Pembroke Power Station Water Framework Directive Assessment

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RWE Generation UK plc

Pembroke Power Station Abstraction License Renewal
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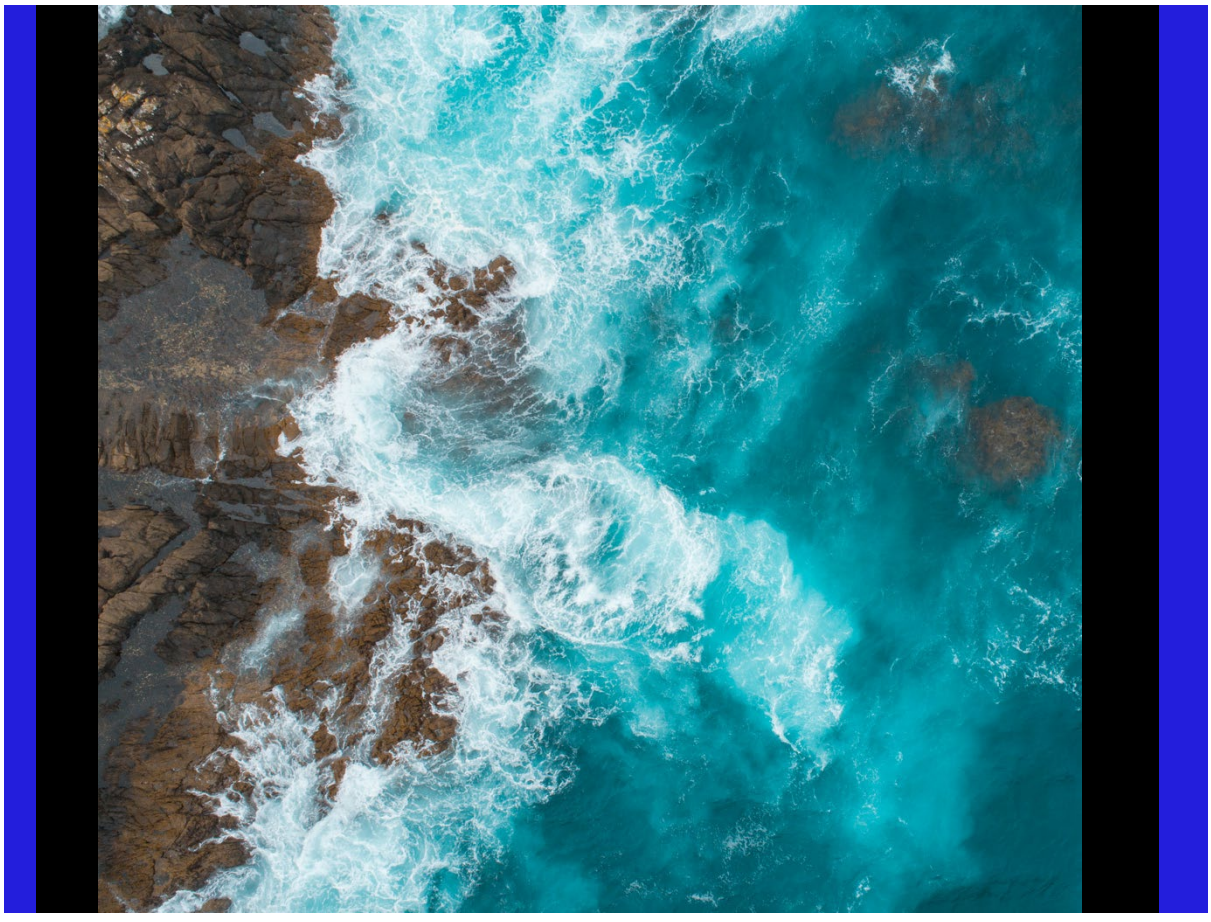

Executive Summary

This report is written to support a request for a renewal of Water Abstraction Licence serial number (22/61/06/0156). The purpose of the WFD assessment is to determine if the project complies with the objectives of the WFD. This is determined by identifying the relevant water bodies and the quality elements that could potentially be at risk from the project. Where risks are identified then an impact assessment is carried out to determine if the project is compliant with the objectives of the WFD.

An initial exercise was undertaken to identify the WFD water bodies potentially impacted by the project both directly and indirectly. An assessment was then made to determine whether the WFD water bodies should be screened in for assessment or whether, due to likelihood of limited impacts, they can be screened out of further assessment. Given the nature of the activities and the potential impact pathways, the water bodies relevant to the assessment of impacts on fish were considered separately. The screening and scoping exercise concluded the need to consider impacts on the fish quality element in Milford Haven Inner (in relation to resident and migratory fish) and in nearby and upstream water bodies (in relation to migratory fish only).

There is no evidence that indicates abstraction related losses of fish adversely affect biological status of the waterbody. The ongoing abstraction of water at Pembroke Power Station therefore would not cause deterioration in the status of any quality elements in the water body in which the activity takes place (Milford Haven Inner) nor would the project prevent the water body from achieving good ecological potential. The Milford Haven Inner waterbody has continued to be classified as good for fish, during the operation of the current abstraction licence.

The assessment considered the potential for the fish quality element in river water bodies to be affected by the loss of migratory species which form part of the riverine fish community. The assessment concluded that the impacts on migratory species are negligible and that there is no potential for deterioration of the fish quality element in any of the river water bodies, nor would the project jeopardise the ability of any of the river water bodies to achieve overall good ecological status or potential.

Consideration of WFD protected areas considered the risks to water-dependent SPAs, SACs, Nitrate Vulnerable Zones, Shellfish Waters and Bathing Waters. The assessment concluded that these sites are not at risk and that the project is compliant with other relevant legislation.

On this basis the project is considered to be fully compliant with the requirements of *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended)*.

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1. Introduction

1.1 Project Description

Water is abstracted year-round from Pennar Gut for non-evaporative cooling of RWE Generation UK plc's (RWE) Pembroke Power Station. Cooling water is drawn from Pennar Gut, at the mouth of the Pembroke River. The current licence (see below) is due to expire on the 31st March 2025.

The existing licence (22/61/06/0156) was originally granted by Environment Agency Wales (EAW) on the 3rd February 2009, and reissued by National Resource Wales (NRW) on the 21st November 2014 to reflect the change in name of the Competent Authority. The licence allows for the following maximum quantities of water to be abstracted from Pennar Gut, Pembroke Dock (NGR SM9365402652):

- 144,000 cubic metres per hour
- 3,456,000 cubic metres per day
- 1,200,000,000 cubic metres per year
- at an instantaneous rate not exceeding 40 cubic metres per second.

The proposed water abstraction licence renewal for Pembroke Power Station is intended as a 'like for like' renewal, with no changes to the current licenced volumes of abstracted sea water, nor changes to the conditions attached to the licence. For avoidance of doubt, the renewal will enable the continued operation of Pembroke Power Station in the same way as already authorised.

1.2 Purpose of this Report

This report is written to support a request for a renewal of Water Abstraction Licence serial number (22/61/06/0156) The purpose of the WFD assessment is to determine if the project complies with the objectives of the WFD. This is determined by identifying the relevant water bodies and the quality elements that could potentially be at risk from the project. Where risks are identified then an impact assessment is carried out to determine if the project is compliant with the objectives of the WFD.

1.3 WFD Assessment Context

The WFD (2000/60/EC) was a significant piece of European Union water legislation that came into force in 2000, with the overarching objective of requiring all water bodies in Europe to attain good or high status/potential. The legislation is transposed into national law by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended)[1] (referred to herein as the 'WFD Regulations'). Since 31st December 2020 the EU Directive no longer directly applies and the WFD Regulations form the principal legal basis. At present the WFD Regulations mirror the EU Directive and the guidance on carrying out WFD assessments has not changed as a result of changes to legislation.

NRW is the competent authority in Wales for delivering WFD targets.

The WFD Regulations outline the following objectives for the protection of WFD water bodies:

- to prevent deterioration in the status of WFD water bodies;

[1] The Water Environment (WFD) (England and Wales) Regulations 2017 have been amended by The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

- aim to achieve Good Status and good surface water chemical status in WFD water bodies by 2021 or 2027 (depending on feasibility);
- for WFD water bodies designated as artificial or heavily modified, aim to achieve Good Potential by 2021 or 2027 (depending on feasibility);
- comply with objectives and standards for protected areas where relevant; and,
- reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.

The overall status/potential of a WFD water body comprises a series of biological, physico-chemical and hydromorphological quality elements for surface WFD water bodies and quantitative and qualitative quality elements for groundwater WFD water bodies. These should not be allowed to deteriorate in the event of modifications being made to the WFD water body.

