

Assessing Welsh Aquaculture Activities Inception Report

Report No: 605

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We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well-resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

This Evidence Report series serves as a record of work carried out or commissioned by Natural Resources Wales. It also helps us to share and promote use of our evidence by others and develop future collaborations. However, the views and recommendations presented in this report are not necessarily those of NRW and should, therefore, not be attributed to NRW.

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Crynodeb Gweithredol

Cynlluniwyd Prosiect Asesu Gweithgareddau Dyframaethu Cymru i gefnogi datblygiad cynaliadwy ynghyd â rheolaeth gynaliadwy o adnoddau dyframaethu o fewn fframwaith cynllunio morol gofodol ac integredig. Bydd y prosiect yn cefnogi cynllunio morol yng Nghymru drwy ddarparu set o adnoddau cyffredin a thryloyw a fydd yn seiliedig ar dystiolaeth ar gyfer datblygwyr, rheoleiddwyr a chynghorwyr.

Mae adnoddau'r Prosiect yn cynnwys:

- Cronfa Ddata sy'n cynnwys dystiolaeth am effeithiau gweithgareddau dyframaethu;
- Taenlen Rymgweithiol sy'n dangos sensitifrwydd cynefinoedd a rhywogaethau i weithgareddau dyframaethu amrywiol;
- Asesiadau o weithgareddau dyframaethu ar sail dystiolaeth; a
- Mapiau sensitifrwydd o fiotopau cynefinoedd a rhywogaethau i weithgareddau dyframaethu.

Mae'r Adroddiad Cychwynnol hwn yn cyflwyno gwybodaeth am gwmpas ac amcanion Prosiect Asesu Gweithgareddau Dyframaethu Cymru. Mae'n rhoi disgrifiad manwl o'r dull gweithredu ar gyfer pob un o'r tasgau a sut y caiff y canlyniadau eu paratoi. Darperir rhagdybiaethau allweddol lle bo hynny'n briodol.

Cefnogir y Prosiect gan yr Undeb Ewropeaidd drwy Weinidogion Cymru ac fe'i hariennir yn llawn gan Gronfa'r Môr a Physgodfeydd Ewrop.

Executive Summery

The Assessing Welsh Aquaculture Activities Project has been designed to support the sustainable development and sustainable management of aquaculture resources within a spatial and integrated marine planning framework. It will support marine planning in Wales through providing developers, regulators and advisors with a set of common, transparent, evidence-based resources.

The Project resources include:

- An Evidence Database on the impacts of aquaculture activities;
- An Interactions Spreadsheet showing the sensitivity of habitats and species to various aquaculture activities;
- Evidence-based aquaculture Activity Assessments; and
- Sensitivity Maps of habitat biotopes and species to aquaculture activities.

This Inception Report presents information on the scope and objectives of the Assessing Welsh Aquaculture Activities Project. It provides a high level description of the approach for each of the tasks and how the deliverables will be produced. Key assumptions are provided where appropriate.

The Project is supported by the EU through Welsh Ministers and is fully funded by the European Maritime and Fisheries Fund.

1 Introduction

1.1 Project Background

Natural Resources Wales' (NRW) purpose is to ensure that the natural resources of Wales are sustainably maintained, used and enhanced, now and in the future. NRW has sustainable development at the heart of its evidence programme, delivering results for the people, environment and economy in Wales.

NRW has been awarded funding through the European Maritime and Fisheries Fund (EMFF) Measure II.7: Article 51 (increasing the potential of aquaculture sites) to undertake the Assessing Welsh Aquaculture Activities Project (the AWAA Project).

The AWAA Project is supported by the EU through Welsh Ministers and is fully funded by the EMFF.

The AWAA Project will support the sustainable development and sustainable management of aquaculture resources within a spatialised and integrated marine planning framework. The AWAA Project will assess and map the sensitivity of marine habitats and species to the impacts from a variety of aquaculture activities, indicating the most environmentally sustainable opportunities for aquaculture development and conversely indicating areas of potential constraint. The AWAA Project will support marine planning in Wales through providing developers, regulators and advisors with a set of common, transparent, evidence-based resources on which to inform decisions and guidance. While the Project resources will not refer to particular environmental conditions, footprint or intensity of activities they can be used to inform any relevant environmental assessments or reports.

