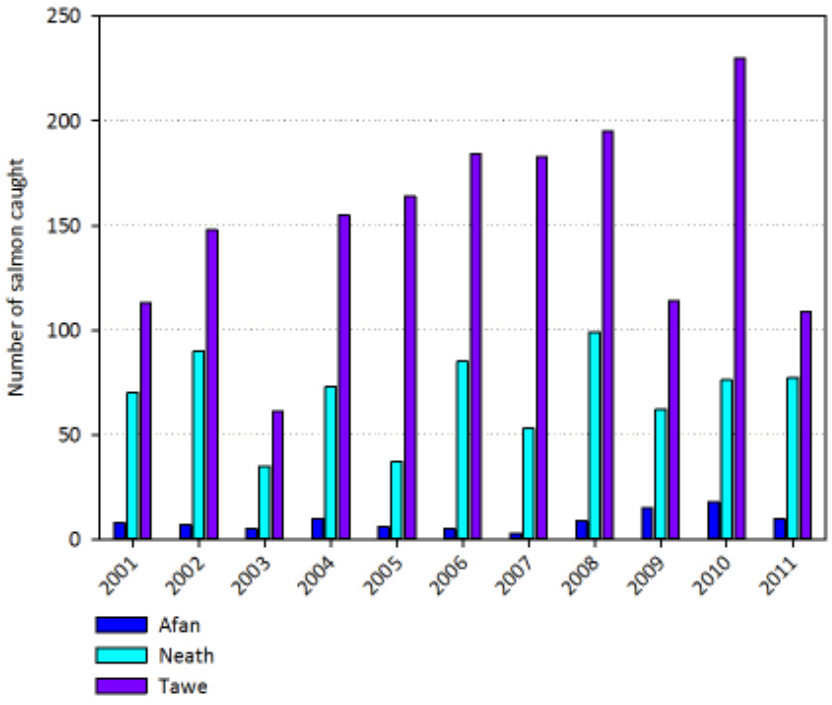


Figure 9.29 Salmon catches in the Rivers Afan, Neath and Tawe (2001-2011).

Trout

9.5.3.15 Rod catch data show significantly higher numbers of trout than salmon (Figure 9.30). In the past ten years, an average of 482 sea trout was caught in the River Neath, 274 in the River Tawe and 137 in the River Afan.

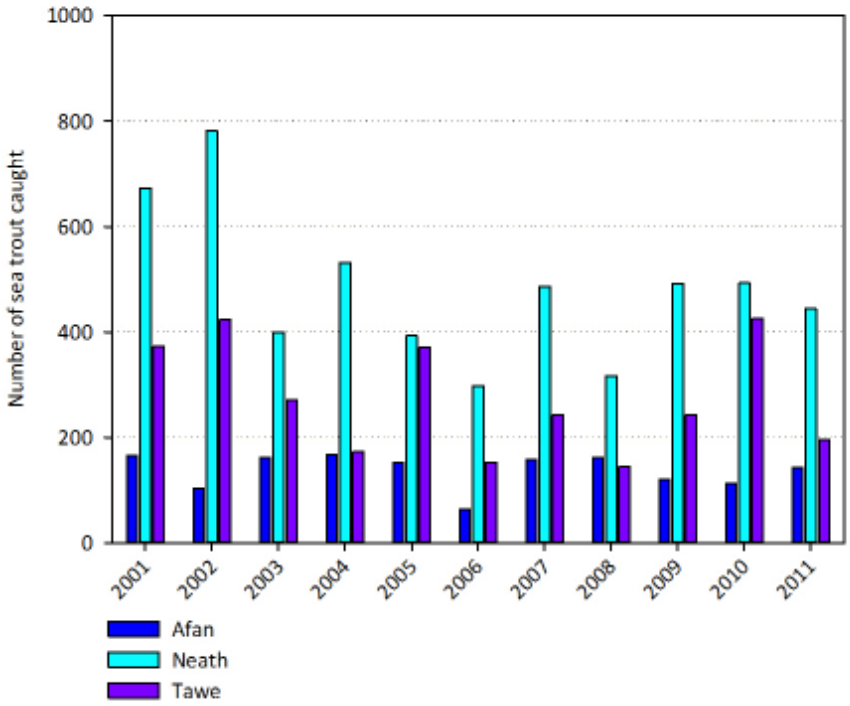


Figure 9.30 Sea trout catches in the Rivers Afan, Neath and Tawe (2001-2011).

Fish Passage through the Tawe Barrage

9.5.3.16 The Tawe Barrage was constructed in 1992, the first amenity barrage of its kind to be completed in the UK. The impoundment has resulted in a largely freshwater lake upstream of the barrage which runs for the majority of the original estuary (Russell et al., 1998). A pool and traverse fish pass was included in the impoundment to allow for the movement of migratory fish (Figure 9.31). The primary weir is set between MHWN (7.23 m A.C.D.) and MHWS (9.48 m A.C.D) at 8.05 A.C.D. A secondary weir is set at 8.35 m A.C.D. This arrangement allows an estimated 71 % of tides to overtop (for approximately 16 % of the time) (Mee, Kirkpatrick, & Stonehewer, 1996).

9.5.3.17 A study investigating salmonid behaviour migrating past the Tawe barrage was conducted by Mee et al. (1996). Over a period of two years 127 adult fish (both salmon *Salmo salar* and sea trout *Salmo trutta*) were tagged. Fish were sourced both above the barrage (72) and below (55). A combination of acoustic and radio tags were used to monitor their movement following release below the barrage. Results indicated that 38 (29.9 %) of released fish migrated past the impoundment, 53 (41.7%) were last recorded in the estuary downstream of the barrage, 2 (1.6%) were not detected and a single fish (0.8%) was captured in another river. Successful approaches were primarily made during periods close to high tide, with a mean entry of three minutes before high water. Of the successful passes, nine fish entered through the fish pass, taking between 0.4 and 24 hours to ascend the fish pass. Strong correlation was found between successful entries to the impoundment and tidal state, with 78 % of fish found to do so over the primary or secondary weir during inundating tides.

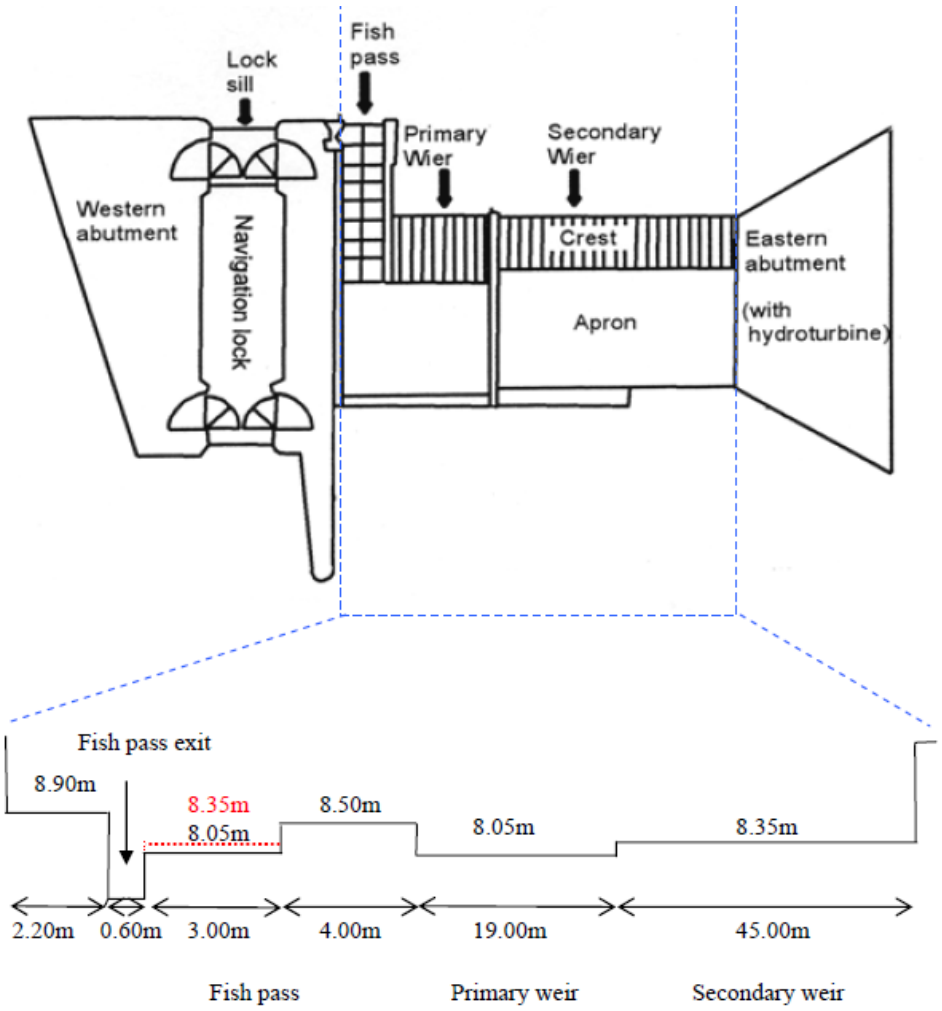


Figure 9.31 General arrangement of the River Tawe Barrage. Black levels are representative of levels before fish pass alteration, whilst red is level post alteration. (Reproduced from Washburn, 2005)

9.5.3.18 A separate study (Russell et al., 1998), concurrent with the work from Mee et al. (1996), assessed the movement of a proportion of the same adult fish using HiRes methods (6 in 1993 and 22 in 1994). The majority of fish (73%) were found to hold station below the barrage (< 10 m) for relatively long periods of time, a significant proportion being attracted by the plume of the fish pass.

9.5.3.19 In addition to adult passage, the behaviour of smolts in proximity of the barrage was investigated during their spring seaward emigration. Fish used were trapped 2.6 km above the head of tide using fyke nets. Over the course of the study, 52 smolts were tagged (31 salmon and 21 sea trout) and released within 30 minutes of capture to resume their downstream migration. Downstream progress of smolts was monitored using a sonar buoy array, from freshwater, through the impoundment, and to the outer estuary. Movements of smolts were found to be primarily nocturnal. Through the tidal and impounded sections of the river, up to the barrage, smolts were found to migrate with speeds equivalent to an inert object (5.8 ± 1.25 hours), whilst significant delays were encountered upon reaching the barrage (mean ± S.E. = 54.8 ± 23.1 hours in 1994; and, 42.9± 22.5 hours in 1995). Smolts were found to be attracted by the filling of the

lock, and ultimately passed the barrier via a number of possible routes, including: over the weirs, via the fishpass and through the lock.

9.5.3.20 Conclusions drawn up by the study indicated that several factors could be attributed to the delays experienced by the adult salmon, including: turbulent flows within the pass, poor fish pass design, time for physiological adjustments to freshwater, switch from passive to active migration. In regards to smolts, it was concluded that the barrage prevented smolts from using tidal currents to assist their movement through the estuary, representing a partial barrier to their migration. Russell et al. (1998) concluded by saying that both results from the Mee et al. (1996) study, and their own, showed that the barrage on the Tawe physically constrain the migration of salmonids, both adult and juvenile.