'Good status' refers to WFD water bodies where characteristics show only a slight deviation from a natural/near natural condition. 'Good Potential' refers to WFD water bodies that are designated as Artificial and Heavily Modified Water Bodies (A/HMWB), which have been extensively modified, or artificially constructed, to deliver important socio-economic functions. A/HMWBs have a target to achieve 'Good Potential', rather than 'Good Status', recognising the socio-economic importance of the modifications, whilst ensuring that the quality elements associated with the WFD water body are protected as far as possible.

Where a scheme is considered likely to cause deterioration, or where it could contribute to failure of the WFD water body to meet Good Status/Potential, then a Regulation 19 (Article 4.7) assessment would be required. Regulation 19 is an exemption to the WFD legislation where new modifications prevent a WFD water body (or bodies) from achieving good status or where they may cause a deterioration in status. Should a scheme meet all of the conditions set out in Regulation 19 then it is considered as being compliant with the WFD Regulations.

2. Assessment Methodology

2.1 Data Sources

- Cycle 3 (2021), Cycle 2 (2015) and Cycle 1 (2009) River and Waterbodies Map for GIS layers including WFD protected areas and WFD habitats (Water Watch Wales, 2022);
- Transitional Water Assessment Method - Fish Fauna: Transitional Fish Classification Index (WFD-UKTAG, 2014);
- Practitioners Guide to the Transitional Fish Classification Index (TFCI) Water Framework Directive: Transitional Waters (UK-TAG, 2012);
- Entrainment and impingement sampling at Pembroke Power Station from 2012 to 2022 (summarised in annual reports); and
- NBN atlas – Wales INNS Portal (NBN atlas, 2023).

2.2 WFD Assessment Methodology

Guidance has been produced on carrying out WFD assessments. This includes guidance for WFD assessments in estuarine and coastal waters, known as 'Clearing the Waters for All' (Environment Agency, 2017) as well as CIEEM guidance for specifying zones of influence. This guidance is the basis for the methodology used in this assessment which is set out below.

Stage 1: WFD Screening

The screening stage identifies the project activities which require assessment and where relevant provides justification for excluding activities from the scoping stage. Zones of influence for key receptors (quality elements) are defined. The relevant WFD water bodies are identified and justification is provided.

Stage 2: WFD Scoping

The scoping stage identifies the potential risks of the project activities to WFD water bodies with reference to the key receptor groups. This stage includes:

- setting out the baseline conditions of the water bodies that have been screened into the assessment;
- an initial assessment to identify the risks from the proposed project and which (if any) receptors require impact assessment.

Stage 3: Impact Assessment

If the scoping stage identified a receptor (quality element) at risk from the activity then this is considered at the impact assessment stage. This stage uses Marine Pressures-Activities Database v1.5 (JNCC, 2022) to identify ways that the activity could affect the receptors and whether there is a pathway linking the pressure to the receptor.

Where a risk is identified then the following aspects are considered in relation to WFD objectives (see Section 1.3) which includes the following aspects where relevant:

- assessment for deterioration of a quality element;
- consideration of whether the achievement of good status could be jeopardised;
- in the case of artificial or heavily modified water bodies, whether water body mitigation measures could be jeopardised; and
- project complies with objectives and standards for protected areas where relevant.

3. Stage 1: Screening

3.1 Identification of Relevant Activities

The project is defined in Section 1.1 and the Marine Pressures-Activities Database v1.5 (JNCC, 2022) was used to identify potential impact pathways/pressures. The activity which is relevant to this assessment and potential pathways are outlined in Table 1.

Table 1. Screening of project activities

Activity	Screening assessment
Continued abstraction of cooling water from Milford Haven (maximum of 144,000m^3 per hour (40m^3s^{-1})	Screened in. Potential impact pathways include: impingement of marine organisms; and entrainment of marine organisms.

3.2 Defining Zones of Influence

The 'zone of influence' is defined in line with CIEEM guidelines as *"the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities"* (CIEEM, 2022).

A zone of Influence (ZoI) approach has been used to inform the WFD screening stage which takes account of all relevant receptors. For the purposes of the WFD assessment a receptor is defined as a quality element, or component of a quality element, that could potentially be affected by the project. Taking into consideration the relevant activities and potential impact pathways the following zones of influence have been defined:

- For passive fauna (e.g., early life-stages of fish and invertebrates) the distance of the tidal excursion in the vicinity of the intake has been calculated based on the currents that a particle would experience on a spring tide. The ZoI for passive fauna therefore extends approximately 10km. This encompasses the maximum area considered at risk to larval fish and invertebrate entrainment due to passive transport by normal tidal flows.
- For resident estuarine fish the ZoI is defined as the water body limits of Milford Haven Inner (GB531006114100) and Outer (GB641008220000) waterbodies (approximately 12km downstream and 21.9km upstream).
- For migratory fish the zone of influence is based on the migration route for each species. The downstream boundary is the point at which they leave the coast and enter the estuary, i.e. the downstream limit of Milford Haven Inner. From this point onwards migratory fish have the potential to be affected by the abstraction as they will swim past it. The upstream limit is the furthest point at which the species is known to be present, which may differ for individual species.

3.3 Identification of Relevant WFD Water Bodies

An initial exercise was undertaken to identify the WFD water bodies potentially impacted by the project both directly and indirectly. An assessment was then made to determine whether the WFD water bodies should be screened in for assessment or whether, due to likelihood of limited impacts, they can be screened out of further assessment (Table 2). The water bodies are shown in Figure 1. Given the nature of the activities and the potential impact pathways, the water bodies relevant to the assessment of impacts on fish were considered separately.

Table 2. Screening of water bodies

Operational catchment	Water body name (and ID)	Water body type	Screened in/out (all elements except fish)	Screened in/out for fish	Justification
Pembrokeshire South	Pembrokeshire South (GB611008590003)	Coastal	Out	Out	Given the size of this water body and the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on this water body. Fish is not a quality element for coastal water bodies.
Milford Haven	Milford Haven Inner (GB531006114100)	Transitional	In	In	The activities take place within this water body.
	Milford Haven Outer (GB641008220000)	Coastal	Out	In	Given the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on these water bodies. However, given the potential pathways to impacts on migratory fish (which are not a quality element for coastal water bodies), a precautionary approach has been taken.
Pickleridge Lagoon	Pickleridge Lagoon (GB610100084000)	Coastal	Out	Out	Given the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on this water body. Fish is not a quality element for coastal water bodies.
Coastal streams of North Milford Haven - Llangwm Pill to St Annes Head	Westfield Pill - headwaters to tidal limit (GB110061031260)	River	Out	In	Given the distance of the river from the intake and the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on these water bodies. However, given the potential pathways to impacts on migratory fish, which form part of the fish quality element in upstream water bodies, and the fact that fish would have to move past Pennar Gut a precautionary approach has been taken and any rivers upstream have been screened in.
	Huberston Pill - headwaters to tidal limit (GB110061031240)	River	Out	Out	Given the distance of the rivers from the intake and the extent and nature of the activities which involves the continuation of the

Operational catchment	Water body name (and ID)	Water body type	Screened in/out (all elements except fish)	Screened in/out for fish	Justification
	Sandy Haven Pill (GB110061031000)	River	Out	Out	current abstraction regime, there are no predicted impacts on these water bodies. Although there is overlap with the zone of influence for migratory fish, taking a proportionate approach it is considered that fish migrating into Huberston Pill, Sandy Haven Pill and Winterton Marsh, are very unlikely to encounter the intake given the distance of the mouths of these water bodies from the intake (~5km for Huberston Pill, ~13km for Sandy Haven Pill and ~16km for Winterton Marsh).
	Winterton Marsh - HW to TL, Nr Pickleridge Lagoon (GB110061030930)	River	Out	Out	
Coastal streams of South Pembs and South Milford Haven - Pendine to Landshipping	Pembroke - headwaters to tidal limit (GB110061025050)	River	Out	In	Given the distance of the rivers from the intake and the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on these water bodies. However, given the potential pathways to impacts on migratory fish, which form part of the fish quality element in upstream water bodies, a precautionary approach has been taken and any rivers above the expected prevalence threshold of diadromous fish species have been screened in.
	Carew - HW to conf with Carew Tidal Mill Pond (GB110061031210)	River	Out	Out	Given the distance of the rivers from the intake and the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on these water bodies. Although there is overlap with the zone of influence for migratory fish, taking a proportionate approach it is considered that fish migrating into Carew and the Cresswell River, are very unlikely to encounter the intake given the distance of the mouths of these water bodies from the intake (~14km for both water bodies).
	Cresswell River, headwaters to tidal limit (GB110061030981)	River	Out	Out	
Cleddau Western	Millin Brook - headwaters to tidal limit (GB110061031320)	River	Out	Out	Given the distance of the rivers from the intake and the extent and nature of the activities which involves the continuation of the