The AWAA Project resources include:

- An Evidence Database on the impacts of aquaculture activities;
- An Interactions Spreadsheet showing the sensitivity of habitats and species to various aquaculture activities;
- Evidence-based aquaculture Activity Assessments; and
- Sensitivity Maps of habitat biotopes and species to aquaculture activities.

Developing aquaculture evidence in this way will support the implementation of the Welsh National Marine Plan (WNMP) and the sustainable development and management of marine natural resources. The outputs of the AWAA Project will complement the Welsh Government's recently completed Sustainable Management of Marine Natural Resources Project (SMMNR) (Welsh Government, 2020). The SMMNR Project collated environmental evidence and mapped, at a high level, potential ecological constraints to aquaculture, tidal stream and wave energy developments. The AWAA Project represents an important next step in the mapping of environmental considerations in relation to aquaculture development, as it will examine in more detail the sensitivities of marine biotopes (that comprise habitats) and species to different types of aquaculture.

This Inception Report presents information on the scope and objectives of the AWAA Project. It provides a high level description of the approach for each of the tasks and how the deliverables will be produced. Key assumptions are provided where appropriate.

The AWAA Project contract will be delivered by ABPmer Ltd. on behalf of NRW following a competitive procurement process. NRW will manage the contract and employ a part-time ecologist, funded by EMFF, to quality assure the AWAA Project outputs.

The AWAA Project started in December 2021 and will complete all tasks by June 2023. The approach to the delivery of these interlinked tasks, along with the associated work programme, is outlined in this Inception Report.

2 Project Scope

2.1 Geographic scope

The geographic scope of the AWAA Project is the ‘Welsh Zone’, defined as that part of the sea within British fishery limits adjacent to Wales by The Welsh Zone (Boundaries and Transfer of Functions) Order 2010 (Figure 1).

