Natura Impact Statement of Extensive Aquaculture operations in Slyne Head Peninsula SAC (Site Code: 002074), Co. Galway

October 2023

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1 Introduction

1.1 Overview of this document

This is a report supporting the Appropriate Assessment of extensive aquaculture operations in Slyne Head Peninsula SAC (002074). It details the Natura Impact Statement and subsequent appropriate assessment and follows from a Screening exercise carried out and reported in Marine Institute (2023).

This report is to consider if the proposed activities are likely to adversely affect the Qualifying Interests (QIs) of Natura 2000 sites in view of their Conservation Objectives (COs), and any adjacent sites, individually or in combination with existing or planned activities. This is achieved following the assessment process outlined in this document. If there is potential for the activities considered to likely, significantly affect QIs and their conservation features, they are carried forward for a Stage 2 Appropriate Assessment, which considers the impacts on the integrity of the Natura 2000 site with respect to the sites conservation objectives, and is considered on a cumulative basis with other activities and other potentially disturbing activities.

1.2 Legislative Context

Articles 3 - 16 of the European Community (EC) Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the **Habitats Directive**[1]) provide the legislative means to protect habitats and species of Community interest through the conservation of an EU-wide network of protected sites, known as **Natura 2000** sites[2]. The Habitats Directive was originally transposed into Irish law by the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997). The 1997 Regulations were subsequently replaced by the *European Communities (Birds and Natural Habitats) Regulations 2011*[3], as amended (referred to as the *2011 Birds and Natural Habitats Regulations*). Natura 2000 sites are referred to as European sites in these Regulations.

The terms Natura 2000 sites and European sites are synonymous - the term Natura 2000 sites is used in this report. Natura 2000 sites in Ireland form part of the Natura 2000 European network of protected sites. SACs are designated due to their significant ecological importance for habitats and for species protected under Annex I and Annex II respectively of the Habitats Directive. SPAs are designated for the protection of populations and habitats of bird species protected under the Birds Directive, EC 79/409/EEC[4]. The National Parks and Wildlife Service (NPWS) are the competent authority for the management of Natura 2000 sites in Ireland.

The specific named habitats and/or (non-bird) species for which an SAC or SPA are selected are called the Qualifying Interests (QI), of the site. The specific named bird species for which a SPA is selected is called the 'Special Conservation Interests' (SCI). However, in practice, the common terminology of QI applies also to SCI. The term QI is used throughout this report.

Under Article 6(3) of the Habitats Directive any plan or project likely to significantly affect the integrity of a Natura 2000 site must be subject to an Appropriate assessment (AA). The AA focuses on the likely

[1] https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm
[2] https://ec.europa.eu/environment/nature/natura2000/index_en.htm
[3] European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 - Unofficial Consolidation (Updated to 28 July 2022)(1).pdf (npws.ie)
[4] https://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

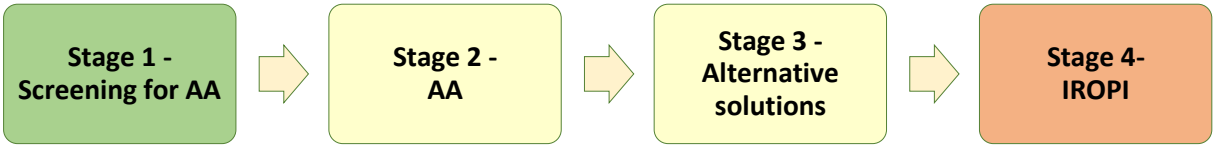
significant effects of a plan or project on a Natura 2000 site and considers the implications for the site in view of its Conservation Objectives (COs). Every Natura 2000 site has COs which are set out by the NPWS.

DAFM has responsibility for foreshore licensing functions in respect of activities wholly or primarily for the use, development or support of aquaculture under the 1933 Foreshore Act, as amended. DAFM is also the aquaculture licensing authority under the *Fisheries (Amendment) Act (1997)*[5] and determines applications for new, or renewal of, aquaculture licences. They are also the competent authority responsible for undertaking AA of aquaculture licence applications. As part of the licensing process DAFM must determine if the proposed aquaculture activities, individually or in-combination with other activities, are likely to significantly impact the Conservation Status of QIs and the integrity of the Natura 2000 site. DAFM must base its determination on an AA and is also responsible for ensuring that an AA is carried out.