Operational catchment	Water body name (and ID)	Water body type	Screened in/out (all elements except fish)	Screened in/out for fish	Justification
	Merlin's Brook - headwaters to conf with W Cleddau (GB110061031300)	River	Out	Out	current abstraction regime, there are no predicted impacts on these water bodies. Although there is overlap with the zone of influence for migratory fish, taking a proportionate approach it is considered that fish migrating into the Western Cleddau (and upstream water bodies) and into Merlin's brook, are very unlikely to encounter the intake given the distance of the mouths of these water bodies from the intake (~22km for Merlin's Brook and ~24km for the Western Cleddau).
	Cartlett Brook - HW to conf with W. Cleddau (GB110061031330)	River	Out	Out	
	W Cleddau - Anghof conf to Cartlett Brook conf (GB110061031340)	River	Out	Out	
	Pelcomb Brook - headwaters to conf with W. Cleddau (GB110061031170)	River	Out	Out	
	Camrose Brook - headwaters to conf with W. Cleddau (GB110061031180)	River	Out	Out	
	Rudbaxton Water - HW to conf with W. Cleddau (GB110061031190)	River	Out	Out	
	Spittal Brook - headwaters to conf with W. Cleddau (GB110061031350)	River	Out	Out	
	Anghof - headwaters to conf with Western Cleddau (GB110061038690)	River	Out	Out	
	Western Cleddau - Cleddau North to Anghof conf (GB110061038651)	River	Out	Out	

Operational catchment	Water body name (and ID)	Water body type	Screened in/out (all elements except fish)	Screened in/out for fish	Justification
	W Cleddau - headwaters to conf with Cleddau North (GB110061038670)	River	Out	Out	
	Cleddau North - H'waters to conf with W. Cled (GB110061038680)	River	Out	Out	
	Nant y Bugail - headwaters to conf with Cleddau N. (GB110061038660)	River	Out	Out	
Cleddau Eastern	Narbeth Brook - headwaters to conf with E. Cleddau (GB110061030660)	River	Out	Out	Given the distance of the rivers from the intake and the extent and nature of the activities which involves the continuation of the current abstraction regime, there are no predicted impacts on these water bodies. Although there is overlap with the zone of influence for migratory fish, taking a proportionate approach it is considered that fish migrating into the Eastern Cleddau (and upstream water bodies), are very unlikely to encounter the intake given the distance of the mouths of these water bodies from the intake (~22km for the Eastern Cleddau).
	Eastern Cleddau - conf with Syfynwy to tidal limit (GB110061030670)	River	Out	Out	
	Longford Brook - HW to conf with E. Cleddau (GB110061030680)	River	Out	Out	
	E. Cleddau - conf with Wern to conf with Syfynwy (GB110061038290)	River	Out	Out	
	Deepford Brook - headwaters to conf with Syfynwy (GB110061030690)	River	Out	Out	
	Syfynwy - Llys-y-fran to conf with E Cleddau (GB110061030700)	River	Out	Out	
	Syfynwy - headwaters to Llys-y-fran (GB110061038300)	River	Out	Out	

Operational catchment	Water body name (and ID)	Water body type	Screened in/out (all elements except fish)	Screened in/out for fish	Justification
	Eastern Cleddau - headwaters to conf with Wern (GB110061038320)	River	Out	Out	
	Wern - headwaters to conf with Eastern Cleddau (GB110061038310)	River	Out	Out	
Cleddau and Pembrokeshire	Cleddau and Pembrokeshire (GB41002G200400)	Groundwater	Out	Out	The activities do not result in any pathway to impacts on the groundwater body.
Pembrokeshire Carboniferous Limestone	Pembrokeshire Carboniferous Limestone (GB41002G206000)	Groundwater	Out	Out	The activities do not result in any pathway to impacts on the groundwater body.

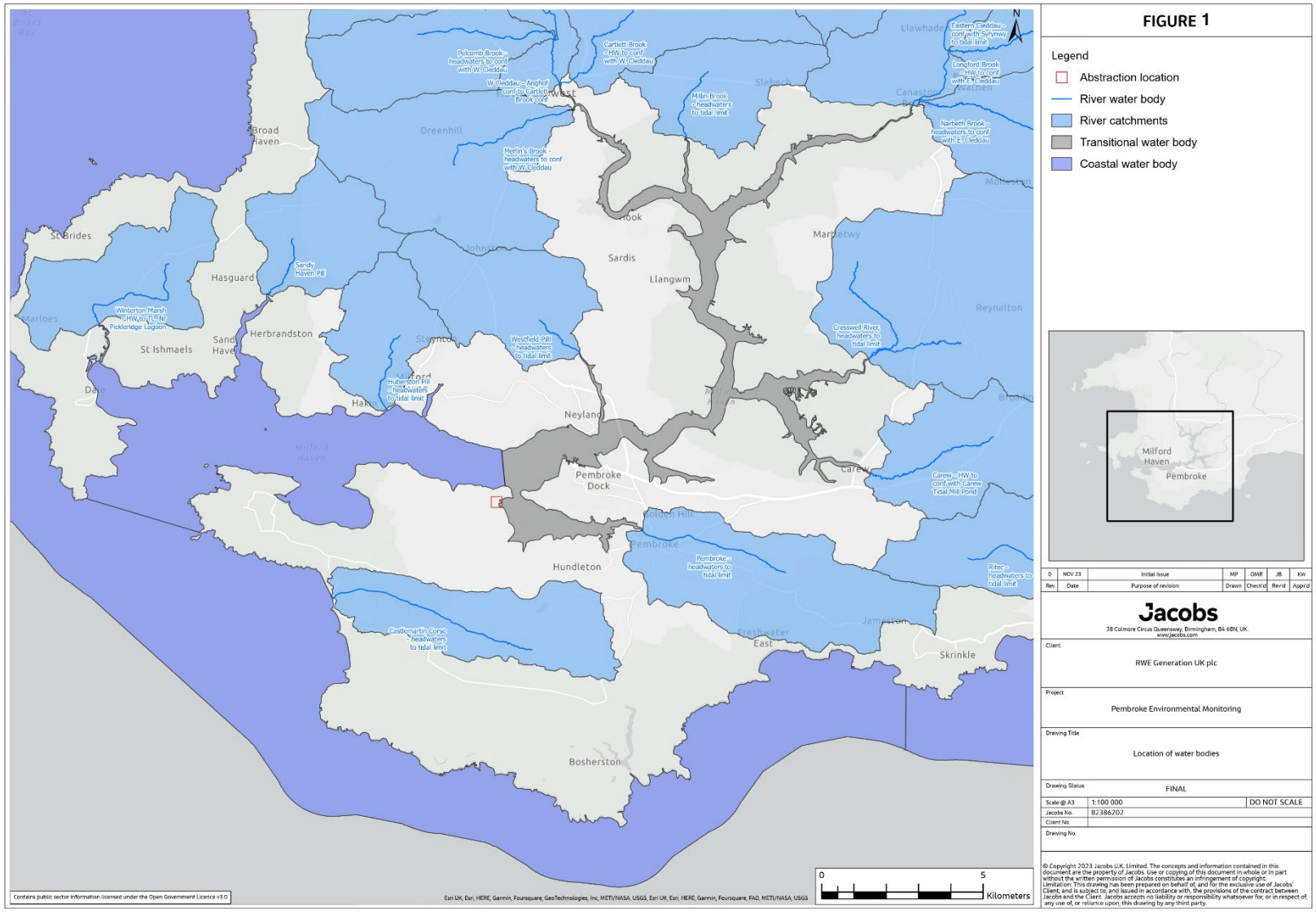

Figure 1. Location of water bodies

4. Stage 2: Scoping – Milford Haven Inner

4.1 Milford Haven Inner Baseline Conditions

The baseline conditions of the Milford Haven Inner transitional water body are provided in Table 3.