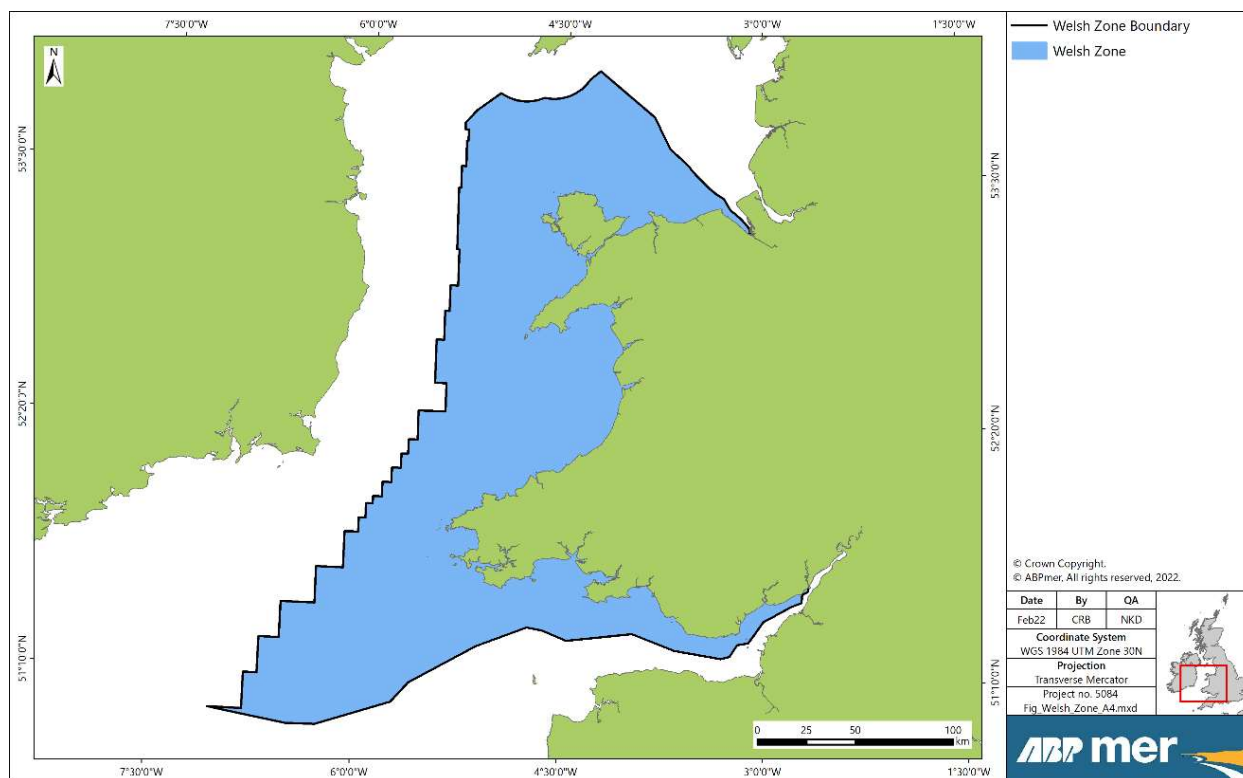


Figure 1: Geographic scope of the AWAA Project

2.2 Definition of aquaculture

The AWAA Project, like the SMMNR Project (Welsh Government, 2020), defines aquaculture as;

“the rearing or cultivation of aquatic organisms such as finfish, shellfish and algae. Aquaculture includes producing aquatic organisms for direct commercial purposes (e.g. seafood for human or animal consumption, pharmaceuticals, or algae for fertiliser or energy) or for restocking and enhancing of wild populations”.

2.3 Identification of relevant aquaculture activities

The aquaculture activities identified and defined for consideration in the AWAA Project (Table 1) are primarily focused on those activities that currently take place in Wales or are considered to have significant potential for commercial development.

Table 1: Aquaculture activities

Activity Category	Description
Intertidal Shellfish (Trestles / Bags and Poles / Purses)	Systems of trestles with bags and / or poles with purses for growing shellfish
Intertidal Shellfish (Ground Laid, Hand Harvested)	Ground laid shellfish harvested by hand
Intertidal Shellfish (Ground Laid, Mechanically Harvested)	Ground laid shellfish harvested using machinery such as dredges
Intertidal Seaweed (Planted)	Seaweed planted direct in substrate or containers
Subtidal Shellfish (Baskets or Rafts)	Includes baskets or rafts growing shellfish on the seabed, or the surface of the water, or between the seabed and surface of the water
Subtidal Shellfish (Ropes)	Ropes to self-seed or with seeded shellfish in the water column
Subtidal Shellfish (Ground Laid, Mechanically Harvested)	Ground laid shellfish harvested using dredges
Subtidal Seaweed (Rope)	Ropes to self-seed or with pre-seeded lines in the water column
Subtidal Seaweed (Rafts or Nets)	Includes raft or nets growing seaweed on the seabed, or the surface of the water, or between the seabed and surface of the water
Subtidal Fish (Cages)	Includes cages containing fish on the seabed, or the surface of the water, or between the seabed and surface of the water

The pressures associated with finfish farming will not be considered in detail by the AWAA Project as there is no sea-based cultivation of finfish in Wales and there is considered to be limited current potential for commercial development. The focus of the AWAA Project, as highlighted by the WNMP and SMMNR guidance, will be the cultivation of bivalve shellfish and seaweed.

Land-based aquaculture activities and ancillary activities such as access to aquaculture sites will not be considered by the AWAA Project. However, relevant AWAA Activity Assessments will identify where further consideration may be needed on the impacts from ancillary activities that are beyond the scope of the Project.

2.4 Pressures arising from aquaculture activities

A fixed list of pressures that potentially arise from aquaculture activities (see Appendix 1) will be used by the AWAA Project, based on the standardised list produced by OSPAR (as used in MarLIN, 2014). This ensures consistency with any future work undertaken by NRW, the way pressures are assessed, and their impact on biodiversity evaluated. Following the AWAA evidence review, the full pressures list will be refined to include only those relevant to the Project.

2.5 Habitats and species to be considered

The habitats of interest will be those referred to under various legislation such as Annex 1 of the Habitats Directive, habitats designated as Marine Conservation Zones (MCZs) under the Marine and Coastal Access Act 2009, habitats designated as Sites of Special Scientific Interest (SSSIs) under the Wildlife and Countryside Act 1981 and habitats listed under Section 7 of the Environment (Wales) Act 2016. The AWAA Project will include intertidal and subtidal habitats known to be present in Welsh waters. Coastal habitats and their component species will not be considered in the Project. Intertidal and subtidal habitats will be further broken down into their component biotopes (EUNIS levels 5 and 6) to inform sensitivity assessments.