9.5.3.21 In light of the results from Mee et al. (1996) and Russell et al. (1998), in 2001, modifications to the fish pass were carried out in order to address the problems associated with excessive turbulence in the pools (i.e. low rates of energy dissipation). A doctoral thesis was carried out following the modifications to quantify the fish use of the modified fish pass (Washburn, 2005). The movement of migratory fish was studied through the Tawe Barrage fish pass using an underwater video system. Results indicated that between July to October 2001 some 335 salmonid entered the impoundment through the fish pass, other species included mullet *Muglidae* spp., bass *Dicentrarchus labrax* and eel *Anguilla anguilla*. An overall passage of 0.20 fish per hour of video was found. No data were provided for the number of fish which approached the fish pass versus numbers successfully ascending, rather, emphasis was placed on the relationship between successful passage and differing environmental conditions (i.e. tide, water quality and light), thus conclusions on efficiency can only be drawn in terms of the presence of fish within the fish pass under a range of conditions.

9.5.3.22 Contrary to earlierstudies (Mee et al., 1996; Russell et al., 1998), Washburn (2005) indicated that the majority of salmonid fish entered the impoundment through the fish pass during periods of non-inundating tides, though both inundating and non-inundating tides led to successful passage. Diel movement patterns of fish indicated that there were differences in the timings of passage based upon tidal state. During July and August, 98 % of fish were found to exit the pass during daylight hours, whilst in September more fish were observed exiting the fish pass through the day. Washburn (2005) suggested that the improvements to the fish pass led to fish being able to use the pass at higher flow rates than was previously possible, with flows associated to peak passage falling between 6 and 8 m3 s-1.

9.5.3.23 In summary, evidence suggests that following the construction of the River Tawe Barrage migratory fish incurred some delay during their movements between the tidal and non-tidal reaches of the estuary. Initially, this delay was exacerbated by the unsuitability of the fish pass constructed during the initial design of the project. However, following modification to improve energy dissipation levels within the pools in 2001, the fish pass now allows fish to migrate under a wider range of environmental conditions

9.5.3.24 Water Framework Directive assessments concerning all waterbodies linked to the River Tawe, Neath and Afan have indicated that physical and morphological alteration represents the second biggest risk to achieving WFD objectives. It is therefore likely that the carrying capacity, of the R. Tawe, if not all three catchments, is restricted by

physical barriers, this is further supported by evidence provided in the River Tawe Salmon Action Plan (Environment Agency, n.d.). It is therefore recognised that river restoration or fish passage schemes would greatly benefit the catchments in the Swansea Bay area.

9.5.4 Water Framework Directive

9.5.4.1 The Water Framework Directive (2000/60/EC) is a European Instrument which seeks to improve and integrate the way water bodies are managed across Europe by 'establishing a framework for the community action in the field of water policy'. The fundamental principle of the Directive is to protect water resources and to promote sustainable water use. The Directive is transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The objectives of the directive are summarised in Table 9.13.

Table 9.13 Summary of Water Framework Directive objectives

Objectives	Reference
Member states shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water.	4.1(a)(i)
Member states shall protect, enhance, and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status by 2015.	4.1(a)(ii)
Member states shall protect and enhance all artificial and heavily modified water bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015	4.1(a)(iii)
Progressively reduce pollution from priority substances and cease or phasing out emissions, discharges and losses of priority hazardous substances.	4.1(a)(iv)

9.5.4.2 The WFD creates a mechanism through which each signatory has to aim to bring its water resources to an accepted biological and chemical standard (good ecological/chemical status for natural water bodies; and good ecological potential/good chemical status for artificial/heavily modified water bodies) by 2015; this is based on a series of parameters (quality elements) dependent on the type of water body considered (i.e. rivers; lakes; transitional waters and coastal waters) and its hydromorphological designation (i.e. natural; artificial or heavily modified). In cases where good status/potential cannot be achieved by 2015 a provision is given under Article 4.4 of the directive allowing extending the deadline to 2021 or 2027. Within England and Wales the competent authority, as of 2013, for delivering the Directive is NRW (preceded by the Environment Agency).

9.5.4.3 Water Framework Directive quality elements include biological, hydromorphological, physio-chemical parameters.

9.5.4.4 The Directive states that 'the ecological status classification for the body of water shall be represented by the lower of the values for the biological and physico-chemical monitoring results for the relevant quality element'. Results are judged against a five point scale: High; Good; Moderate; Poor; and Bad. Thus, for instance, if a water body achieved a high status for all of its biological quality elements (including fish fauna) with exception of phytoplankton, which achieved a poor, the overall ecological status will be judged as poor.

9.5.4.5 The quality element "fish fauna", within river waterbodies, is assessed against criteria drafted by the United Kingdom Technical Advisory Group on Water Framework

Directive (UKTAG) (WFD-UKTAG, 2008). A set of 23 indicator species, with differing tolerances to environmental disturbance are used to classify rivers according to the monitoring requirements of the WFD. However, within the waterbodies concerned, only populations of eel *Anguilla anguilla*, stone loach *Barbatula barbatula*, bullhead *Cottus gobio*, lamprey *Lampetra fluviatilis*, salmon *Salmo salar* and trout *Salmo trutta* are monitored. It should be noted that although sea lamprey *Petromyzon marinus* have been known sporadically enter some of the rivers in Swansea Bay, no known populations exist, thus they are not considered to contribute significantly to the WFD fish fauna quality element. Data used to quantify the fish fauna WFD quality element is taken from seasonal fish surveys undertaken in each waterbody. For salmon *Salmo salar* and trout *Salmo trutta* only juveniles contribute to WFD calculations, adults are excluded from them.

9.5.4.6 For transitional waters, the "fish" quality element is determined using the UKTAG Transitional Fish Classification Index (TFCI); a multi-metric assessment which compares the observed parameters (e.g. abundance and diversity of a fish population) of a waterbody with a reference condition for that ecotype.

9.5.4.7 Any activity which has the potential to have an impact on ecology needs consideration in terms of whether it can cause deterioration to the ecological status or potential of a waterbody. It is necessary therefore to consider the possible changes associated to these against the impacts of the Swansea Tidal Lagoon Project.

9.5.4.8 The only species, which could be affected by the Project, and contribute significantly to the WFD status of river waterbodies within Swansea Bay are diadromous fish, namely salmon *Salmo* salar, eel *Anguilla anguilla* and lamprey *Lampetra fluviatilis*. Sea trout *Salmo trutta*, although contributing, are recognised as playing a smaller role, owing to the fact that both freshwater resident and anadromous fish are counted cumulatively, and the relative population size of resident fish is significantly larger.

Project description

9.5.4.9 The Lagoon will be located within Swansea Bay (WFD waterbody ID and name: GB641008260000 Swansea Bay) which is designated as a coastal water under the Water Framework Directive and linked to waterbodies identified in Table 9.14. Swansea Bay itself is a coastal waterbody, designated as Heavily Modified, and as such its fish population is not one of the ecological quality elements used in its WFD assessment, as a result it will not be discussed further in this assessment. However, given that the Afan, Kenfig, Neath and Tawe all have migratory fish populations, are designated as freshwaters, and are connected to Swansea Bay, an assessment of the scheme on their WFD in relation to fish must be made. Additionally, impacts on the three transitional waterbodies must be quantified.

9.5.4.10 Within this section only impacts relating to the fish quality elements of the waterbodies in question are discussed, for an overall assessment please refer to WFD CHAPTER. As a result remaining quality elements have not been considered further in this assessment.

WFD baseline

9.5.4.11 Swansea Bay lies within the Western Wales River Basin Management Plan area, in the Ogmore to Tawe catchment. All coastal, estuarine and river waterbodies were identified

from the RBMP; in addition, to ensure the most up to date information was included, data relating to WFD statuses was also sourced directly from NRW.

9.5.4.12 There are a total of 50 WFD waterbodies associated with Swansea Bay: the majority of which (46) are classed as river waterbodies, with three transitional waterbodies and a single coastal water body.

9.5.4.13 The four principal rivers flowing into Swansea Bay are the Tawe, Afan, Neath and Kenfig (Figure 9.32). For the purposes of WFD classification these rivers are split further into management units, each river has several of these: Tawe=16; Afan=6; Neath=17; and, Kenfig=5. An additional two freshwater water bodies not connected to the above catchments flow within Swansea Bay, the Clyne River, and the Brynmill Stream. The three transitional water bodies are associated to the estuaries of the principal rivers, whilst the single coastal waterbody represents the whole of Swansea Bay (Table 9.14).

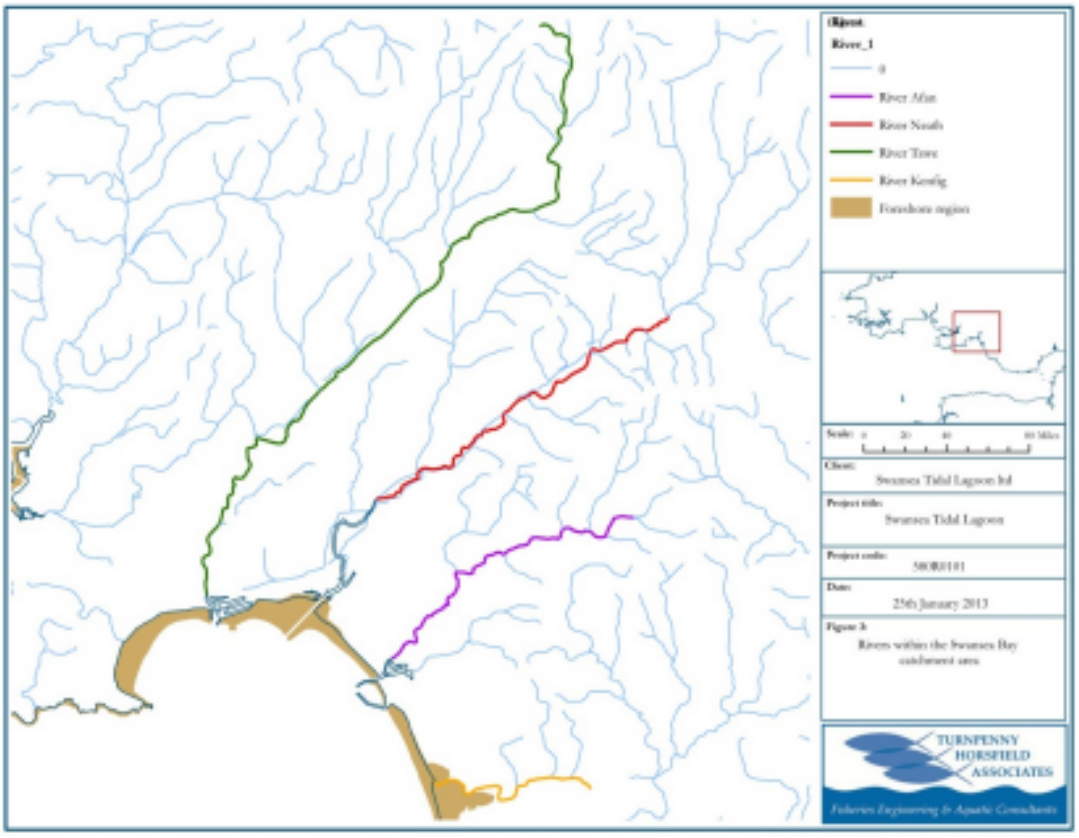


Figure 9.32 Principal river systems flowing into Swansea Bay.