Table 3. Milford Haven Inner baseline water body conditions

Aspect	Details
Water body ID	GB531006114100
River basin district name	Western Wales
Water body type	Transitional
Water body total surface area	21.02km^2
Overall water body status (2021)	Moderate
Ecological status (2021)	Moderate (achieving at least good for most biological quality elements including fish; exceptions being macroalgae and subtidal opportunistic macroalgae. moderate for physico-chemical quality elements; high for specific pollutants).
Chemical status (2021)	Moderate
Target overall water body status and deadline	Target is good to be achieved by 2027
Hydromorphology status of water body	Not High
Heavily modified water body and for what use	Natural
Reasons for not achieving good status	▪ Brominated dipenylether (BDPE) from both contaminated sediments (diffuse) and sewage discharge (point). ▪ Dissolved Inorganic Nitrogen (point and diffuse sources associated with sewage discharge and agriculture and rural land management). ▪ Macroalgae from both diffuse and point sources originating from primarily sewage discharge but also from agriculture.
WFD protected areas	Water dependent Special Areas of Conservation (SAC) and Special Protection Areas (SPA) Pembrokeshire Marine SAC (UK0013116) Nitrate Vulnerable Zones (NVZs) Pembroke Eutrophic NVZ (NVZ ID 207) Shellfish Water Directive Lower Cleddau
Higher sensitivity habitats (within 500m)	▪ Intertidal seagrass ▪ Saltmarsh ▪ Blue mussel bed
Lower sensitivity habitats (within 500m)	▪ Intertidal soft sediment like sand and mud ▪ Rocky shore

Aspect	Details
	▪ Subtidal soft sediments like sand and mud

4.2 Identification of Risks to Receptors

In line with the 'Clearing the Waters for All' guidance (Environment Agency, 2017) the scoping assessment considers the potential risks to key receptors in the following sections.

4.2.1 Hydromorphology

The risks to hydromorphology are detailed in Table 4. The assessment did not identify any risks to hydromorphology parameters.

Table 4. Scoping assessment of hydromorphology risk issues.

Consideration	Risk issue
Consider if your activity could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status?	No. Milford Haven Inner is currently at moderate status and there are no impacts on a high-status water body.
Consider if your activity could significantly impact the hydromorphology of any water body?	No. Milford Haven Inner's hydromorphology status is currently assessed as 'Not High'. The project involves continuing the existing regime in its current layout. There is no change to the current physical footprint of the works or to the abstraction regime. The project and would not alter the coastline or change current sediment transport processes.
Consider if your activity is in a water body that is heavily modified for the same use as your activity?	No. There is no change to the existing footprint and therefore the existing hydromorphology conditions would be maintained.

4.2.2 Biology

The risks to habitats are detailed in Table 5. The assessment did not identify any risks to biology (habitat) parameters.

Table 5. Scoping assessment of biology (habitat) risk issues.

Consideration	Risk issue
Is the footprint of the activity 0.5 km^2 or larger?	No. There is no footprint associated with the abstraction of cooling water.
Is the footprint of the activity 1% or more of the water body's area?	No. There is no footprint associated with the abstraction of cooling water.
Is the footprint of the activity within 500 m of any higher sensitivity habitat?	Yes. However, there is no footprint associated with the abstraction of cooling water as there is no direct impact on habitats from the abstraction process. Therefore there is no pathway to effect so a risk assessment is not required.
Is the footprint of the activity 1% or more of any lower sensitivity habitat?	No. There is no footprint associated with the abstraction of cooling water.

The risks to fish are detailed in Table 6. The assessment identified that the risks to fish from the abstraction of cooling water should be scoped into the assessment and considered at Stage 3 impact assessment (see Section 6).

Table 6. Scoping assessment of biology (fish) risk issues (Milford Haven Inner)

Consideration	Risk issue
Consider if your activity is in an estuary and could affect fish in the estuary,	Yes. The abstraction is within Milford Haven Inner which is a transitional (estuarine) water body. There is a potential pathway to impacts on fish

Consideration	Risk issue
outside the estuary but could delay or prevent fish entering it, or could affect fish migrating through the estuary?	including species which are resident in the estuary and those which migrate through the estuary to freshwater or coastal habitats.
Consider if your activity could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)?	No. Whilst there are mitigation measures associated with the abstraction these are to act as a deterrent to fish from entering the intake. The AFD and strobe installed will result in localised displacements of species rather than large scale behavioural changes. The continued abstraction of cooling water is therefore considered to not affect fish behaviour.
Consider if your activity could cause entrainment or impingement of fish?	Yes. Abstraction of cooling water at Pembroke PS is known to entrain fish larvae and eggs.

4.2.3 Water Quality

The risks to water quality including on phytoplankton and algae and on chemical parameters is detailed in Table 7. The assessment did not identify any risks to water quality.

Table 7. Scoping assessment of water quality risks issues

Consideration	Risk issue
Consider if your activity could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)?	No. The continued abstraction of cooling water would not affect these parameters. It must be noted that the effects of station operation are considered and assessed under the Environmental Permit and are not relevant to this assessment on abstraction.
Consider if your activity is in a water body with a phytoplankton status of moderate, poor or bad?	No. Milford Haven Inner has current High status for phytoplankton (2018-2021).
Consider if your activity is in a water body with a history of harmful algae?	No. While harmful / toxic species of phytoplankton have been recorded as being present within Milford Haven (Jacobs, 2022) they have never been in concentrations or approached concentration thresholds deemed to be of concern.
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if the chemicals are on the Environmental Quality Standards Directive (EQSD) list?	No. This is not relevant to the abstraction of water for cooling.
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if it disturbs sediment with contaminants above Cefas Action Level 1?	No. The abstraction of cooling water will not mobilise sediments therefore release of chemicals is not a consideration.
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if the chemicals released are on the Environmental Quality Standards Directive (EQSD) list?	No. This is not relevant to the abstraction of cooling water.

4.2.4 Protected Areas

Consideration should be made regarding whether WFD protected areas are at risk from any of the proposed activities. Protected areas within 2km of Milford Haven Inner include:

- Water-dependent Special Protection Areas (SPA) and Special Areas of Conservation (SAC);
- Nutrient Sensitive Areas including Nitrate Vulnerable Zones (NVZ) and Sensitive Areas under the Urban Waste Water Treatment Directive (UWWTD);
- Shellfish Waters; and

- Bathing Waters.

The potential risks to protected areas are considered in Table 8.

Table 8. Scoping assessment of protected areas

Consideration	Risk issue
Water-dependent Special Protection Areas (SPA) and Special Areas of Conservation (SAC)	Yes. The relevant site is the Pembrokeshire Marine SAC. A report has been prepared to provide information to Natural Resources Wales to inform a Habitats Regulations Assessment (HRA) under The Conservation of Habitats and Species Regulations 2017 (as amended). The report provides information in relation to stage 1 screening and stage 2 appropriate assessment and concludes that there would be no adverse effects on the integrity of any European designated sites from the ongoing abstraction of cooling water at Pembroke PS.
Nutrient Sensitive Areas including NVZ and Sensitive Areas	The Pembroke eutrophic water NVZ is located 4.5km South of the intake on the South Pembrokeshire coast. The ongoing abstraction of cooling water does not impact nutrient concentrations and the risk to Nutrient Sensitive Areas is scoped out of the assessment.
Shellfish Waters	The intake at Pembroke PS is within the 'Lower Cleddau designated Shellfish Water. Shellfish Waters are classified according to the extent of microbial (faecal) contamination as shown by monitoring of *E. coli* in shellfish flesh. The ongoing abstraction of cooling water does not impact bacteriological water quality and the risk to Shellfish Waters is scoped out of the assessment.
Bathing Waters	The nearest bathing waters are at Sandy Haven and West Angle, both over 9km downstream. The ongoing abstraction of cooling water does not impact bacteriological water quality and the risk to Bathing Waters is scoped out of the assessment.

4.2.5 Invasive Non-native Species (INNS)

Consideration has been given as to whether there is a risk that the ongoing abstraction could introduce or spread INNS. The introduction or spreading of INNS can originate from the use of materials or equipment that have come from, had use in, or travelled through, other water bodies, as well as activities that help spread existing INNS, either within the immediate water body or other water bodies.

The following INNS are reported to occur in the Milford Haven (NBN atlas, 2023; Jacobs 2023a):

- Wireweed
- Harpoon weed
- Wakame
- Harvey's siphon weed
- Pom-pom weed
- Solier's Red String Weed
- *Antithamnionella spirographidis* (red algae)
- *Antithamnionella ternifolia* (red algae)
- Devil's tongue weed
- Green sea fingers
- Australian tubeworm
- Red ripple bryzoan
- Orange striped anemone
- Pacific brown banded sea spider
- Striped barnacle
- Japanese skeleton shrimp
- Asian shore crab
- Modest barnacle
- Sexton's mudshrimp
- Pacific oyster
- Slipper limpet
- Sand gaper
- Bamboo clam
- Leathery sea squirt
- Compass sea squirt
- Orange-tipped sea squirt

There is no risk of new introduction of INNS from the ongoing abstraction of cooling water as there are no new pathways for introduction. This risk is scoped out of further assessment.

5. Stage 2: Scoping – river water bodies screened in for fish

The baseline conditions of the river water bodies relevant to the assessment of impacts on fish are provided in Table 9.