1.3 Appropriate Assessment (AA) Process

The requirement for an AA derives directly from Article 6(3), which outlines the decision-making tests for considering plans and projects that may have a significant effect on a Natura 2000 site. No definition of the content or scope of AA is given in the Habitats Directive, but the concept and approach are set out in EC guidance [6]. The *Guidance on Appropriate Assessment of Plans and Projects in Ireland* document[7] published by the Department of Environment, Heritage and Local Government in 2009, sets out how an AA of plans or proposals in Natura 2000 sites in Ireland should be carried out in alignment with EC guidance. In 2021, the Office of the Planning Regulator (OPR) published a practice note on AA Screening[8], which provides guidance on how a planning authority should screen an application for planning permission for AA.

The *Guidance on Appropriate Assessment of Plans and Projects in Ireland* document promotes a four stage process to complete the AA. The four stages are:



The key procedures involved in completing the first two stages of the AA process are described below. Stage 3 and Stage 4 (Imperative reasoning of overriding public interest) are not applicable here.

1.3.1 Stage 1: Appropriate Assessment Screening

Stage 1 AA Screening is the process that addresses and records the reasoning and conclusions in relation to whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of the site's COs. If the effects, on the basis of objective information, are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to *Stage 2 Appropriate*

[5] https://revisedacts.lawreform.ie/eli/1997/act/23/revised/en/html
[6] EC 2018. Guidance on Aquaculture and Natura 2000 Sustainable aquaculture activities in the context of the Natura 2000 Network Link
[7] DEHLG, 2009. Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Link
[8] OPR - Office of Planning Regulator (2021). Appropriate Assessment Screening for Development Management. March 2021. 43pp Link

Assessment. Screening should be undertaken without the inclusion of mitigation. The triggers for appropriate assessment screening are based on a '*likelihood*' (read as '*possibility'*) of a potential significant effect occurring and not on certainty. This test is based on the precautionary principle[9]. The greatest level of evidence and justification will be needed in circumstances when the process ends at screening stage on grounds of no effect.

1.3.2 Stage 2: Appropriate Assessment

This stage considers whether the plan or project, alone or in combination with other projects or plans, will adversely affect the integrity of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. This stage requires a targeted scientific examination of the plan or project and the relevant Natura 2000 sites, to identify and characterise any possible implications for the site in view of the site's QIs and COs, taking account of in combination effects.

The sensitivity of identified QIs in relation to the proposed activities is assessed and the significance of any identified adverse effects is the then determined. If significant effects are determined to be likely, then their scale, magnitude, intensity, and duration are considered in light of the COs and relevant guidance documents. If the assessment is negative and adverse effects on the integrity of the Natura Site cannot be dismissed, then recommendations on mitigation measures or on licensing decisions will be made.

1.4 Structure of Report

This report provides:

1. **Introduction -** an outline of the legislative context and the processes.
2. **Proposed project Background -** providing details of the activity proposed.
3. **Summary of Stage I Appropriate Assessment (Screening)**
4. **Stage II Appropriate Assessment (Natura Impact Statement)** - details the assessment of impacts on relevant Natura sites.
5. **Conclusions** – summary of the findings of the screening and assessment process.

1.5 Data sources

This process and report rely on data and information from a broad and diverse range of sources. Some of the key sources of information that are generally viewed, consulted and/or utilised to inform the screening and AA processes are listed below. Others are consulted as required, and significant sources are cited in the reports.