The species of interest will be those referred to under various legislation such as Annex 2 of the Habitats Directive, the Birds Directives, those named in Ramsar Sites, those named in SSSI designations and those listed in Section 7 of the Environment (Wales) Act 2016. A full list of habitats and species will be produced for the Project. Species will be grouped by characterising behaviours (e.g. diving sea birds) following a similar approach taken with the Natural England (2016) and SMMNR (Welsh Government, 2020) projects. Some specific habitats and species may be scoped out if aquaculture activities in Wales are considered unlikely to interact with these features now and in the future. Scoping out of any habitats and species will be done in consultation with NRW with clear justification provided.

Information on the pressures and effects from aquaculture activities on marine habitats and species will be determined from a detailed evidence review. The sensitivity of component biotopes (that comprise habitats) and species will be derived from the respective MarESA and Natural England databases. Further details on how this will be undertaken are provided in Section 3.

Sensitivity Maps will be produced showing where biotopes and species are in Welsh waters in relation to the various aquaculture activities assessed.

3 Project Tasks

The interlinked tasks and resources to be delivered by the AWAA Project are detailed in Figure 2.

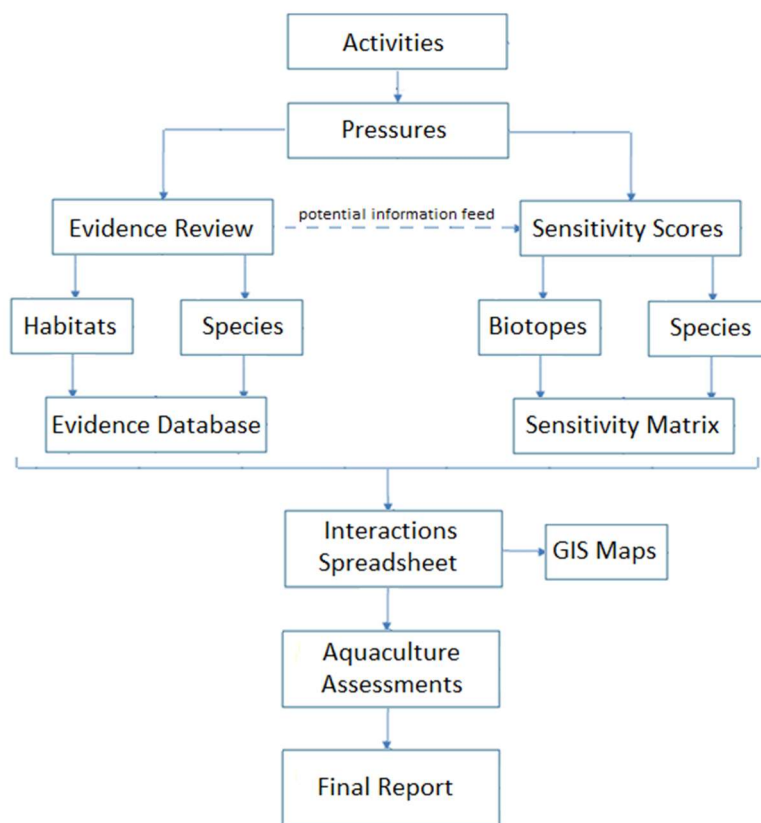


Figure 2: Project tasks, resources and linkages

3.1 Evidence Database

The evidence review will investigate the evidence available for the various pressures exerted on habitats and species by aquaculture activities. The review will provide a compilation and synthesis of the relevant aquaculture evidence to produce the AWAA Evidence Database. The Database will be searchable and built to facilitate integration with the sensitivity scores of component biotopes and species (section 3.2) to produce an Interactions Spreadsheet (section 3.4). The Database will use standardised terminology wherever possible and be supported by a “Readme” tab providing instructions / guidance for use. Categories within the Evidence Database will include (but are not limited to) those presented in Table 2.

For the purpose of the Project, evidence is defined as peer-reviewed papers, data, methodology, results from data analysis, interpretation of data analysis, collations and interpretations of scientific information (meta-analysis), expert opinion or advice, industry knowledge, grey literature, and anecdotal evidence.