9.5.4.14 Each management unit is given an overall *'class'* which represents its overall WFD status/potential. Currently, out of the 46 river waterbodies within the Swansea Bay region, 17 are judged as having good overall class; 21 as moderate; 4 as poor and 4 have not yet been assessed. All transitional waterbodies are judged as currently achieving a good overall class, whilst Swansea Bay is currently achieving an overall bad class (Table 9.14; Figure 9.33).

Table 9.14 WDF Waterbodies linked to Swansea Bay

Catchment	Waterbody ID	Current Ecological Status/Potential	Fish quality element status	Failing elements which have been assessed	Elements not assessed (2012)	Overall risk category	Risks	Ecological Objective
Rivers								
Afan	GB110058026100	Moderate	Moderate	Fish	Morphology; Hydrology	At risk	A;B	Good ecological status by 2027
	GB110058026110	Moderate	No fish data	Mitigation measures assessment	Fish; diatoms; macrophytes	At risk	C	Good ecological potential by 2027
	GB110058026120	Good	Good	None	Macrophytes; diatoms and morphology	At risk	A	Good ecological status by 2015
	GB110058026130	Good	Good	None	Morphology; hydrology	At risk	A;D;C	Good ecological status by 2027
	GB110058026140	Poor	Poor	Invertebrates; fish	Macrophytes; diatoms; morphology	At risk	A;B;D;E;F	Good ecological status by 2027
	GB110058026150	Good	Good	None	Macrophytes; diatoms; phosphate; temperature; diss. oxygen; pH; ammonia; morphology; hydrology	At risk	A;B;D;M;N;C	Good ecological status by 2027
Kenfig	GB110058026160	Good	No fish data	None	Macrophytes; diatoms; invertebrates; fish; morphology; hydrology	Probably at risk	A;G;H;C	Good ecological status by 2027
	GB110058026170	Good	Good	None	Macrophytes; diatoms; morphology; hydrology	At risk	A;B	Good ecological status by 2015
	GB110058026180	NYA	No fish data	None	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology; hydrology	Probably at risk	A;G;H;C	Good ecological status by 2015
	GB110058026190	Moderate	Moderate	Fish	Macrophytes; diatoms; invertebrates; morphology; hydrology	At risk	A;B;H	Good ecological status by 2027
	GB110058026450	Moderate	No fish data	Diatoms	Fish; morphology; hydrology	Probably at risk	H	Good ecological status by 2027
Neath	GB110058026350	NYA	No fish data	None	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology	Probably at risk	A;G	Good ecological status by 2015
	GB110058026360	Moderate	No fish data	None	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology	Probably at risk	A;G	Good ecological status by 2027
	GB110058026370	Moderate	No fish data	Mitigation measures assessment	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology	At risk	C;A;G	Good ecological potential by 2027

	GB110058026380	Poor	Poor	Fish	Macrophytes; diatoms; invertebrates; phosphate; temperature; diss. oxygen; pH; ammonia; morphology	At risk	A;B	Good ecological status by 2015
	GB110058026390	Moderate	Moderate	Fish	Macrophytes; diatoms; morphology	At risk	A;B;K	Good ecological status by 2027
	GB110058032320	Good	Good	None	Macrophytes; diatoms; morphology; hydrology	At risk	O;J;A;B;K;M;P;C	Good ecological status by 2027
	GB110058032330	NYA	No fish data	None	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology; hydrology	Probably not at risk		Good ecological status by 2015
	GB110058032340	Good	No fish data	None	Macrophytes; diatoms; fish; morphology	Probably not at risk		Good ecological status by 2015
	GB110058032350	Good	No fish data	None	Macrophytes; diatoms; invertebrates; fish; morphology; hydrology	Probably not at risk		Good ecological status by 2015
	GB110058032360	Poor	Poor	Fish	Macrophytes; diatoms; morphology; hydrology	At risk	O;L;M;N;P;E;F;A;B	Good ecological status by 2027
	GB110058032370	Moderate	Moderate	Fish	Macrophytes; diatoms; invertebrates; morphology	At risk	A;I	Good ecological status by 2015
	GB110058032380	Moderate	Good	Annex 8 (pollutants)	Macrophytes; diatoms; morphology; hydrology	Probably at risk	A;Q;I	Good ecological status by 2015
	GB110058032390	Moderate	Moderate	Fish; Annex 8 (pollutants)	Macrophytes; diatoms; morphology	Probably not at risk		Good ecological status by 2027
	GB110058032400	Good	Good	None	Macrophytes; diatoms; invertebrates; morphology	At risk	A;I	Good ecological status by 2027
	GB110058032410	Moderate	Moderate	Fish	Macrophytes; diatoms; invertebrates; morphology	Probably not at risk		Good ecological status by 2015
	GB110058032420	Good	Good	None	Macrophytes; diatoms; invertebrates; morphology; hydrology	At risk	A;I;C	Good ecological status by 2015
	GB110058032430	Moderate	Good	Diatoms; Annex 10 (pollutants)	Morphology; hydrology	At risk	A;B;D;C;O;J	Good ecological status by 2015
Tawe	GB110059025690	Moderate	No fish data	Mitigation measures	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology	At risk	C;A;G;K	Good ecological potential by 2027
	GB110059025700	Moderate	No fish data	None	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology; hydrology	Probably at risk	A;G	Good ecological status by 2027
	GB110059025710	Moderate	Good	Diss. Oxygen; Annex	Morphology	At risk	C;A;K	Good ecological

				10 (pollutants); Mitigation measures				potential by 2027
	GB110059032170	Good	High	None	Macrophytes; diatoms; morphology; hydrology	At risk	O;L	Good ecological status by 2027
	GB110059032180	Moderate	High	Diatoms	Morphology	At risk	O;L	Good ecological status by 2015
	GB110059032190	Good	High	None	Diatoms; morphology	Probably at risk	A;I;D	Good ecological status by 2015
	GB110059032200	Moderate	High	Invertebrates	Macrophytes; diatoms; morphology	Probably at risk	A;B	Good ecological status by 2015
	GB110059032210	Moderate	No fish data	Invertebrates; Annex 8 (pollutants); Mitigation measures	Diatoms; fish; morphology	At risk	C;A;D	Good ecological potential by 2015
	GB110059032220	Moderate	Good	Mitigation measures	Macrophytes; diatoms; invertebrates; morphology	At risk	C;A;D	Good ecological potential by 2027
	GB110059032240	Good	Good	None	Diatoms; phosphate; temperature; diss. oxygen; ph; ammonia; morphology; hydrology	Probably not at risk		Good ecological status by 2015
	GB110059032250	Good	Good	None	Macrophytes; diatoms; invertebrates; phosphate; temperature; diss. oxygen; ph; ammonia; morphology	At risk	A;D	Good ecological status by 2015
	GB110059032260	Good	Good	None	Macrophytes; morphology	At risk	A;D;E;F;C	Good ecological status by 2027
	GB110059032270	Good	No fish data	None	Macrophytes; diatoms; fish; morphology	Probably at risk	M;N	Good ecological status by 2015
	GB110059032280	Moderate	Good	None	Macrophytes; diatoms; morphology	At risk	O;J;A;D;E;F	Good ecological status by 2027
	GB110059032290	NYA	No fish data	None	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology			Good ecological status by 2015
	GB110059032300	Good	Good	None	Diatoms; invertebrates; morphology; hydrology	Probably at risk	A;I	Good ecological status by 2015
Brynmill Stream	GB110059025600	Moderate	No fish data	Mitigation measures	Macrophytes; diatoms; invertebrates; fish; phosphate; temperature; diss. oxygen; pH; ammonia; morphology	No data	No data	Good ecological potential by 2027
Clyne River	GB110059025620	Poor	Poor	Fish; ammonia	Diatoms	No data	No data	Good ecological status by 2027

Transitional waters								
Tawe	GB541005900900	Good	No fish data	None	Phytoplankton; macrophytes; invertebrates; temperature; diss. oxygen; salinity; nutrient status; other pollutants; priority substances	No data	No data	Good ecological potential by 2015
Neath	GB541005800700	Good	No fish data	None	Phytoplankton; macrophytes; invertebrates; temperature; salinity; nutrient status; other pollutants	No data	No data	Good ecological potential by 2015
Afan	GB541005800600	Good	No fish data	None	Phytoplankton; macrophytes; invertebrates; temperature; diss. oxygen; salinity; nutrient status; other pollutants; priority substances	No data	No data	Good ecological potential by 2015
Coastal waters								
Swansea Bay		Bad	n/a	Phytoplankton; Dissolved inorganic nitrogen; Mitigation measures.	Macrophytes; Invertebrates; morphology; temperature; nutrient status	No data	No data	Good ecological potential by 2027

Risks: A= Diffuse source pollution; B=Mines and minewaters; C=Physical or morphological alteration; D=Acidification; E=Combined source nutrients; F=Phosphate; G=Phosphorous from agriculture; H=Water abstraction and flow regulation; I=Sheep dip; J=Dangerous substances; K=Urbanisation; L=Metals; M=Combined source sanitary; N=Ammonia; O=Point source pollution; P=Biological oxygen demand; Q=Pesticides. N

*Note: risks are presented in two colours red for actively at risk from; and blue for probably at risk from. Data for transitional, coastal waters, the Clyne river and the Brynmill Stream was not part of the 2012 dataset used for rivers but was extracted from the Environment Agency River Basin Management Plan (2009).

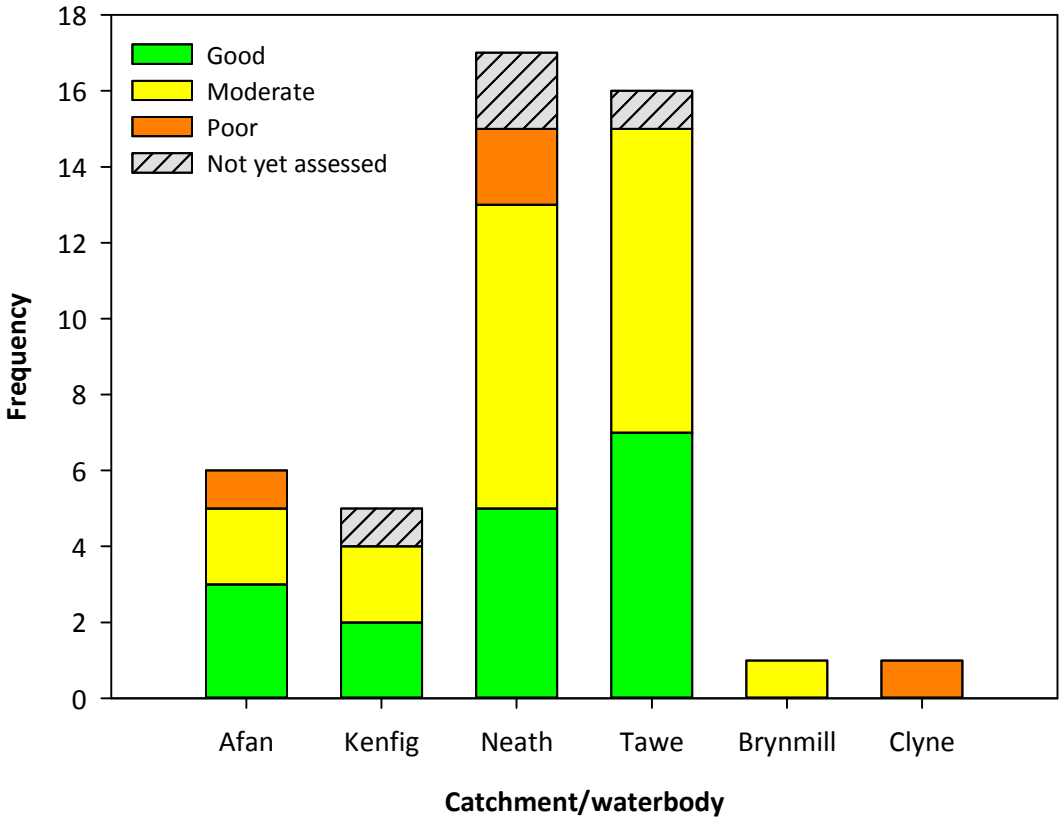


Figure 9.33 Overall status/potential for rivers flowing into Swansea Bay. Please note that the Tawe, Neath and Afan transitional waterbodies have been excluded from the above graph.