Reference documents and Sources of information used to inform this process include:

- The Application
- DAFM Aquaculture & Foreshore Management website
- DAFM - Aquaculture viewer – AquaMIS
- National Parks & Wildlife (NPWS) protected site information
- NPWS Guidance documents
- BIM profiling reports

[9] OPR - Office of Planning Regulator (2021). Appropriate Assessment Screening for Development Management. March 2021. 43pp Link

- Targeted scientific studies
- Primary research literature
- Grey literature, reviews and report documents
- Expert opinion
- Direct queries to applicants through DAFM
- Fisheries (Amendment) Act 1997
- Foreshore Act, 1933
- Aquaculture (Licence Application) Regulations, 1998
- Aquaculture (Licence Application) (Amendment) Regulations 2018
- Ireland's Marine Atlas
- MI/BIM Inshore fishing reports
- DHLGH Foreshore licencing database
- EPA GeoHive
- EPA maps tool
- NPWS Status of EU Protected Habitats and Species in Ireland – Article 17 (Habitats & species
- EU Commission assessments of birds population status and trends web tool
- Marine Life Information Network
- EPA Catchments.ie dashboard
- Ordnance Survey of Ireland (OSI)
- Birdwatch Ireland website
- National Biodiversity Data Centre
- European Environmental agency
- OPR, 2021. Appropriate Assessment Screening for Development Management. March 2021; Office of Planning Regulator.
- DEHLG, 2009. Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. NPWS, 2009 – updated in 2010 with reference to Natura Impact Statement.
- Möckel, S., 2017. The European ecological network "Natura 2000" and the appropriate assessment for projects and plans under Article 6 (3) of the Habitats Directive. Nature Conservation, 23.
- EC Article 6 - Managing and protecting Natura 2000 sites
- EC Management of Natura 2000 sites: Best Practice
- EC 2000. Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg.
- EC 2002. Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg.
- EC 2006. Nature and biodiversity cases: Ruling of the European Court of Justice. Office for Official Publications of the European Communities, Luxembourg.
- EC 2018. Guidance on Aquaculture and Natura 2000 Sustainable aquaculture activities in the context of the Natura 2000 Network.
- EC 2012. Common methodology for assessing the impact of fisheries on marine Natura 2000. Service Contract No. 070307/2010/578174/SER/B. DGEnv Brussels.
- Poelman *et al*., 2022. Study on state-of-the-art scientific information on the impacts of aquaculture activities in Europe.
- Federal Agency for Nature Conservation information for the FFH impact assessment
- ABPMer, 2013a – h. Tools for Appropriate Assessment of Fishing and Aquaculture Activities in Marine and Coastal Natura 2000 Sites. Marine Institute.

- Marlin.ac.uk
- AMBI Sensitivity Scale
- MarESA
- Marine Institute (2013). A risk assessment framework for fisheries in Natura 2000 sites in Ireland: with case study assessments. Version 1.3., Galway, 31pp.
- Open Street Maps, Google Earth, and Bing aerial photography

1.6 Assumptions made for Appropriate Assessment Reports

Certain assumptions are made for this report to ensure that it follows a precautionary approach when considering the extent, magnitude, intensity, and duration of the potential significant effects of the proposed activities. These are:

- All aquaculture sites considered in this assessment report are assumed to be fully operational and that the operations (as well as environmental impacts) are occurring across the entire area of the sites, at a minimum.
- Any aquaculture applications which were submitted prior to that being considered here, but still pending decisions (e.g., in process, under appeal, etc.), are also assumed to be fully operational across the entire area of the relevant sites. This ensures a conservative approach, in that it assumes these activities will be operational to the maximum extent possible.
- Other assumptions identified on a case-by-case basis and clearly communicated in the AA report.

2 Overview of Existing and Proposed Aquaculture Activities in the Slyne Head Peninsula SAC (Site Code: 002074)

This document assesses the potential effects of a single proposed extensive aquaculture activity in combination with existing aquaculture activities on those Qualifying Interests (QIs) of the Slyne Head Peninsula SAC (Site Code: 002074), among others. Extensive aquaculture is defined in Regulation 3(iii) of the Aquaculture (Licence Applications) (Amendment) Regulations 2018 as "aquaculture activities where there is no external supply of feed and the culture depends entirely on natural processes for production and supply of feed". Shellfish (molluscs, echinoderms, bivalves and gastropods) and seaweed aquaculture fall within this definition, finfish aquaculture does not.

The aim of this report is to consider if the proposed aquaculture activities are likely to result in an adverse effect on the integrity of Natura 2000 sites in view of their Conservation Objectives (COs). This is achieved by following a screening process. If there is potential for the activities considered to likely significant effect QIs and their conservation features, they will be carried forward for full assessment in subsequent sections and considered on a cumulative basis with other aquaculture activities and other potentially disturbing activities (e.g. fisheries).