Table 2: Breakdown of main evidence database category columns

Evidence Database Category Columns	Description
Source Reference / Citation	Citation of evidence reference study (with link if available)
Source Summary	Brief summary of referenced study
Source Location	Geographic location of referenced study
Aquaculture Activity	Type of aquaculture (see Table 1)
Pressure / Impact Pathway	ICG-C standardised pressure list (see appendix)
Habitat / Species Type Impacted	Predefined list based (see Project Scope)
Summary of Impact	Summary of the evidence presented in the source on the impact of the specified activity and associated pressure on the habitat / species type. This will include information on intensity of the activity and any benchmarks / thresholds of impact if available.
Evidence Source Type	Peer reviewed, white paper, grey literature, website
Evidence Type	Quantitative or qualitative
Evidence Confidence	See section 3.1.2
Justification	Paragraph or statement from source reference that justifies the entry into the Evidence Database

Each row of the Database will relate to a particular combination of relevant information from the source material for a particular activity / pressure / habitat or species combination. This means the Database will contain multiple entries (rows) for some evidence sources, as some sources will include information relevant to several aquaculture activity / pressure / habitats or species combinations.

To make this manageable, it is intended to use a pivot table to show aquaculture activity vs habitat or species evidence, with the total number of evidence records for each combination displayed. By selecting a result, a new worksheet will be created that displays all the matching evidence records and their full details.

3.1.1 Approach to finding evidence sources

A literature search will initially be carried out using Web of Science to identify evidence sources from peer-reviewed journal articles. Relevant evidence sources will also be

identified within existing evidence databases such as such as the JNCC Pressures-Activities Database, the MBA's MarESA (Marine Evidence-based Sensitivity Assessment), Scottish Government's IMPACT tool, NatureScot's FeAST database, the Assessing Welsh Fishing Activities (AWFA) evidence database and Natural England's Fishing Impacts Evidence Database (FIED) etc. Additionally, a web-based literature search will also be undertaken to identify any further evidence sources.

Compound search terms designed to capture aquaculture related literature with respect to potential impacts on habitats and species will be recorded so that they are replicable. The search protocol will follow Collaboration for Environmental Evidence standards for both conduct and reporting (CEE, 2020a), and eligibility screening (CEE, 2020b). Where literature on specific species or habitats is found in general high-level searches (e.g. searches to obtain information on aquaculture in general) or from other resources (e.g. sharing of knowledge within professional network), these will be included in the review so as not to omit potentially useful information. Furthermore, useful papers or studies cited within the literature will also be reviewed.

3.1.2 Confidence in the evidence sources

Confidence in the evidence will be assigned a High, Medium or Low confidence according to the following criteria:

- *High (H) Confidence*: evidence based on peer reviewed papers and grey literature reports by established agencies.
- *Medium (M) Confidence*: evidence is based on proxy information outside of the UK or in the laboratory and / or based on limited peer-reviewed papers with reliance on grey literature and expert judgement.
- *Low (L) Confidence*: limited evidence available with a strong reliance on expert judgement.

3.2 Sensitivity Spreadsheet

The sensitivity of component biotopes that comprise marine habitats, will be derived from MarESA. MarESA uses the pressures list as defined by OSPAR ICG-C (see Project Scope and appendix), and as such will be consistent with the pressures terminology used in the Evidence Database. In addition to gathering evidence at the level of habitats and species groupings for the Evidence Database, where possible, the sensitivities of biotopes to the pressures arising from aquaculture activities will also be extracted. These will combine to produce a list that illustrates individual biotope sensitivity to each aquaculture pressure identified. Similarly, sensitivity information will be extracted for mobile species where it is available in the equivalent Natural England (2016) database.

It is possible that some pressures arising from aquaculture activities might not have been fully captured through the current standardised OSPAR definitions. Pressure definitions, benchmarks and impact thresholds will be reviewed and amended (if necessary) for suitability. However, it is noted that any modification to the pressure definitions could have implications for wider workstreams and / or advice on operations that is currently provided

by NRW. Details of any changes will therefore be discussed with NRW and fully recorded along with the supporting justification. Any changes will be for the purposes of this AWAA Project only and clearly signposted in relevant AWAA Activity Assessments.

Within the MarESA and Natural England databases a confidence score is also assigned to each biotope / species pressure relationship. This confidence score will be extracted from the databases and captured within the Sensitivity Spreadsheet. Given the large number of biotopes / mobile species and pressure combinations this process of extracting sensitivity information from the respective databases will be largely automated.