9.5.4.15 Each river unit is also given a fish quality element status, these are summarised in Figure 9.34. As can be seen, the fish population of several waterbodies has not been quantified in terms of fish population. This is most likely owing to the fact that monitoring for WFD purposed is risk based, and some sites are prioritised over others. In certain cases, where site specific surveys are lacking, a precautionary value of '*moderate'* is given to the fish quality element of a waterbody. Additionally, over time, waterbodies may have been consolidated or split for management purposes.

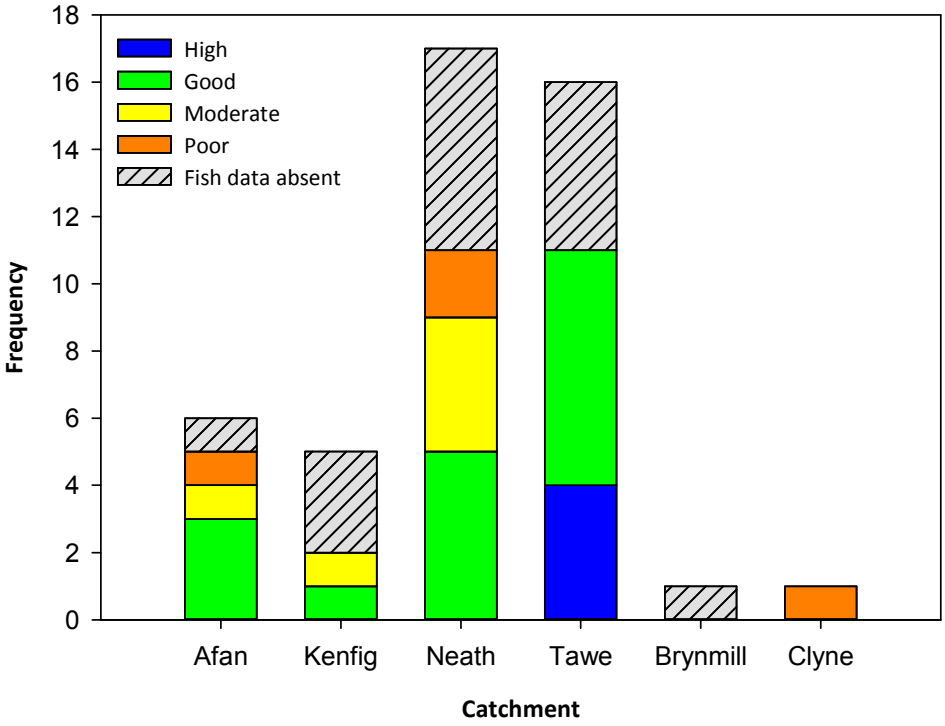


Figure 9.34 Overall status for fish ecological quality element for rivers flowing into Swansea Bay

Pressures on WFD fishery quality element

9.5.4.16 As well as providing statuses for all quality elements, WFD management plans provide evidence regarding the potential risks associated to waterbodies (Table 9.14). Figure 9.35 summarises the potential risks that have been identified for waterbodies flowing within Swansea Bay. As is evident, the biggest risk to waterbodies within the Swansea Bay region is diffuse source pollution, most likely from farming effluent (Environment Agency, n.d.). Physical/morphological alteration to rivers also poses a significant risk to waterbodies, this includes barriers such as weirs. The Tawe Salmon action plan estimates that of the 95.9km of river length within the catchment only 46km (47%) are accessible to migratory fish, though it must be noted that the report was produced in 2001 and no data is available as to the current availability of habitat.

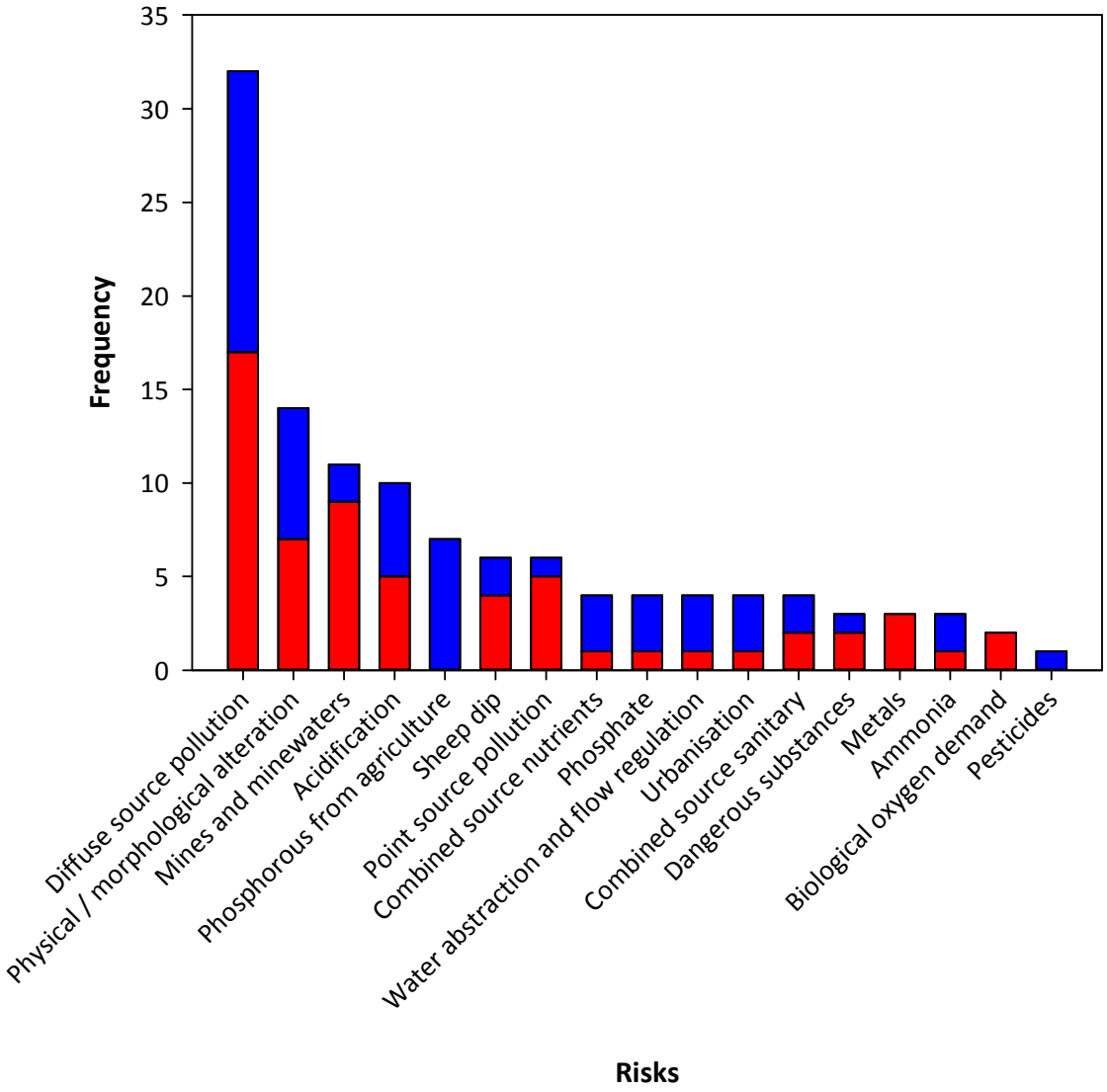


Figure 9.35 Risks to waterbodies linked to Swansea Bay. Blue shading indicates potential risk, whilst red indicates actively at risk.

9.5.4.17 Fishing pressure on anadromous fish can also contribute to stress the WFD fish fauna quality element by removing spawning stock from waterbodies. Typically, recreational angling of salmon and sea trout targets "fresh run" fish which have yet to spawn, ulitmately contributing to decreasing the number of juveniles which have the potential to be caught during seasonal surveys. Eel and lamprey are not typically directly targeted.

9.5.4.18 Environment Agency data, based on declared catches, provides a record of fish which have been taken from the waterbodies in question. Figure 9.36 summarises the % of salmon lost as a result of recreational angling for the period between 2002 and 2011 in the R. Afan, Neath and Tawe. The greatest losses have occured on the Tawe (range=54.3 % - 86.88 %), followed by the Neath (range= 39.62 % – 77.92 %) and Afan (range= 0 - 80%).

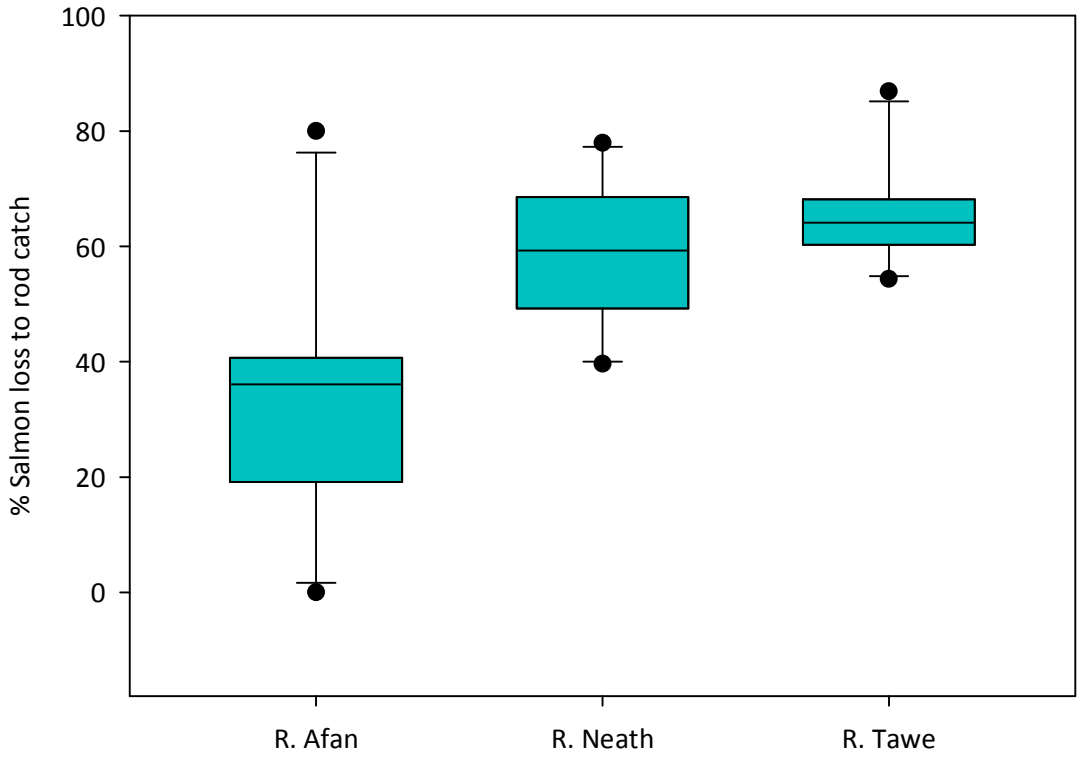


Figure 9.36 Salmon losses to recreational fishing between 2002 and 2011.