Table 9. Baseline water body conditions for water bodies screen in for fish.

Operational catchment	Water body name	Water body ID	Latest fish classification	Cycle/year of classification
Coastal streams of North Milford Haven - Llangwm Pill to St Annes Head	Westfield Pill - headwaters to tidal limit	GB110061031260	Good	C3 2021
	Huberston Pill - headwaters to tidal limit	GB110061031240	Not available	Not available
Coastal streams of South Pembs and South Milford Haven - Pendine to Landshipping	Pembroke - headwaters to tidal limit	GB110061025050	Moderate	C3 2021

The risks to fish in river water bodies are detailed in Table 10. The assessment identified that the risks to fish from the abstraction of cooling water should be scoped into the assessment and considered at Stage 3 impact assessment (see Section 6).

Table 10. Scoping assessment of biology (fish) risk issues (river water bodies)

Consideration	Risk issue
Consider if your activity is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it, or could affect fish migrating through the estuary?	Yes. The abstraction is within Milford Haven Inner which is a transitional (estuarine) water body. There is a potential pathway to impacts on fish including species in upstream river water bodies as abstraction could potentially result in a loss of individuals that would otherwise form part of the fish community in upstream rivers.
Consider if your activity could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)?	No. The intake system has an acoustic deterrent system and strobe as mitigation for entrapment. The effect of these systems is localised to the intake face and the continued abstraction of cooling water would not affect spawning or migrating fish behaviour.
Consider if your activity could cause entrainment or impingement of fish?	Yes. Abstraction of cooling water at Pembroke PS is known to entrain fish larvae and eggs. There is a potential impact on migratory fish in river water bodies nearby and upstream of the intake from a loss of individuals that would otherwise form part of the fish community in rivers.

6. Stage 3: Impact Assessment

6.1 Assessment Context

The results of the scoping stage are summarised in Table 11. The screening and scoping exercise concluded the need to consider impacts on the fish quality element in Milford Haven Inner (in relation to resident and migratory fish) and in nearby and upstream water bodies (in relation to migratory fish only). It should be noted that the 2021 (Cycle 3) classification for fish in the Milford Haven Inner waterbody is Good, with the current Pembroke PS abstraction in place.

The impact assessment stage considers the predicted losses of individual fish from entrainment and impingement and the impact that this could have on the fish quality element in each of these water bodies.

Table 11. Summary of Scoping stage

Consideration	Risk issue
Hydromorphology	Scoped out of the assessment
Biology: habitats	Scoped out of the assessment.
Biology: fish	Requires impact assessment. These impacts are relevant to Milford Haven Inner transitional water body and to river water bodies nearby and upstream of the intake where the expected prevalence threshold of diadromous fish species is exceeded.
Water quality	Scoped out of the assessment
Protected areas	Yes – discussed in separate HRA
Invasive non-native species	Scoped out of the assessment.

Compliance is ultimately determined based on the following criteria:

1. Whether the impact would result in deterioration of the fish quality element in any water body; and
2. Whether the impact would jeopardise the achievement of good status or potential for any water body.

In relation to the second objective consideration must also be given to water body mitigation measures.

6.2 Classification of the Fish Quality Element and Relevant Species

The fish quality element in each water body is classified by NRW by applying the relevant tool/metric to the available data. Where data are not available professional judgement can be used based on information gained from other similar water bodies. The fish classification tool for river water bodies is not publicly available but information on the Transitional Fish Classification Index (TFCI) tool has been used. The metrics within the tool have been considered to inform the understanding of how fish communities could be affected by the losses of individuals where those individuals contribute to the fish community.

Metric 1 relates to species composition and a list of species relevant to metric 1 (taking all catch methods into account) is provided in Appendix A. Of those species listed the following taxa were recorded in the impingement and entrainment surveys at Pembroke PS:

- Pogge (*Agonus cataphractus*)
- Lesser sand eel (*Ammodytes tobianus*)
- European eel (*Anguilla anguilla*)
- Transparent goby (*Aphia minuta*)
- Sand smelt (*Atherina presbyter*)
- Solenette (*Buglossidium luteum*)
- Common dragonet (*Callionymus lyra*)
- Reticulated dragonet (*Callionymus reticulatus*)
- Thicklip grey mullet (*Chelon labrosus*)
- Tub gurnard (*Chelidonichthys lucernus*)
- Fivebeard rockling (*Ciliata Mustela*)
- Herring (*Clupea harengus*)
- Corkwing wrasse (*Crenilabrus melops*) Black goby (*Gobius niger*)
- Two-spotted goby (*Gobiusculus flavescens*)
- Greater sand eel (*Hyperoplus immaculatus*)
- Great sand eel (*Hyperoplus lanceolatus*)
- Ballan wrasse (*Labrus bergylta*)
- Dab (*Limanda limanda*)
- Shanny (*Lipophrys pholis*)
- Golden grey mullet (*Liza aurata*)

- Thinlip mullet (*Liza ramada*)
- Whiting (*Merlangius merlangus*)
- Striped red mullet (*Mullus surmuletus*)
- Straightnose pipefish (*Nerophis ophidion*)
- Flounder (*Platichthys flesus*)
- Plaice (*Pleuronectes platessa*)
- Pollack (*Pollachius pollachius*)
- Common goby (*Pomatoschistus microps*)
- Sand goby (*Pomatoschistus minutus*)
- Painted goby (*Pomatoschistus pictus*)
- Thornback ray (*Raja clavata*)
- Sea trout (*Salmo trutta*)
- Lesser spotted dogfish (*Scyliorhinus canicular*)
- Sole (*Solea solea*)
- Stickleback (*Spinachia spinachia*)
- Sprat (*Sprattus sprattus*)
- Greater pipefish (*Syngnathus acus*)
- Lesser pipefish (*Syngnathus rostellatus*)
- Long-spined sea scorpion (*Taurulus bubalis*)
- Pouting (*Trisopterus luscus*)
- Poor cod (*Trisopterus minutus*)
- Sea bass (*Dicentrarchus labrax*)
- Lesser weever (*Echiichthys vipera*)
- Snake pipefish (*Entelurus aequoreus*)
- Grey gurnard (*Eutrigla gurnardus*)
- Cod (*Gadus morhua*)
- Three-spined stickleback (*Gasterosteus aculeatus*)

Metric 2 identifies 'indicator' species. These are the species for which the presence or absence is an indicator of condition of the fish population (quality element) within a water body. A list of species relevant to metric 2 (taking all catch methods into account) is provided in Appendix A.

Given the location of the abstraction the species relevant to the assessment of impacts on river water bodies from entrainment/impingement are those which migrate between Milford Haven Inner upstream and rivers where they may form part of the fish community. The following migratory species are considered relevant:

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

Of these species European eel, Sea lamprey, River lamprey and Sea trout have been recorded during impingement and entrainment surveys at Pembroke power station since monitoring began in 2012.

6.2.1 Entrainment Monitoring

Entrainment monitoring at Pembroke PS has been undertaken since 2012 with results reported annually to NRW.

Each survey comprises a single 24-hour monitoring period, with entrained samples sorted and speciated. This data set provides an accurate reflection of variation in larval fish affected by the abstraction licenced for the PS. The monitoring programme has been adapted to focus on the period of peak entrainment. Table 12 outlines the number of entrainment surveys undertaken each month between 2012 and 2022.

Table 12. Number of entrainment sampling surveys undertaken per month between 2012 and 2022 (note 2020 had reduced sampling owing to Covid)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	1	-	1	-	2	2	2	-	1	-	1	-
2013	-	-	-	-	2	2	2	-	-	-	-	-
2014	-	-	-	-	2	2	2	-	-	-	-	-
2015	-	-	-	1	2	2	2	1	-	-	-	-

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	-	-	-	1	2	2	2	1	-	-	-	-
2017	-	-	-	1	2	2	2	1	-	-	-	-
2018	-	-	-	1	2	2	2	1	-	-	-	-
2019	-	-	-	1	2	2	2	1	-	-	-	-
2020	-	-	-	-	-	-	2	1		-	-	-
2021	-	-	-	2	2	2	2	1	-	-	-	-
2022	-	-	-	2	2	2	2	1	-	-	-	-

Fish eggs are most vulnerable to entrainment during the early spring (March – May) while peak larval fish entrainment occurs predominantly during late spring and summer (May – July). The total numbers of entrained fish from 2012 to 2021 are shown in Figure 2.

Since 2012, between 3.7 and 14.8 million eggs are estimated to have been entrained during the peak spawning period (May -July) each year, with between 22.2 and 76.7 million fish larvae entrained during the corresponding period (2020 data excluded due to incomplete data set) (Figure 2). Statistical analysis has shown that rates and species composition of entrainment have remained relatively consistent throughout the sampling period (Jacobs, 2021).