This document considers the potential ecological interactions between the existing and proposed extensive aquaculture activities and the Conservation Objectives (COs) of the Slyne Head Peninsula SAC (Site Code: 002074), among others.

In addition to the single application site for extensive shellfish culture, there are currently, within the Slyne Head Peninsula SAC, 4 sites licenced for extensive (shellfish) aquaculture (Table 2-1 and Figure 2-1), and one site (T09 – 140A) for intensive (finfish) aquaculture:

- 1 Application for intertidal shellfish culture of Pacific oysters (T09-522A).
- 4 licenced extensive aquaculture sites for the culture of Pacific oysters (T09-417A, B, C and T09-517A).
- 1 Licenced intensive Aquaculture site for culture of finfish (salmon) (T09-140A).

Table 2-1 Licenced aquaculture and applications for aquaculture activities considered in this report.

Site No.	Status	Activity/Species	Total Area (ha.)
T09-417A	Licensed	Pacific Oyster	4.00
T09-417B	Licensed	Pacific Oyster	5.04
T09-417C	Licensed	Pacific Oyster	3.12
T09-517A	Licensed	Pacific Oyster	7.93
T09-140A	Licenced (review and renewal)	Finfish (Salmon)	4.09
T09-522A	Application	Pacific Oyster	0.96

Existing and proposed aquaculture sites are presented graphically in Figure 2-1.

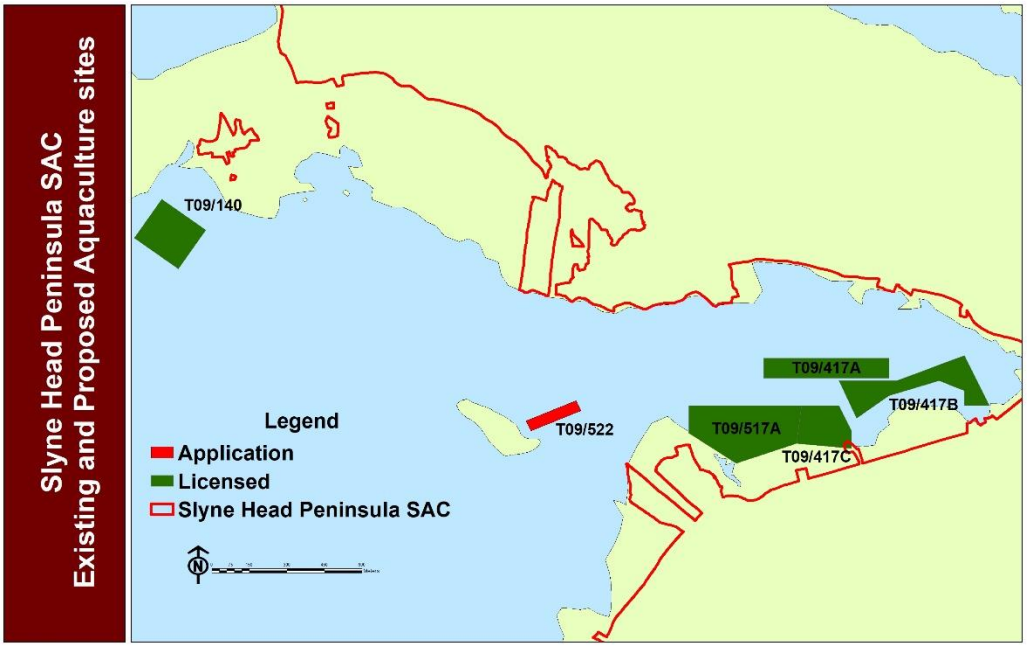


Figure 2-1 Existing and proposed aquaculture sites (Licenced and Applications) in Slyne Head Peninsula SAC.