9.5.4.19 The inter-yearly variation in the number of fish kept is significant (Table 9.15), as is the number of fish caught. The numbers presented are not representative of the total population of the rivers in question, and care must be taken to interpret the data, as the relationship between catch and stock size is complex.

Table 9.15 Reported catches between 2002 and 2011 on the R. Afan, Neath and Tawe.

Year	River					
	Afan		Neath		Tawe	
	Reported	Returned	Reported	Returned	Reported	Returned
2002	7	4	90	44	148	56
2003	5	4	35	15	61	8
2004	10	6	73	21	155	50
2005	6	5	37	14	164	50
2006	5	3	85	48	184	72
2007	3	3	53	32	183	74
2008	9	6	99	32	195	63
2009	15	10	62	26	114	45
2010	18	11	76	30	230	105
2011	10	2	77	17	109	37

9.5.5 Migratory Fish Characterisation

9.5.5.1 Swansea Bay is used by diadromous fish species moving between the sea and rivers to spawn. Anadromous fish move from the sea to rivers to spawn, while catadromous fish move from rivers to the sea to spawn. Migration for these fish is crucial to their life history; disruption to these movement patterns can severely affect their ability to reproduce. Table 9.16 gives an overview of fish migratory behaviour.

9.5.5.2 European Sturgeon (*Acipenser sturio*) have not been included in the list of identified migratory fish due to their rarity, however some evidence relating to their presence has been given in section 9.5.6.18.

Table 9.16 Summary of spawning (= downstream and = upstream) and main migratory periods (dark blue) for migratory species relevant to Swansea Bay. The table represents a generalised view of spawning and migration, which can vary regionally. For salmonids downstream movement is undertaken by smolt and kelt, whilst upstream movement is undertake by returning adults.

Common Name	Scientific Name	J	F	M	A	M	J	J	A	S	O	N	D
Atlantic salmon	*Salmo salar*												
Sea trout	*Salmo trutta*												
European eel	*Anguilla anguilla*												
River lamprey	*Lampetra fluviatilis*												
Sea lamprey	*Petromyzon marinus*												
Twaite shad	*Alosa fallax*												

Conservation Status of Migratory Fish

9.5.5.3 All of the above species are protected and/or have been identified as threatened within UK and/or EU wildlife legislation. With the exception of sea trout, all of the species are listed under Annex II of the European Habitat and Species Directive (92/43/EEC). Additionally, Atlantic salmon and river lamprey are listed in Annex V, giving protection from over-exploitation. A summary of relevant conservation legislation for each species is listed in (Table 9.17). Legislation was covered in greater detail in Section 9.1.

Table 9.17 Summary of protection legislation for migratory fish relevant to the Swansea Bay Tidal Lagoon project (JNCC, 2012)**.**

Common name	Scientific name	UK BAP	Bern Conv.	Habitats Directive Annex II	OSPAR Conv.	IUCN	W&C Act	The Eels Regulations 2009
Allis shad	*Alosa alosa*			√				
Atlantic salmon	*Salmo salar*	√	√	√	√			
Sea trout	*Salmo trutta*	√						
European eel	*Anguilla anguilla*	√			√	√		√
River lamprey	*Lampetra fluviatilis*	√	√	√				
Sea lamprey	*Petromyzon marinus*	√	√	√	√			
Twaite shad	*Alosa fallax*	√	√	√	√		√	

9.5.6 Presence of Migratory Fish Species, Spawning and Nursery Areas

Atlantic salmon and sea trout

9.5.6.1 Salmon typically spend the first two to four years of life in freshwater, and migrate out of these as smolt. Smolt leave natal rivers and migrate to the sea to mature for up to four years, before returning to spawn in their natal rivers as adults. As a result, it is crucial that the passage between freshwater and seawater is not disrupted. Adult salmon that survive the spawning process return to the sea to build their body mass up in preparation to spawn again; female adult salmon that survive the spawning process are called kelt. Typically the movement of kelt within Swansea Bay occurs between December and March.

9.5.6.2 Sea trout share much of the life history traits of salmon, migrating up estuaries to shallow gravelly habitats to spawn in winter. They differ from salmon in that: they have a greater tendency to survive and undertake repeated spawning; and, their marine phase is much more coastal than Salmon, which undertake more extensive marine migrations.

9.5.6.3 Evidence indicates that there are good salmon and sea trout fisheries within the rivers proximate to Swansea Bay (Environment Agency & CCW, 2009). With the exception of the River Kenfig, salmon spawning occurs regularly within all catchments, whilst trout spawning occurs in most tributaries of the three catchments.

9.5.6.4 The River Tawe has the greatest numbers of salmon in the area, steadily increasing since 1976 (Environment Agency, 2002). In 2002, habitat available to spawning salmonids represented ca. 47% of the total catchment length. Restricted access to habitat is primarily a result of barriers (both anthropogenic and natural) blocking access to reaches. There is on-going work to improve access to spawning areas. For example, in 2011 a weir on the Upper Clydach River, a tributary of the Tawe, was removed to improve fish passage (Cefas & Environment Agency, 2012).

9.5.6.5 The River Neath has important salmon spawning grounds in its upper reaches, though most of the tributaries are used by non-migratory trout, as migration is obstructed.

9.5.6.6 Salmon and sea trout spawn in the River Afan and the majority of its tributaries, though evidence indicates connectivity issues, primarily as a result of over-abstraction and barriers.

9.5.6.7 Rod catches are known to be poor indicators of migratory fish numbers, due to their non-quantitative nature. Anecdotal accounts from the Environment Agency indicate that numbers of migratory fish over the last ten years have been decreasing (Evans, H., pers. comm., 15th February 2013). Inter-annual variation in salmon and trout numbers according to rod catch data is evident, however broad scale estimates of fish numbers seem to indicate fairly stable populations. It should be noted that populations across the UK are in decline.

European eel

9.5.6.8 Eel occur in all catchments flowing into the embayment, they metaporphose into ‘glass ells; and subsequently develop into more pigmented ‘elvers’ as they reach coastal areas from their spawning grounds in the Sargasso Sea. They migrate into rivers during spring and early summer as elvers, and remain there for several years. They spend most of their adult life in freshwater, before migrating out of estuaries, and back to the sea to spawn.

For males, the average duration of the freshwater stay is 6 years, whilst it is 8.7 years for females (Tesch, 2003). Eel numbers have declined dramatically across Europe in the last 22 years. Since 2006, eel recruitment has reduced by around 90% when compared to pre-1980 levels (Bark et al., 2007).

9.5.6.9 Availability of spawning habitat is not an issue in the case of eel, as reproduction occurs in the western-central Atlantic Ocean. It is, however, crucial that both connectivity during their migratory phase and habitat during their freshwater stay are good to ensure sufficient numbers of eel return to spawn.

9.5.6.10 Artificial barriers are prevalent on rivers in the Swansea Bay area, due to its industrial past (Defra, 2010). Measures to mitigate barriers, such as the construction of fish passes and river restoration will need to continue to further ensure the survival of this species.

River lamprey and sea lamprey

9.5.6.11 Lamprey spend their adult lives in the sea and return to rivers to spawn, typically river lamprey show fidelity to the estuaries of their natal rivers or coastal waters in their vicinity, whilst sea lamprey are known to undertake significant oceanic movements. There is no evidence to indicate the extent of lamprey spawning in any of the rivers flowing into Swansea Bay, though evidence exists for other tributaries flowing into the Bristol Channel, with significant populations present on the Rivers Wye and Usk (Bird, 2008). The Severn Estuary as a whole is also considered to support the greatest number of sea and river lampreys of any northern European river.

9.5.6.12 Spawning of river lamprey is observed by the Environment Agency on an annual basis on most rivers entering Swansea Bay (Evans, H., pers. comm., 15th February 2013). Sea lamprey have also been seen spawning in low numbers at the mouth of the River Neath (2 pairs in 2011).

9.5.6.13 Sporadic catches of lamprey have been reported on the Rivers Kenfig, Neath and Tawe in Environment Agency electric fishing data. Additional anecdotal evidence from recreational fishermen has shown presence of lamprey in the River Neath.

Allis and Twaite shad

9.5.6.14 Allis and Twaite shad enter estuaries in spring and move up into rivers where they spawn nocturnally. Nocturnal spawning occurs over gravel and stony beds from April to June and young of year (YOY) colonise the estuary from July, before returning to the sea by the end of the summer.

9.5.6.15 Only four rivers within the Severn catchment are known to support breeding populations of twaite shad: the Severn, the Wye, the Usk and the Tywi. Only two rivers are thought to hold breeding populations of allis shad: the River Usk and the Wye (Hillman et al., 2003).

9.5.6.16 Twaite shad are caught as by-catch within the Bay during spring (Bulley, D., pers. comm., 15th January 2013; Evans, H., pers. comm., 15th February 2013). They have also been captured by the Environment Agency at the mouth of the River Neath.

9.5.6.17 Anadromous fish populations, such as shad, are known to stray into areas other than their natal rivers, thereby providing a mechanism for colonisation of new catchments and gene flow between populations. It is possible that twaite shad could be moving into Swansea Bay from the nearby Tywi SAC, where breeding populations exist.

Sturgeon

9.5.6.18 Records from the United Kingdom Fish Recording Scheme indicate that a single sturgeon was reported due south of Swansea between 1970 and 2004. A second sturgeon was captured in 2004 (BBC, 2004). There may be scope for recolonisation of the River Severn, given improvement in water quality and connectivity.

9.5.6.19 Sturgeon have become very rare, though they can move into the Severn Estuary on occasion. It is highly unlikely that sturgeon would spend prolonged periods in Swansea Bay.

9.5.7 Commercial Fisheries

9.5.7.1 Eel are the only commercially fished migratory species in the Swansea Bay area. As of 2012, a single licensed commercial fisherman was present within Swansea Bay, primarily fishing for glass eel on the River Neath (Evans, H., pers. comm., 15th February 2013).

9.5.7.2 Due to local bylaws stopping the use of nets during migratory seasons, salmonids are not commercially targeted.

9.5.8 Illegal fishery

9.5.8.1 Illegal fishing for migratory fish, such as salmon and sea trout, is known to occur within the Bay and its rivers, though it is considered fairly rare. Typical methods involve setting static nets across river sections (Figure 9.37).

9.5.8.2 Eight to ten years ago, an average of 10 nets a year were seized by Environment Agency enforcement officers, whilst in 2012 only two nets were seized (Evans, H., pers. comm., 15th February 2013). The decrease in illegal fishing is thought to be as a direct consequence of the local bylaws introduced to stop harvesting of migratory fish species, primarily sea trout and salmon. It is likely that any net currently being set illegally within Swansea Bay is targeted at bass rather than migratory species (Evans, H., pers. comm., 15th February 2013).