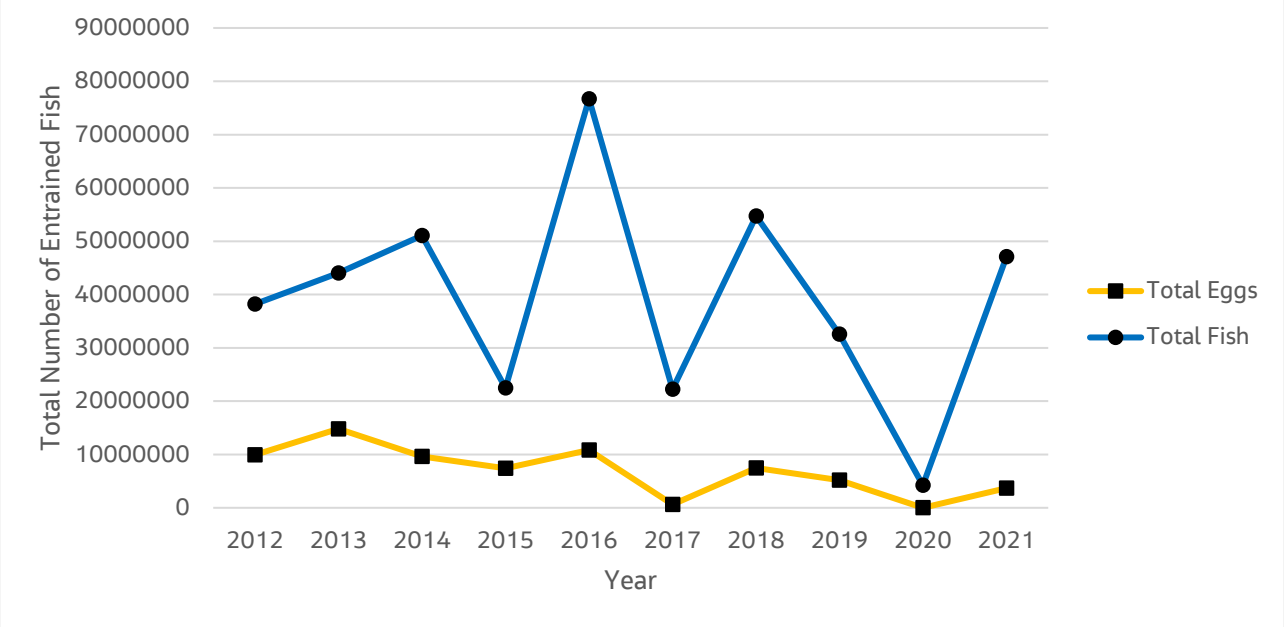

Figure 2. Total estimated egg and larval abundance entrained during the peak spawning period from May to July (Jacobs, 2021).

6.2.2 Impingement Monitoring

Impingement monitoring at Pembroke PS has been undertaken since 2012 with results reported annually to NRW.

Impingement sampling is intended to assess the abundance and biomass of fish impinged within the CW intake system. In 2012, impingement surveys took place over a 24-hour period at a rate of 15 surveys per annum with survey effort concentrated during the early part of the year. During the 2012 monitoring programme, impingement patterns demonstrated strong seasonality with the highest and most variable catches observed during the spring, autumn and to a lesser extent, winter months (Jacobs, 2013). Since

2013, impingement surveys have continued to take place over a 24-hour period but at a rate of 40 surveys per annum.

To determine a 'typical' daily (i.e. 24-hour) impingement catch for each month, the geometric mean was calculated using data from surveys carried out within the same month. To extrapolate to 10^6 m^3 of seawater abstracted, typical daily catches were divided by the typical daily abstraction volume (derived by taking the mean daily CW flow (m^3 per day) for each month) and multiplying by 10^6. To estimate annual impingement pressure, the typical daily impinged catch for a month was divided by the typical daily abstraction volume for that month, multiplied by the actual total monthly abstraction volume to get a monthly total and then summed over each month for the year.

For analysis of fish catches, data collected between 2012 and 2022 have been used to examine temporal impingement patterns. The estimated total numbers of fish impinged are shown in Figure 3. Fish monitoring data has shown that temporal variations in the impingement of fish taxa has largely reflected patterns of abundance and distribution within Milford Haven and the vicinity of the intake. During 2017, RWE began a more intensive maintenance programme of the fish protection measures which could have resulted in improved efficiency of the mitigation. This change in abundance was examined in the annual monitoring reports prepared as part of the Environmental permit compliance and concluded that there is no evidence to suggest that entrapment at Pembroke Power Station is applying a detectable or significant ecological pressure to fish populations at the species or community level (Jacobs 2023b).

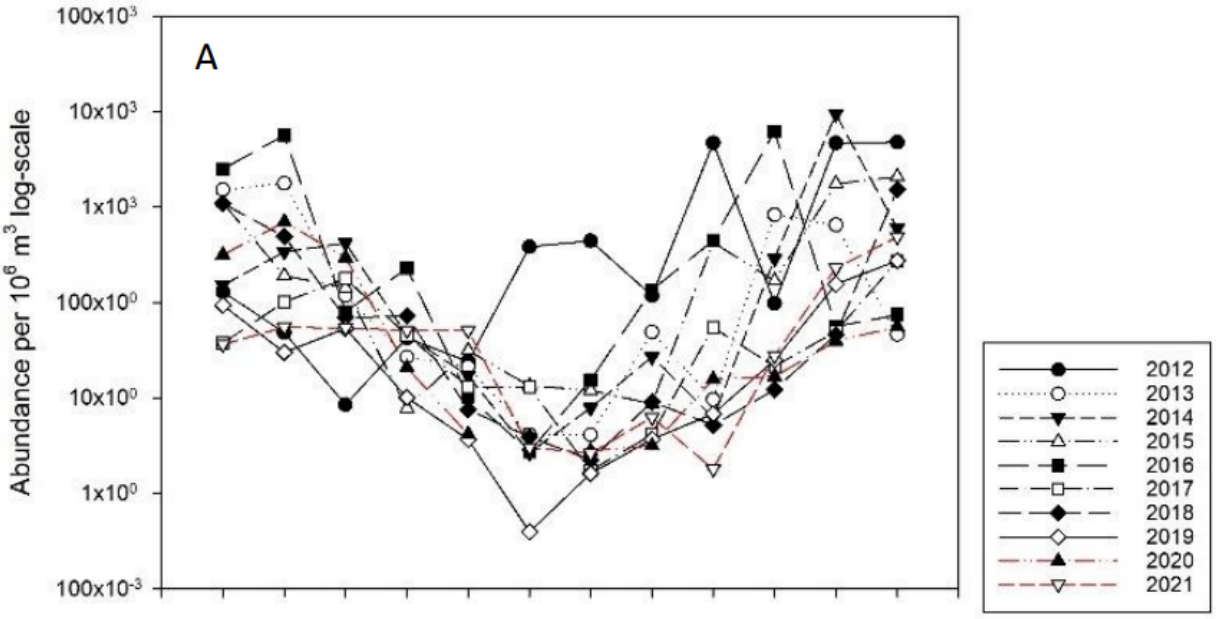

Figure 3. Geometric mean abundance of fish impingement at Pembroke Power Station.

6.2.3 Equivalent Adult Values

Entrapment of larval (ichthyoplankton) and juvenile fish on power station CW screens is commonly assessed using the EAV concept (Dempsey, 1988). This is considered the best practical approach for assessing the commercial significance of entrapment (BEEMS, 2011).

EAVs provide ecological context to entrapment catches, equating larval and juvenile fish numbers to adult population estimates. Furthermore, EAVs enable entrapment of larval and juvenile fish to be interpreted in the context of the dietary needs of marine predators which target adult life stages.

The EAV of a fish is calculated from species specific lifetables (developed specific to the Celtic sea region) which require data such as age-specific fecundity, survivorship and weight-at-age which is derived from published literature. The applicability of the EAV method is therefore limited to those species for which

adequate life history data are available which are often the more studied commercially important species. Application of EAV is undertaken assuming 100% mortality of all species entrapped to represent a worst case for the purposes of assessment.

Whilst these species only represent a small proportion of the community it provides a useful context to understanding how the raw numbers of entrapped individuals mean in the context of the fish community.

Data for the EAVs of entrapped fish (entrainment and impingement combined) are shown in Table 13. These data demonstrate the estimated total adult loses of the Pembroke Power Station abstraction over the whole reported sampling period (2012 to 2021). The maximum annual values for these species are 229 sand eel in 2013; 2,929 herring in 2013; 505,211 sprat in 2014; and 75,181 Gobiidae in 2016. It is noted that the total EAVs vary markedly between years and are often much lower than the maximum (or are zero for some species).