In some instances, if the sensitivity of a biotope for a pressure has not been assessed in the existing MarESA database, an alternative biotope and its associated sensitivity may be used as a proxy. The biotopes to which this applies will be clearly identified within the output matrix. If no alternative biotope can be identified these will remain as gaps within the Sensitivity Spreadsheet. For species where sensitivity data for a pressure is not available the sensitivity of an alternative species (chosen based on having similar ecological and behavioural traits) may be used as a proxy. The species to which this applies will be clearly identified within the output matrix. If no alternative species can be identified these will remain as gaps within the Sensitivity Spreadsheet.

The outputs of this exercise will allow the mapping of biotope and species sensitivity to pressures arising from the various aquaculture activities throughout Welsh waters. The Sensitivity Spreadsheets will also feed into the Interactions Spreadsheet as outlined below.

3.3 Sensitivity Maps

GIS layers will be provided for each individual pressure, with the sensitivity of biotopes and species illustrated. These Maps will be used to provide a spatial element to the analysis and can be overlaid with protected site boundaries. They will be used in conjunction with the Evidence Database, and Interactions Spreadsheet to inform the aquaculture Activity Assessments. The format of the mapping will be designed to be as interactive as possible to allow data layers to be overlaid to inform levels of biotope or species sensitivity within a particular location.

3.4 Interactions Spreadsheet

Information collated within the Evidence Database and the Sensitivity Spreadsheet will be combined to produce an Interactions Spreadsheet. This will summarise the sensitivity of biotopes (that comprise habitats) and species to the pressures arising from each of the aquaculture activities.

The degree of confidence in the activity-pressure-sensitivity relationship will also be captured within the Interactions Spreadsheet. An example of the broad definitions of confidence that could be used are outlined below in Table 3, specifically the quality of evidence (information sources), applicability of evidence, and degree of concordance (agreement between studies). The principles of key evidence review guidance e.g. Defra (2014), JNCC (2019) and CEESAT (2021) will be followed.

- *High (H) Confidence:* There is a good understanding of the impact on the same species / habitats in the UK marine environment and it is well supported by peer

reviewed papers (observational or experimental) or grey literature reports by established agencies. There is consensus amongst the experts on the impact (direction and magnitude).

- **Medium (M) Confidence:** Whilst there is an understanding of the impact on species / habitats, the evidence is based on proxy information outside of the UK or in the laboratory and / or the assessment is based on limited peer-reviewed papers and relies heavily on grey literature or expert judgement. There is a majority agreement between experts on the direction of the change; but conflicting evidence/opposing views exist on the magnitude of impact.

Low (L) Confidence: There is limited or no understanding of the impact on species / habitats and the assessment is not well supported by evidence, or only by expert judgement. There is no clear agreement amongst experts on the direction or magnitude of the impact.

Table 3: Matrix illustrating how confidence will be scored

Confidence	Evidence quality	Evidence applicability	Evidence agreement
High	Based on more than 3 recent and relevant peer reviewed papers or grey literature from established agencies.	Based on the pressure acting on the habitat / species or biotope in the Welsh Zone.	Strong agreement between multiple (>3) evidence sources.
Medium	Based on either relevant but older peer reviewed papers or grey literature from less established agencies; or based on only 2-3 recent and relevant peer reviewed evidence sources.	Based on similar pressures, or other pressures with a similar impact, acting on the habitat / species or biotope in the Welsh Zone.	Some disagreement but majority of evidence agrees. Or fewer than 3 evidence sources used.
Low	Based on either less relevant or older grey literature from less established agencies; or based on only 1 recent and relevant peer reviewed evidence source.	Based on similar pressures acting on the habitat / species or biotope in other areas, or the pressure acting upon a similar habitat / species or biotope in the UK.	Little agreement between evidence.

Note: High (H) confidence = 3, Medium (M) confidence = 2 and Low (L) confidence = 1. Scores are added up across columns to reach a total confidence score for an evidence source. An overall score and confidence rating is based on H = 7-9, M = 4-6 and L = 1-3.

3.5 Aquaculture Activity Assessment Reports

3.5.1 Assessment proforma

The aquaculture Activity Assessments will follow an agreed standardised structure, with each Assessment detailing one of the aquaculture activity types with details on impact pathways and the pressures exerted on habitats and species. The sensitivity scores of respective biotopes (that comprise habitats) and species will be included.