Figure 9.37 Illegal net seized on the River Afan (Cefas & Environment Agency, 2012).

9.5.9 Recreational Fishing

9.5.9.1 The Swansea Bay area and the Rivers Afan, Kenfig, Neath and Tawe are popular with recreational anglers. Rod catch data made available by the Environment Agency were discussed for the Afan catchment, the Kenfig, the Neath and for the Tawe in Section 9.5.3. Data specifically on salmon and trout catches were also covered in that section.

9.5.9.2 Recreational angling will be explored in section 9.7. Angling stakeholders were consulted for their use of the Bay area and for their opinions on how the scheme might have an impact on said use. A list of consultees can be found in Appendix A.

9.6 Commercial Fishing Activity

9.6.1 Data Acquisition, Information and Sensitivities

9.6.1.1 Historical fisheries data for commercial fisheries were requested for ICES statistical rectangles encompassing the near-field and far-field areas (32E5, 32E6 and 31E6). Five-year historical data were requested.

9.6.1.2 Commercial fishing is described as any form of fishing activity legally undertaken for taxable profit. Data requested included characteristics such as species targeted, gear used and statistical area in which the catch was caught.

9.6.1.3 This assessment is based on a characterisation study into the existing commercial and recreational fisheries within and in proximity of the PDS, comprising two main elements: (a) review of official data on catches and landings from the identified ICES statistical rectangles and (b) extensive consultation with fishing industry representatives from the South Wales region.

9.6.2 International Council for the Exploration of the Sea (ICES) Statistical Rectangles

9.6.2.1 International Council for the Exploration of the Sea (ICES) statistical rectangles are currently the smallest spatial unit used by the European Community (EC) and its Member States to assess fishing activity in European waters.

9.6.2.2 In towed gear fisheries, such as trawling, catches are typically recorded within the rectangle in which the gear is hauled. Given that hauls are typically greater than 10 nautical miles in length, they may in some cases cross rectangle boundaries.

9.6.2.3 The proposed Swansea Bay Tidal Lagoon (~12 km^2) will be situated wholly within ICES rectangle 32E6 (Figure 9.38), which occupies an area of 3,842km^2.

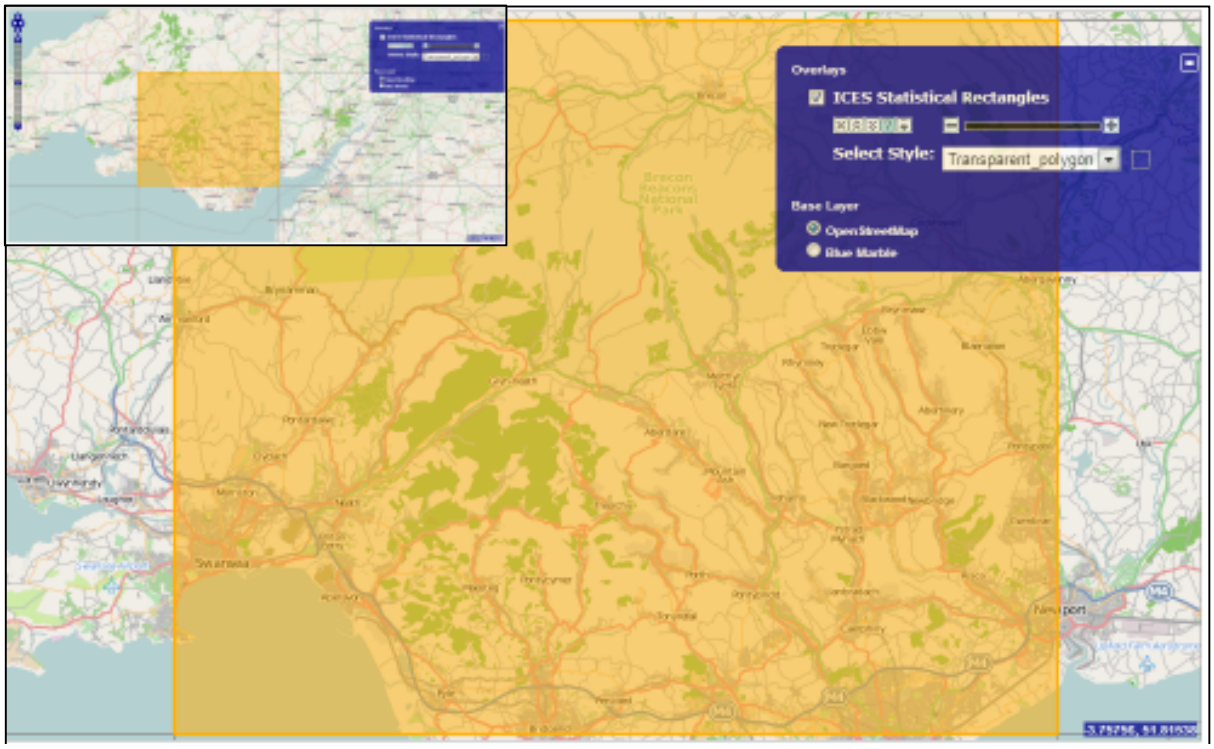


Figure 9.38 Extent of ICES statistical rectangle 32E6 (and its position in South Wales, inset), within which the proposed Swansea Bay Tidal Lagoon falls (ICES, 2012).

9.6.3 Marine Management Organisation (MMO) Landings Data

9.6.3.1 The MMO is the government body that holds all landings data for ICES statistical rectangles. The data include all landings by UK vessels from the statistical areas identified, as well as landings by foreign vessels into UK ports.

9.6.3.2 The primary source of data which serves to populate the landings statistics is the European Commission (EC) daily log sheets. Vessels of 10 or more metres are required to complete and submit these daily, whilst vessels smaller than 10 metres do so on a voluntary basis, at their discretion. As a result, data for 10+ metre-vessels aim to achieve full coverage of all fishing activity by that sector of the fleet.

9.6.3.3 There is some scope for illegal and unreported fishing to occur and not be identified within the MMO dataset.

9.6.4 Overview of Fisheries in the Swansea Bay Area

9.6.4.1 In 1995, Swansea supported a fleet of 37 fishing vessels, the majority of which fished using static gear (Gray, 1994). Official data from the MMO indicates that in 2012 a total of 29 fishing vessels from Swansea fished within rectangles 32E5; 32E6 and 31E6. The fleet is constantly changing but this serves as a guideline to fishing effort within the area.

9.6.4.2 Currently it is estimated that around 20 boats fish the area between Port Talbot and Mumbles Head (far-field zone of impact), with some fishing occurring further east, towards Oxwich Bay (Bulley, D., pers. comm., 15th January 2013). Typically, vessels remain inshore and are located in Swansea Marina.

9.6.4.3 The majority of fishing involves the use of static gear and is primarily aimed at benthic invertebrates, such as whelks. The pelagic fishery within the Bristol Channel is recognised as being of relatively low value compared to other areas around the UK (Cefas, n.d.), with the exception of a herring fishery in Milford Haven. Gray (1994) indicates that an established scallop fishery existed in the vicinity of Mumbles Head in the mid-1990s, though no present-day evidence has been found to support this. Lobster fishing occurs west of Mumbles Head, where the foreshore is rockier, though densities are considered low.

9.6.4.4 Significant unlicensed, commercial, rod-and-line fishing for bass is thought to occur within the area (Lancaster, J., pers. comm., 15th January 2013). Static gear comprises the greater portion of the fishery within the Swansea Bay area.

Fishing Ports in the Area

9.6.4.5 The key fishing ports within the area are Burry Port and Swansea. Domestic and foreign trawlers use Swansea as one of the primary landings ports within the region. Table 9.18 gives a breakdown of ports from which vessels fishing within the ICES rectangles of interest departed.

Table 9.18 Top five departure ports for vessels fishing in ICES rectangles 32E5, 32E6 and 31E6 (MMO, 2012)

Vessel Count	Departure Port
7	Tenby
8	Fishguard
18	Milford Haven
18	Saundersfoot
29	Swansea
57	Burry Port

9.6.4.6 Official landing statistics indicated that a total of five foreign vessels fished within the identified ICES rectangles. Thus, effort from non-UK vessels is relatively low.

Inshore and Offshore Fleet

9.6.4.7 In total, it is thought that around 20 boats regularly fish within the area, comprising both the far-field and near-field zones of impact, with all but two of the boats being less than 10 metres in size (Bulley, D., pers. comm., 15th January 2013). Two boats are known to regularly pot for whelks within the footprint of the PDS, whilst the majority of the fleet

stays outside the confines of the Bay, except in large tides. There are also a small number of small vessels operating static gill nets which fish both within the Bay and further along the coast.

9.6.4.8 A marine traffic survey conducted between 14th and 28 August 2013 indicated that during the survey period, the Project site and the area within 5nm of the Project boundary was being used primarily by vessels steaming to fishing grounds, and not targeted itself. Some fishing activity was witnessed South-West of Port Talbot.

Potting

9.6.4.9 The Swansea Bay area has a significant potting fishery (Bulley, D., pers. comm., 15th January 2013). The five main shellfish species targeted are whelks, cockles, spider crab, edible crab and lobster. Due to their preference for different substrates, these species are typically the targets of selective fisheries.

9.6.4.10 **The greater majority of potting for whelks occurs within the far-field zone of impact, whilst the majority of potting for lobsters occurs west, where the coastline is rockier. A small number of boats fish regularly within the Bay for whelk.**

9.6.4.11 Static gill netting is the primary netting method within the Swansea Bay area, although some drift netting is known to occur. Nets are typically left for several hours, and do not require the heavy towing or hauling equipment needed for trawl nets.

9.6.4.12 Gill netting is not a very selective method of fishing; the primary target species for gill nets in the Swansea Bay region are mullet and bass. By-catch of shad and salmon is regularly recorded by fishermen in the area (Bulley, D., pers. comm., 15th January 2013). Owing to local bylaws enacted to protect migratory fish populations, gill netting within the intertidal areas of the Bay is restricted to periods between November and March.

Trawling

9.6.4.13 The majority of trawling within the area of interest is targeted at demersal or epibenthic fish species, such as sole, plaice, flounder, turbot, cod and skate. Though not strictly targeted, considerable numbers of smooth-hound and dogfish are also caught. Trawlers typically operate outside the bounds of the Bay. However, under certain conditions (highest tides), some vessels are known to fish within the near-field zone of impact.

Hook and Line Fishing

9.6.4.14 Hook and line fishing makes up a small proportion of the commercial fisheries catch in the Swansea Bay area (less than 1%). The primary target species for the fishery are bass, mackerel and mullet.

Shellfish Harvesting and Potential Fisheries

9.6.4.15 Historically, large amounts of cockles were gathered within Swansea Bay (ca. 500 tonnes in 2002). However, due to a declassification of the beds, there has been no recent commercial interest in the species (Arnold, B., pers. comm., 17th September 2012).

9.6.4.16 There is some interest in re-establishing an oyster fishery in the Swansea Bay area. This is primarily being driven by the Fisheries Local Action Group, which recently secured European funding for the scheme. Additionally, The Mumbles Oyster Company received permission in September 2013 from the Welsh Government for a plan to place 10,000

young oysters on a 70 acre historic bed off Oystermouth within Swansea Bay. The initial part of the project will see if juvenile Oysters (transported from Stranraer in Scotland) can survive in Swansea Bay, with the hope that the oysters placed on the seabed will then breed (BBC, 2013). No commercial fishing is currently being undertaken for the species.