Table 13. Equivalent Adult Values of entrained fish species combined with total number impinged each year (extrapolated to monthly abstraction rates). * The speciation of larval gobies with a high degree of certainty is extremely difficult and therefore the majority of individuals were recorded as Gobiidae.

Taxa	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sand eel	220	229	92	177	202	144	9	23		
Gobiidae*	52,316	36,691	39,259	21,112	75,181	21,636	47,612	24,003	10,346	42,318
Sand goby	57,475	26,235	5,689	18,534	13,248	884	605	82	3,655	3,687
Sprat	88,112	309,971	505,211	182,172	474,950	8,275	54,837	9,209	14,685	14,879
Clupeidae (as sprat)	724,283	79,534	4,744	22,615	84,601	45,997	9,560	9,474	3,820	44,384
Herring	1,451	2,929	795	2,713	1,427	512	142	49	109	214
Clupeidae (as herring)	64,863	80	62	1,095	1,201	381	40	61	288	1,300
Bass	3	32	42	239	72	24	8	20	36	6
Corkwing wrasse					4		7	8		
Dab										1
Dragonet						3				9
Plaice					127	83	64			
Solenette						2	7			
Whiting					643	490	82	20	248	127

Entrainment of juvenile fish and larvae by Pembroke Power Station is considered to represent a very small fraction of the number of fish removed from the community by other means, especially when compared with commercial fishing within the Celtic Sea. Based on analysis of other fish surveys within the wider area of Milford Haven from 2008 to 2021 there have been no discernible changes in the fish community (Jacobs, 2023). Whilst intuitively these numbers appear large in isolation, considering the life history traits of fishes (i.e. over-production of eggs and larvae to account for high rates of natural mortality), the equivalent adult value (EAV) of early life stages and environmental monitoring data from the wider Haven, there is no evidence to suggest that entrainment at Pembroke Power Station is applying a detectable or ecologically significant pressure on wider fish populations. Detailed assessments of entrapment pressure are undertaken on a regular basis through the Environmental Permit compliance (Jacobs 2023b, c). These studies have shown that there is no evidence to suggest that ongoing entrapment pressure is having a significant ecological effect on fish at the species of community level. The assessments consider patterns at the individual species level as well as looking for trends at the community level.

6.3 Impacts on Fish

6.3.1 European Eel

European eel have been recorded in the impingement surveys at Pembroke power station in all years from 2012 to 2022 (Figure 4). European eel has not been recorded in entrainment samples.

The abundance of the different life stages of this species which have been recorded within impingement surveys is summarised in Table 12. The abundance of glass eel recorded within impingement catches has ranged from zero in 2012, which is possibly due to the lower sampling resolution during this monitoring year; and ten individuals recorded in 2014. For the period from (2015 – 2020), the number of glass eel recorded in impingement catches remained consistent at two individuals per annum and increased to three in 2021 and then dropped to one in 2022. Glass eel are predominately vulnerable to impingement during the late winter and early spring months (January to May).

Catches of yellow/silver eel increased between 2012 and 2014 from two to 32 individuals. A further increase was observed between 2015 and 2016 from 19 to 80 individuals. Since 2017 a maximum of 25 individuals (2018) and a minimum of zero individuals (2021) have been impinged. A number of yellow/silver eel recorded in 2016 occurred over two days (18th and 19th January, n = 34). The approach to the intake was dredged two days prior to these surveys (16th and 17th January), with additional dredging works being carried out within the wider Haven under a separate marine licence. It is highly likely that the subsequent increase in impingement of yellow/silver eel was due to the disturbance of habitats within the vicinity of the intake and the degradation of strobe light penetration as a result of increased suspended sediment, therefore represents an 'abnormal' activity in the context of normal abstraction. Whilst eel are impinged at the Power Station, studies have shown that they can have up to 80% survival and are returned to the Haven in a viable state (2016).

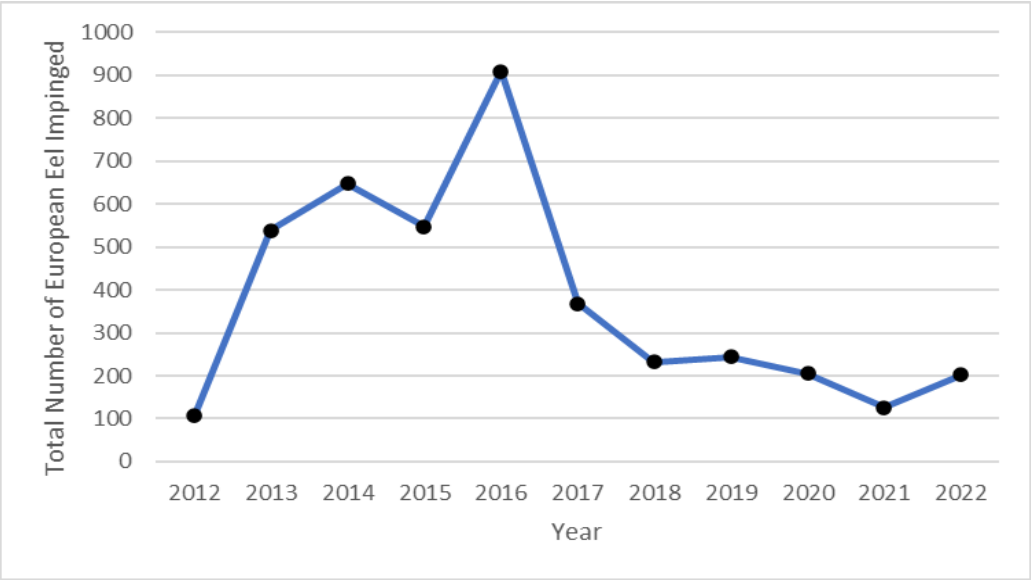

Figure 4. Total estimated European Eel impingement at Pembroke Power Station.

Yellow/silver eel populations within Milford Haven appear to be vulnerable to impingement all year round (greatest impingement between November and May). During 2017, a regular cleaning and maintenance of the fish deterrent system has been undertaken which likely increased the efficiency of the fish protection measures. Based on the long-term dataset of entrapment at Pembroke Power Station it is considered that the numbers of eel entrapped annually comprise a small proportion of the estimated silver eel output for the Western Wales River Basin District. European eel, including glass eel, yellow and silver eel life stages are not unexpected within the screen surveys, as they are known to migrate into the Pembroke River upstream of the intake. The 2020 and 2021 extrapolated annual abundance of 40 and 43 eels respectively (all life stages

combined) continues to represent a small proportion of the estimated silver eel output for the Western Wales River Basin District (11768kg in 2019 NRW Pers comm).

6.3.2 Lamprey

In total, 25 sea lamprey have been recorded in impingement surveys since monitoring began in 2012; the highest abundance recorded in a single year was seven (2013). No sea lamprey were recorded in 2020 and 2022 while one was recorded in 2021.

6.3.3 Salmonids

Sea trout have been recorded in small numbers (nine in total) in impingement surveys in six years (2013-2017, 2021) since the Power Station commenced operation. Due to the life-cycle of salmonids it is extremely unlikely that individual juvenile life-stages would be present in the vicinity of the Pembroke Power Station.

6.3.4 Twaite Shad

Historic fish data from Milford Haven have been provided by the Field Studies Council (Crothers, 1966) and record the presence of Twaite Shad. NRW (2009) state that ad-hoc records of twaite shad exist for Milford Haven but that the number of individuals within the area is likely to be highly seasonal as well as dynamic and while present in the Cleddau are unlikely to be spawning (Clarke *et al*, 2021). This species has not been recorded in any surveys relating to Pembroke Power Station. While this species may be an occasional visitor to Milford Haven this is at such low numbers that no examples of the species have been found in any surveys relating to Pembroke Power Station.

6.3.5 European Smelt

European smelt have not been recorded in any surveys at Pembroke Power station. There are currently no records of this species having been found in Milford Haven (MARLIN, 2023). While this species may be an occasional visitor to Milford Haven this is at such low numbers that no examples of the species have been found in any surveys relating to Pembroke Power Station.

6.3.6 Estuarine Fish Community

The Pembroke Power Station abstraction results in a loss of fish, fish eggs and larvae from the resident fish community within Milford Haven. The species affected include a number of those which are considered to be important to the overall composition of the fish community. The species assemblage entrapped in the Pembroke Power Station intake are typical of an estuarine community dominated by estuarine residents such as Gobiidae.