A standardised report *proforma* for the structure of the Assessments will be agreed with NRW. A suggested structure could include:

- Activity Description
- Assessment of Pressures Exerted by Activity
- Habitat and Species Impacted by Pressures
- Sensitivity of Habitats Based on Biotopes Present
- Confidence in sensitivity assessment
- Discussion on all pressures and impact pathways and
- Conclusion (Overall Impact of Activity)

The Assessments will be generic (i.e. not taken from a specific development proposal with details of footprint, location, intensity of activity etc.) and describe the relevant impact pathways and how they relate to the pressures and the activity being considered. For each aquaculture activity the respective Assessments will explain how ancillary activities (e.g. access) and issues of concern not considered within the Assessment (e.g. disturbance to coastal habitats or species) should be considered.

The individual Assessments will provide a balanced summary of the available evidence, with expert opinion used to interpret and provide an indication of the potential impacts on habitats and species. Reference will be made to the aquaculture activities Evidence Database and Interactions Spreadsheet, highlighting biotopes (that comprise habitats) and species sensitivities, as well as the Sensitivity Maps. The Assessment conclusions will have an associated confidence score (Table 3).

3.6 Final Report and User Guidance

The Final AWAA Project Report will summarise the outputs of the Project, including those for each of the Activity Assessments produced. The Final Report will provide guidance for the application of the resources produced, clearly highlighting that the generic outputs are a starting point for aquaculture farmers, regulators and advisors to consider their specific proposals. Any evidence gaps, limitations, assumptions, generalisations and lessons learnt will be highlighted.

3.7 Regular Project Updates

Written AWAA Project updates will be produced every two months beginning February 2022 and continue throughout the Project until completion. These updates will be disseminated by email to a stakeholder group and include a standard introduction to the Project, status of the work conducted so far and projected work plan for the remainder of the Project tasks. Progress report documents will be translated into Welsh and distributed to stakeholders by NRW. Additional stakeholder engagement will take place throughout the duration of the Project and may include online meetings and / or presentations as requested by NRW.

4 Project Work Plan

Project milestones are presented in

Table 4 with a work plan timeline in

Table 5.

4.1 Milestones

Table 4: List of AWAA Project milestones

Milestone - Deliverable	Date (Month End)
Inception Report	January 2022
Evidence Database and Sensitivity Scoring Complete	July 2022
Agreed Assessment Proforma and Interactions Spreadsheet Completed	September 2022
Aquaculture Activity Assessments Completed	February 2023
Sensitivity Maps Completed	April 2023
Final Report Published	June 2023

4.2 Work Plan

Table 5: Work plan for Project duration

	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	
Task 1	IR																		
Task 2	Evidence Database																		
Task 3					Sensitivity Scoring														
Task 4					Confidence in Sensitivity Scoring														
Task 5					Interactions Spreadsheet														
Task 6									Proforma										
Task 7									Aquaculture Activity Assessment Reports										
Task 8							Maps of Sensitivity												
Task 9														Final Report and User Guidance					
Task 10																			Publish
Task 11		Bi-Month Report		Bi-Month Report		Bi-Month Report		Bi-Month Report		Bi-Month Report		Bi-Month Report		Bi-Month Report		Bi-Month Report		Bi-Month Report	

5 References

CEE (2020a) Key CEE Standards for Conduct and Reporting – Section 5 Conducting a Search. <https://environmentalevidence.org/information-for-authors/5-conducting-a-search/>

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Defra (2014) Evidence strategy for Defra and its network <https://www.gov.uk/government/publications/evidence-strategy-for-defra-and-its-network>

JNCC (2019) Evidence Quality Assurance <https://jncc.gov.uk/about-jncc/corporate-information/evidence-quality-assurance/>

MarLIN (2014) The Marine Life Information Network <https://www.marlin.ac.uk/>

Natural England (2016) Designing and applying a method to assess the sensitivities of highly mobile marine species to anthropogenic pressures (NECR213) <http://publications.naturalengland.org.uk/publication/4972830704795648>

Welsh Government (2020) Sustainable management of marine natural resources (SMMNR). <https://gov.wales/sustainable-management-marine-natural-resources>