9.6.4.17 Herring are known to spawn within the Bay in numbers, though they are currently not commercially exploited. Their relatively low value and low abundance are probably insufficient for establishing a viable fishery. The population found to spawn within the Bay is negligible when compared to larger exploited stocks found on the north-east coast of the UK.

9.6.4.18 Since 2010, a significant number of spider crabs and velvet swimming crabs have been caught within the Swansea Bay area; these have primarily been exported to Europe. There is scope for an increase in size for the fishery.

9.6.5 Fishing Activity in the Swansea Bay Area, as Derived from MMO Landing Values and Effort Data (2006-2012)

9.6.5.1 Fisheries data were sourced from the MMO, covering the PDS and surrounding areas. The data comprise seven years of official landing statistics (2006-2012), subdivided into the following variables:

a. number of vessels;
b. year;
c. rectangle;
d. nationality;
e. gear;
f. species;
g. total weight (t); and
h. value (£).

Study Area

9.6.5.2 The study area, with respect to commercial fisheries, is defined as within and around the Proposed Development Site (PDS) to include the maritime areas of the International Council for the Exploration of the Sea (ICES) statistical rectangles 32E5, 32E6 and 31E6[2].

9.6.5.3 Both 32E5 and 32E6 are within the coastal region of south Wales. They are primarily made up of land (> 50%). As a result, fish catches are proportionately small when compared to the rest of ICES region VIIf, in which they are situated.

9.6.5.4 Figure 9.39, below, shows the extent of the area analysed in relation to commercial fisheries.

[2] For a full explanation of ICES spatial datasets, see geo.ices.dk.

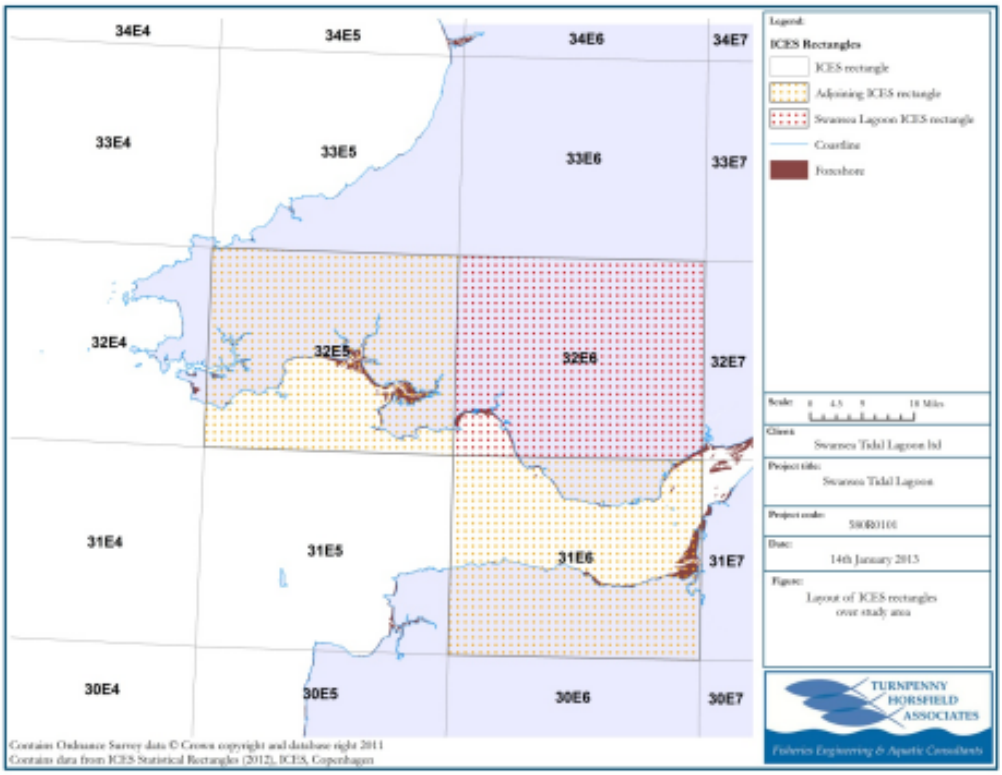


Figure 9.39 ICES statistical rectangles, used to inform commercial landings analysis.

9.6.6 Value of Fishery

9.6.6.1 Table 9.19 shows the relative value of fish landed into UK ports or by UK vessels from the Swansea Bay fishery areas, from 2006 to 2012, inclusive. Across all years, and within all statistical rectangles, the total value of the landed catch was £12,210,513.

Table 9.19 Seven-year and average values, according to statistical rectangle (MMO, 2013).

Statistical Rectangle	7-Year Value (£)	%	Average Value (£)
32E5	10,518,141	86	1,502,592
32E6	53,286	< 1	7,612
31E6	1,639,086	13	234,155

9.6.6.2 From the data, it can be seen that, in terms of commercial catch, rectangle 32E6 is of low importance in the overall Swansea Bay area, making up <1 % of landings and producing a catch value of £7,612 (2006-2012). Conversely, 32E5 is fairly important amongst the three rectangles. This is most likely due to its larger surface area and the greater number of vessels which fish it.

9.6.6.3 The annual effort (days at sea, or DAS) for the three ICES rectangles in which the PDS is located is shown in Table 9.20.

Table 9.20 Annual effort (DAS) for the ICES rectangles relevant to the PDS.

Year	Rectangle	Days At Sea (DAS)
2006	32E5	4,207
	32E6	*
	31E6	595
2007	32E5	7,775
	32E6	*
	31E6	2,754
2008	32E5	4,507
	32E6	*
	31E6	590
2009	32E5	1,519
	32E6	*
	31E6	519
2010	32E5	1,248
	32E6	11
	31E6	607
2011	32E5	1,686
	32E6	33
	31E6	555
2012	32E5	2,211
	32E6	*
	31E6	495

(An aggregated value of 830 DAS was given to these years as <5 vessels fished in the area over the given year (MMO, 2013))

9.6.6.4 Data indicate the most fished rectangle to be 32E5 (3,307 DAS on average), followed by 31E6 (872 DAS on average) and 32E6 (125 DAS on average). The average effort (2006-2012) across all pertinent statistical rectangles is 1,434 DAS.

9.6.6.5 Data were split according to fishing gear. This indicated that, throughout the study period, 51% of the catch was caught by trap (e.g. crab pots); 10% by gill nets and entangling nets; 7% by trawl; <5% by hook and line; and 26% remained undefined.

9.6.6.6 The principle target species (or species groups) for the Swansea Bay area, in terms of landing value, are shown below, in Table 9.21. These species accounted for >96% of total landings from the area. The remainder, each at less than 1% of landings, included: cod, prawn, turbot, mackerel, gurnard, dogfish, brill, lemon sole, flounder, monkfish, black sea bream, dab, smooth-hound, conger eel, cuttlefish, whiting, pollack, John Dory, tope and red mullet.

Table 9.21 Top ten species landed, by value, from the Swansea Bay area (all three statistical rectangles), 2006 to 2012 (MMO, 2013).

Common Name	Scientific Name	7-Year Value (£)	%	Average
Whelk	*Buccinum undatum*	3,671,757	30	524,537
Cockles	*Cerastoderma edule*	2,142,387	18	306,055
Lobster	*Homarus gammarus*	1,891,868	15	270,267
Bass	*Dicentrarchus labrax*	1,657,173	14	236,739
Mussels	*Mytilus edulis*	482,048	4	68,864
Sole	*Solea solea*	466,341	4	66,620
Spider crab	*Maja* spp.	436,151	4	62,307

Common Name	Scientific Name	7-Year Value (£)	%	Average
Edible crab	*Cancer pagurus*	360,635	3	51,519
Skates and rays (not-identified)	*Raja* spp.	248,835	2	35,548
Thornback ray	*Raja clavata*	213,325	2	30,475

9.6.6.7 Annual landings of fish and shellfish (2006-2012) for the Swansea Bay area are shown in Table 9.22, and graphically represented in Figure 9.40.

Table 9.22 Value of fish and shellfish landed from the Swansea Bay area, 2006 to 2012.

Statistical Rectangle	2006	2007	2008	2009	2010	2011	2012
32E5	£1,347,755	£1,780,060	£1,727,678	£1,832,731	£906,478	£1,155,896	£1,767,543
32E6	£8,968	£5,662	£17,329	£4,652	£1,364	£9,608	£5,703
31E6	£126,158	£251,047	£191,133	£213,396	£253,281	£294,594	£309,476

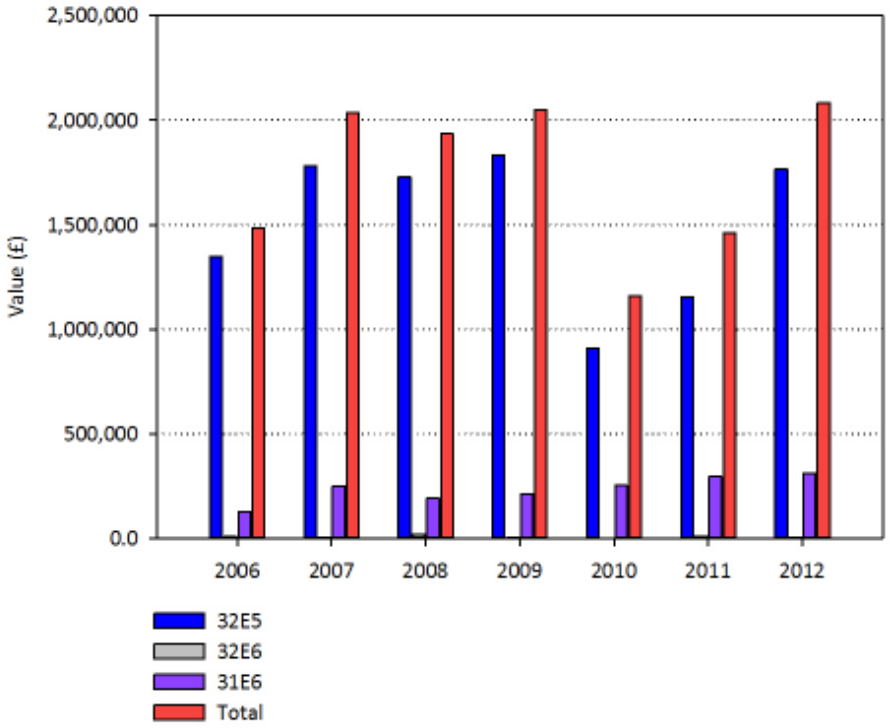


Figure 9.40 Annual landings value from 2006 to 2012 in the Swansea Bay area for each ICES statistical rectangle and for the total area (MMO, 2013).

9.6.6.8 Catch value is relatively stable over the study period. Very little is recognised as being caught from the rectangle in which the PDS is located.

9.6.7 **Landings by Nationality**

9.6.7.1 Table 9.23 shows landings by foreign and domestic vessels over the sampling period. The data indicate that over 97% of catch from the Swansea area is taken by UK vessels. From

the international fleet, Belgium is known to be the most significant contributor to foreign catches (contributing 99.8%).