When considering entrainment of larval fish, the numbers should take into account that many of the fish species tend towards mass over-production of eggs and natural mortality in early life-stages is usually very high (Houde, 1997). The EAV approach has been referenced for selected species to aid with contextualising the 'raw' numbers of larval abundance recorded from entrainment sampling into meaningful numbers of adults (see Section 6.2.3).

6.4 Assessment of Fish in the Milford Haven Inner waterbody

The fish quality element in Milford Haven Inner is currently classified as good (latest assessment in 2021 – Cycle 3). The abstraction is an ongoing activity that has been continually carried out prior to and during the data gathering process which informed the Cycle 3 classification of quality elements. Based on the assessments provided in Section 6, the numbers of fish that are entrapped by Pembroke PS are not considered likely to have any impact on the fish quality element in Milford Haven Inner.

Milford Haven Inner is classified as a natural water body and lies within the Cleddau/Milford Haven opportunity catchment. The West Wales RBMP commits to a number of local actions which once achieved would assist the catchment in achieving overall good potential. An assessment of whether the project could compromise or prevent these actions from being achieved in presented in Table 14. This shows that there are no mitigation measures that would be compromised by the abstraction at Pembroke PS.

Table 14. Consideration of mitigation measures for Milford Haven Inner.

Local action	Local Action ID	Would the action be compromised by the abstraction?
Targeted nutrient reduction visits	LA26	No. There would be no change to the existing situation and this action can continue.
Develop Fisheries Habitat and River Restoration Plan Actions	LA28	No. There would be no change to the existing situation and this action can continue.
Installation of a fish pass on the Eastern Cleddau at Canaston	LA29	No. There would be no change to the existing situation and this action can continue.
Fisheries mitigation work at Llys-y-Fran reservoir	LA30	No. There would be no change to the existing situation and this action can continue.
Review and support Innovative solutions for nutrient reduction	LA31	No. There would be no change to the existing situation and this action can continue.
Action to reduce phosphate in Afonydd Cleddau SAC	LA32	No. There would be no change to the existing situation and this action can continue.
4 Rivers for LIFE Project Afonydd Cleddau delivery	LA62	No. There would be no change to the existing situation and this action can continue.

The assessment of impacts of ongoing abstraction at Pembroke PS on Milford Haven Inner concludes that:

1. There is no potential for deterioration of the fish quality element in this water body; and
2. The project would not jeopardise the ability of the water body to achieve overall good ecological potential.

6.5 Assessment of Riverine Water Bodies

Seven migratory species (European eel, Atlantic salmon, sea trout, River and Sea lamprey, European smelt as well as Twaite shad) were considered in the assessment, given the potential for impacts on those species to affect the classification of the fish quality element in water bodies where the expected prevalence threshold is exceeded.

There are no impacts on juvenile or adult life stages of Atlantic salmon, European smelt, and Twaite shad as these species are not regularly found within the estuary. While a few individuals of sea trout, River and Sea lamprey have been recorded it is considered that the impact on populations in upstream catchments is negligible.

Whilst it is acknowledged that there is impingement of European eel, abundance is limited and individuals impinged has shown significant reduction since the enhanced cleaning and maintenance programme was implemented in 2017. Given the low numbers recorded it was not possible to generate Equivalent Adult Values for European eel derived from entrainment data. It is recognised that the actual numbers that are entrained would be greater than the numbers observed in samples. However, considering that the migration of glass eels typically comprises millions of individuals and that the impingement surveys only recorded 32 individuals over 11 years of sampling, the impact is considered to be negligible.

The assessment of impacts of ongoing abstraction at Pembroke PS on screened in river water bodies concludes that:

1. There is no potential for deterioration of the fish quality element in any of the river water bodies; and
2. The project would not jeopardise the ability of any of the river water bodies to achieve overall good ecological status or potential.

7. Conclusion

There is no evidence that indicates abstraction related losses of fish adversely affect biological status of the waterbody. The ongoing abstraction of water at Pembroke PS therefore would not cause deterioration in the status of any quality elements in the water body in which the activity takes place (Milford Haven Inner) nor would the project prevent the water body from achieving good ecological potential. The Milford Haven Inner waterbody has continued to be classified as good for fish, during the operation of the current abstraction licence.

The assessment considered the potential for the fish quality element in river water bodies to be affected by the loss of migratory species which form part of the riverine fish community. The assessment concluded that the impacts on migratory species are negligible and that there is no potential for deterioration of the fish quality element in any of the river water bodies, nor would the project jeopardise the ability of any of the river water bodies to achieve overall good ecological status or potential.

Consideration of WFD protected areas considered the risks to water-dependent SPAs, SACs, Nitrate Vulnerable Zones, Shellfish Waters and Bathing Waters. The assessment concluded that these sites are not at risk and that the project is compliant with other relevant legislation.

On this basis the project is considered to be fully compliant with the requirements of *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended)*.

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Appendix A. Reference species lists for TFCI metrics

Metric 1 reference species (taking all catch methods into account)

- Pogge (*Agonus cataphractus*)
- Lesser sand eel (*Ammodytes tobianus*)
- European eel (*Anguilla anguilla*)
- Transparent goby (*Aphia minuta*)
- Mediterranean scaldfish (*Arnoglossus laterna*)
- Red gurnard (*Aspitrigla cuculus*)
- Sand smelt (*Atherina presbyter*)
- Solenette (*Buglossidium luteum*)
- Common dragonet (*Callionymus lyra*)
- Reticulated dragonet (*Callionymus reticulatus*)
- Thicklip grey mullet (*Chelon labrosus*)
- Tub gurnard (*Chelidonichthys lucernus*)
- Fivebeard rockling (*Ciliata Mustela*)
- Herring (*Clupea harengus*)
- Corkwing wrasse (*Crenilabrus melops*)
- Sea bass (*Dicentrarchus labrax*)
- Lesser weever (*Echiichthys vipera*)
- Snake pipefish (*Entelurus aequoreus*)
- Grey gurnard (*Eutrigla gurnardus*)
- Cod (*Gadus morhua*)
- Shore rockling (*Gaidropsarus mediterraneus*)
- Three-spined stickleback (*Gasterosteus aculeatus*)
- Black goby (*Gobius niger*)
- Two-spotted goby (*Gobiusculus flavescens*)
- Greater sand eel (*Hyperoplus immaculatus*)
- Great sand eel (*Hyperoplus lanceolatus*)
- Ballan wrasse (*Labrus bergylta*)
- Common dace (*Leuciscus leuciscus*)
- Dab (*Limanda limanda*)
- Common seasnail (*Liparis liparis*)
- Shanny (*Lipophrys pholis*)
- Golden grey mullet (*Liza aurata*)
- Thinlip mullet (*Liza ramada*)
- Whiting (*Merlangius merlangus*)
- Striped red mullet (*Mullus surmuletus*)
- Shorthorn sculpin (*Myoxocephalus scorpius*)
- Straightnose pipefish (*Nerophis ophidion*)
- European perch (*Perca fluviatilis*)
- Rock gunnel (*Pholis gunnellus*)
- Eurasian minnow (*Phoxinus phoxinus*)
- Flounder (*Platichthys flesus*)
- Plaice (*Pleuronectes platessa*)
- Pollack (*Pollachius pollachius*)
- Saithe (*Pollachius virens*)
- Common goby (*Pomatoschistus microps*)
- Sand goby (*Pomatoschistus minutus*)
- Painted goby (*Pomatoschistus pictus*)
- Thornback ray (*Raja clavata*)
- Roach (*Rutilus rutilus*)
- Atlantic salmon (*Salmo salar*)
- Sea trout (*Salmo trutta*)
- Brill (*Scophthalmus rhombus*)
- Lesser spotted dogfish (*Scyliorhinus canicular*)
- Sole (*Solea solea*)
- Stickleback (*Spinachia spinachia*)
- Sprat (*Sprattus sprattus*)
- Greater pipefish (*Syngnathus acus*)
- Lesser pipefish (*Syngnathus rostellatus*)
- Long-spined sea scorpion (*Taurulus bubalis*)
- Pouting (*Trisopterus luscus*)
- Poor cod (*Trisopterus minutus*)
- Eelpout (*Zoarces viviparus*)

Metric 2 reference species (taking all catch methods into account)

- European sea sturgeon (*Acipenser sturio*)
- Allis shad (*Alosa alosa*)
- Twaite shad (*Alosa fallax*)
- European eel (*Anguilla anguilla*)
- River lamprey (*Lampetra fluviatilis*)
- European smelt (*Osmerus eperlanus*)
- Sea lamprey (*Petromyzon marinus*)
- Atlantic salmon (*Salmo salar*)
- Sea trout (*Salmo trutta*)