Appendix 1

OSPAR pressures list

Pressure	Benchmark
Abrasion / disturbance of the substrate on the surface of the seabed	Damage to surface features (e.g. species and physical structures within the habitat)
Barrier to species movement	Permanent or temporary barrier to species movement over ≥50% of water body width or a 10% change in tidal excursion
Changes in suspended solids (water clarity)	A change in one rank on the WFD (Water Framework Directive) scale e.g. from clear to intermediate for one year.
Collision BELOW water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	0.1% of tidal volume on an average tide, passing through artificial structure
Deoxygenation	Exposure to dissolved oxygen concentration of less than or equal to 2mg/l for 1 week (a change from WFD poor status to bad status).
Electromagnetic changes	Local electric field of 1V/m. Local magnetic field of 10μT
Emergence regime changes, including tidal level change considerations	A change in the time covered or not covered by the sea for a period of ≥ 1 year Or An increase in relative sea level or decrease in high water level for ≥ 1 year.
Genetic modification & translocation of indigenous species	Translocation of indigenous species and / or introduction of genetically modified or genetically different populations of indigenous species that may result in

Pressure	Benchmark
	changes in genetic structure of local populations, hybridization, or change in community structure.
Habitat structure changes - removal of substratum (extraction)	Extraction of substratum to 30 cm (where substratum includes sediments and soft rocks but excludes hard bedrock)
Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.	Compliance with all AA EQS, conformance with PELs, EACs/ER-Ls
Introduction of light	Change in incident light via anthropogenic means.
Introduction of microbial pathogens	The introduction of relevant microbial pathogens or metazoan disease vectors to an area where they are currently not present (e.g. <i>Martelia refringens</i> and <i>Bonamia</i> , Avian influenza virus, viral Haemorrhagic Septicaemia virus).
Introduction of other substances (solid, liquid or gas)	Compliance with all AA EQS, conformance with PELs, EACs/ER-Ls
Introduction or spread of invasive non-indigenous species (INIS)	The introduction of one or more invasive non-indigenous species (INIS)
Litter	Introduction of man-made objects able to cause physical harm (surface, water column, sea floor and / or strandline)
Nutrient enrichment	Compliance with WFD criteria for good status
Organic enrichment	A deposit of 100gC/m ² /yr

Pressure	Benchmark
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Damage to sub-surface features (e.g. species and physical structures within the habitat)
Physical change (to another seabed type)	Change from sedimentary or soft rock substrata to hard rock or artificial substrata or vice-versa.
Physical change (to another sediment type)	Change in sediment type by one Folk class (based on UK SeaMap simplified classification).
Physical loss (to land or freshwater habitat)	Permanent loss of existing saline habitat within site
Radionuclide contamination	An increase in 10µGy/h above background levels
Removal of non-target species	Removal of features or incidental non-targeted catch (by-catch) through targeted fishery, shellfishery or harvesting at a commercial or recreational scale.
Removal of target species	Removal of species targeted by fishery, shellfishery or harvesting at a commercial or recreational scale.
Salinity decrease	A decrease or an increase in one MNCR salinity category outside the usual range of the biotope / habitat for one year.
Salinity increase	A decrease or an increase in one MNCR salinity category outside the usual range of the biotope / habitat for one year.
Smothering and siltation rate changes (Heavy)	'Heavy' deposition of up to 30 cm of fine material added to the habitat in a single discrete event

Pressure	Benchmark
Smothering and siltation rate changes (Light)	'Light' deposition of up to 5 cm of fine material added to the habitat in a single, discrete event
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals).	Compliance with all AA EQS, conformance with PELs, EACs, ER-Ls
Temperature decrease	A decrease or an increase in 5°C for one month, or 2°C for one year.
Temperature increase	A decrease or an increase in 5°C for one month, or 2°C for one year.
Transition elements & organo-metal (e.g. TBT) contamination.	Compliance with all AA EQS, conformance with PELs, EACs, ER-Ls
Underwater noise changes	MSFD indicator levels (SEL or peak SPL) exceeded for 20% of days in calendar year
Visual disturbance	Daily duration of transient visual cues exceeds 10% of the period of site occupancy by the feature
Water flow (tidal current) changes, including sediment transport considerations	A change in peak mean spring bed flow velocity of between 0.1m/s to 0.2m/s for more than 1 year
Wave exposure changes	A change in nearshore significant wave height >3% but <5% for one year

Additional pressures (Natural England) for marine mammals and sea birds

Vibration	Particle motion equivalent for MSFD indicator levels (SEL - Sound Exposure Level or peak SPL - Sound Pressure Level) exceeded in areas used by features
Above water noise	The introduction of airborne noise above background levels during periods of site occupancy by the feature
Above water collision	The introduction of aerial structures or devices that introduce collision risk in areas used by features