Table 9.23 Annual landed value from the Swansea area, divided into domestic and foreign vessels of fish and shellfish, 2006 to 2012 (MMO, 2013).

Year	Foreign (£)	Domestic Value (£)
2006	13,986	1,468,895
2007	20,664	2,016,105
2008	36,197	1,899,942
2009	53,058	1,997,722
2010	31,390	1,129,734
2011	110,502	1,349,597
2012	28,567	2,054,155
Total (£)	**294,364**	**11,916,149**
Total (%)	**2.4**	**97.6**

9.6.8 Landings by Species Group

9.6.8.1 Commercial fisheries statistics indicate that the majority of fishing carried out within the Swansea Bay area is geared towards the catch of: shellfish, which accounts for ~75% of the overall catch; followed by demersal fish, which make up ~25% of the catch; and pelagic fish, with <1% of the total catch. Figure 9.41 represents catch by species group; crustaceans and molluscs were merged to form the shellfish category.

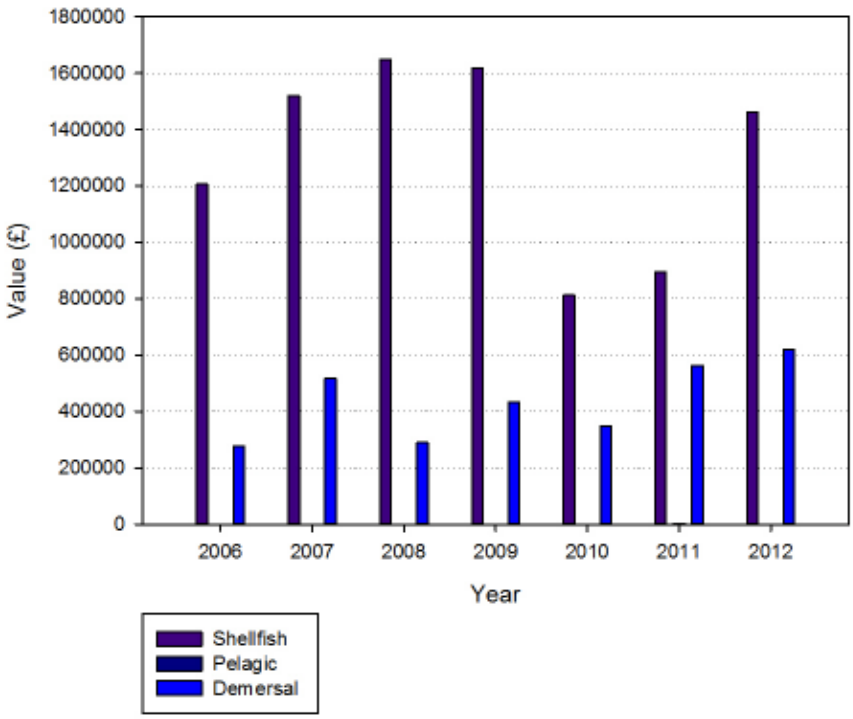


Figure 9.41 Landings from the Swansea Bay area, split into species groups, 2006 to 2012 (MMO, 2013).

9.7 Recreational Fishing

9.7.0.1 In order to assess the extent of use of Swansea Bay by the recreational angling sector, as well as address any concerns that may be held about the proposed development, the following groups were consulted:

a. angling associations;
b. charter boat operators; and
c. fishing tackle shops.

9.7.0.2 A full list of consultees is given in Appendix A at the end of this baseline.

9.7.1 Angling Organisations

9.7.1.1 Individual anglers tend to form local organisations which might be known as clubs, associations, societies or by other names. These can range in size in terms of membership.

9.7.1.2 The Angling Trust offers club and individual membership and is very active in terms of conservation, fisheries management and protecting anglers' rights.

9.7.1.3 The Welsh Federation of Sea Anglers (WFSA) represents sea angling groups in all parts of Wales and also some areas of England. The WFSA gave an estimate that a maximum of only 20% of sea anglers belong to a club, which would make a survey of the local clubs only representative of a small minority of sea angler use of the Bay. It was recommended that tackle shops may be able to offer useful information about non-member angling.

9.7.1.4 The South West Wales Association of Sea Angling Clubs (SWWASAC) has a separate, smaller membership to the WFSA.

9.7.1.5 The Bass Anglers' Sportfishing Society (BASS) is a specialist bass-fishing group, based in Llanelli. The group targets bass within Swansea Bay itself.

9.7.1.6 The salmon and trout angling clubs in the area were also contacted.

9.7.2 Charter Boat Operators

9.7.2.1 Six different charter businesses, each with one vessel, were found to be operating in Swansea Bay. One vessel owner was not interviewed, as his responses were to be collected by the SWWFC. Boat owners in Penarth were also contacted. However, they stated that they do not tend to work in Swansea Bay. One vessel reported only an annual booking for a cod-fishing competition in the Bay.

9.7.2.2 Most charter boat owners said they work exclusively with recreational anglers and spend the majority of winter boat time in the Bay. When the summer weather is bad, a greater proportion of work is carried out within the Bay. Other work included commercial diving. Boats also worked in other parts of the Bristol Channel, such as Gower or Lundy Island. Not all boats reported full-time charter work and stated that poor weather often limited time on the water.

9.7.2.3 Angling was described as being carried out all over the Bay. Some reported using the PDA for fishing, while others did not use this part. Access to shallow water was deemed

important for targeting flatfish. One popular place for angling was the area around the Swigg Buoy in the south-west part of the Bay, around ¾ mile from the Mumbles, known as Green Grounds. Mumbles is fished when there are swells from the west. The Strombus Wreck area was also mentioned. Skippers said they rely upon having access to different parts of the Bay to shelter from adverse weather. In extreme weather, angling is not possible within Swansea Bay.

9.7.2.4 Most owners reported a range of target fishing species, which varied by season and with the weather. In winter, the main species were cod and whiting, whereas in summer, species included flatfish (plaice, sand dab, turbot), roundfish (bass, bream, black bream, mackerel), sharks (bull huss, tope, smooth hound) and rays (skate and others).

9.7.2.5 Initially, no strong opinions were held regarding the impact of the proposed development on fishing and charter boat business, though some surprise at the size of the development was expressed. However, one boat owner made contact again after looking at the plans, reporting that the development would disrupt his work. Most owners said they did not know if the tidal lagoon would affect fishing or their business but that the weather had such an impact as to make turnover unpredictable. Many reported a drop in business over the last few years for this reason.

9.7.2.6 Some suggestions were made in consideration of potential impacts that the development could have. Potential negative impacts from the scheme were identified as:

i. an obstruction in crossing the Bay, incurring a detour of est. 1½ to 2 miles;

ii. access to existing summer fishing grounds around the long sea outfall will be removed;

iii. an obstruction in the only suitable wintering area, limiting charter boat work;

iv. a disruption to bait collection, incurring extra costs for fishers, which may bring a drop in charter-boat business;

v. a build-up of sand around the sea wall, bringing geomorphological and ecological changes;

vi. a disruption to angling during construction (though returning to normal once compete); and

vii. a reduced ability for boats to shelter from prevailing south-westerly winds, due to limited access to some areas.

9.7.2.7 Potential positive impacts from the scheme were identified as:

a. an enhancement of fishing opportunities;

b. an increase in tourism to Swansea and the Bay area; and

c. a development that would be good for the environment.

9.7.3 Fishing Tackle Shops

9.7.3.1 Four local tackle shops at different localities around the Bay were contacted for information on the number of anglers in Swansea Bay and the methods they use for fishing, as well as a source of opinion on the proposed development.

9.7.3.2 Angling was described as taking place from the west pier, along the coast to the County Hall and as far as the Park and Ride. The George Pub in Mumbles is also used by anglers. Mumbles Pier was reported as a popular place at which to fish before its closure and this is expected to popular once again upon reopening. Mumbles was said to be good for sand dab and bass.

9.7.3.3 The development area was described as being well-used with lots of fishing off the west pier.

9.7.3.4 Recreational angling in Swansea Bay was described as mainly consisting of shore angling, but there are also boat trips from Swansea. Coaching takes place on the west pier.

9.7.3.5 No comments had been received by tackle shop staff about the proposed development from the angling clientele. It was suggested that it may be popular with shore anglers, by giving access to depths, allowing cod and shark fishing.

9.7.4 Summary of Responses

9.7.4.1 A range of opinions were encountered among the angling clubs and associations, a summary of responses are provided in Table 9.24. Some of the contacted groups had no strong opinion on the development, some felt it could offer anglers opportunities for enhanced fishing, while others still were concerned that access to the beach and to the structure itself would be limited for anglers. Further concerns were raised on the potential impacts the project could have on the local fish populations, especially migratory fish. Please refer to Chapter 8 of the Consultation Report, submitted in support of the application for development consent, for a comprehensive summary of all consultation.

Table 9.24 Consultation summary for angling clubs and other associations

Consultee	Date of Response	Issues raised
Llandysul Angling Association	05/04/2013	Comments on general deleterious effects of turbines on the environment. Commented on the negative effect of the Cardiff Bay Barrage on local wildlife.
Ogmore Angling Association	06/04/2013	Concerns on the potential physical damage of hydro-turbines on fish stocks, especially migratory species. Comments on noise, vibration, contaminants, changes in temperature and pollutants affecting the local fish populations.
Ridgeway Angling Club	07/04/2013	Commented on the potential for screening the turbines. Also indicated the species and life-stages which may be entrained.
Welsh Salmon and Trout Association	12/05/2013	Raised concerns over the potential effects of the project on migratory fish and absence of screening facilities on the development.
Pontardawe & Swansea Angling Society	31/05/2013	Concerns over the likely impact of proposal on migratory fish movements in the River Tawe.

9.8 References

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Abbreviations

PDS = proposed development site

Cefas = Centre for Environment, Fisheries and Aquaculture Science

MMO = Marine Management Organisation

DASSH = Data Archive for Seabed Species

Appendix A: Recreational angling consultees

Angling associations:

a. The Angling Trust
b. Roger Cook and Colin Doyle, The Welsh Federation of Sea Angers (WFSA)
c. Chris Isaac, The South West Wales Association of Sea Angling Clubs (SWWASAC)
d. Lee Campbell, The Bass Anglers' Sportfishing Society (BASS)
e. Ogmore Angling Association
f. Llandysul Angling Association
g. Ridgeway Angling Club
h. Welsh Salmon and Trout Association

Angling clubs:

i. Pontardawe and Swansea Angling Society
ii. Llandysung

Charter Boat Operators in Swansea Bay:

1) Kevin and Dave Axtell, Seren-y-Mor
2) Ceri Stevens, Susan Jayne
3) Rob Rennie, Lady Jue
4) Alan Jackson, Sarah Louise
5) Mark Thomas, Blue Thunder
6) Paul Davies, Dev-Ocean

Charter Boat Operators outside Swansea Bay:

i. Paul Crossman, Benjoma Too
ii. Craig Deans, Phat Cat

Tackle Shop Staff:

I. Peter, Mainwarings Angling Centre, Sketty
II. Gareth, Swansea Angling Centre, The Marina, Swansea
III. Leon and Luke, Basstastic Fishing Supplies, Mumbles Pier
IV. Brian Davies, Country Stores

Others:

A. Lyndon Lammas, involved with SWWASAC and local journalist