2.1.1 Extensive Oyster Culture

Intertidal oyster aquaculture of the Pacific oyster, *Magallana gigas*, is a form of shellfish culture with oyster seed cultivated in bags on trestles in the intertidal zone, either to half-grown or fully-grown size. The bag and trestle method uses steel table-like structures arrayed in double rows with wide gaps between the paired rows to allow for access. Trestles used are made from steel are typically 3 metres in length, approximately 1 metre in width and stand between 0.5 metre and 0.7 metre in height. In general, oyster farms are positioned between mean Low Water Spring and mean Low Water Neap, allowing on average between two and five hours' exposure depending on location, tidal and weather conditions. The trestles typically hold six HDPE mesh bags approximately 1m by 0.5m by 10cm, using rubber and wire clips to close the mesh bags and to fasten them to the trestles.

The production cycle begins oyster when seed is brought in from oyster nurseries to the site either in spring or late summer. The mesh size in the mesh bags can vary (4mm, 6mm, 9mm and 14 mm) depending on oyster stock grade. For example, 6mm seed is put into 4mm mesh bags at a ratio of 1,000 to 1,500 seed per bag. Oysters are thinned out and graded as they grow and will be taken to the handling / sorting facility twice per year for grading and re-packing then returned to the trestles. In the final stage they will be 'hardened' in the upper intertidal area, before removal, grading, bagging and delivery. Time to harvest, depending on intake size, ranges from 2.5 to 4 years, where they will have reached 60 - 80 to the kilo. At reaching market size oysters are in bags of about 120.

This proposed aquaculture site (T09-522A) in the intertidal area will be accessed during spring tides (at low tide) by boat. Typically, preparatory work is always conducted in onshore service areas in the intervening periods, including grading and packing, preparation of bags and trestles. General maintenance work that occurs on site includes shaking and turning of bags, and hand removal of fouling and seaweed to ensure maintenance of water flow through the bags when submerged. The site will be used for finishing oysters grown at the applicant's other sites in Mannin Bay.

2.1.2 Access Routes

There are a number of access routes for the extensive aquaculture operations in the Slyne Head Peninsula SAC (Figure 2-2). For some of the sites, access is by tractor across the intertidal areas, from a single access point on the south shore of Mannin Bay. The same point is used to access sites T09-417A (Licenced) and the new application T09-522A, by boat.

Calculation of area of the access routes across intertidal habitats in the SAC is linear length (in metres) by a putative route width of 10m, which is considered a sufficiently precautionary estimate, which gives a total spatial overlap of 0.13ha (Figure 2-2).

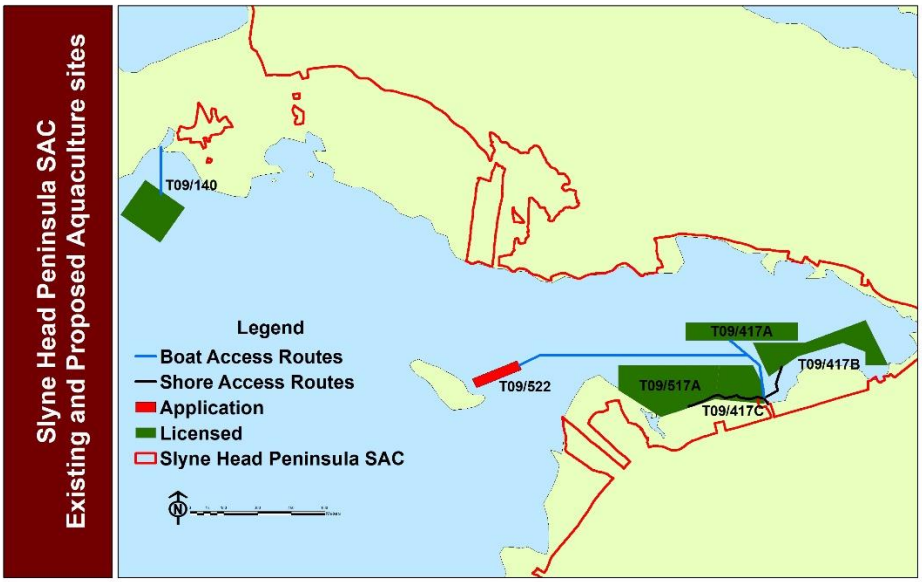


Figure 2-2 Existing and proposed access routes to the existing and proposed shellfish culture sites within the Slyne Head Peninsula SAC.

2.1.3 Intensive Salmon Culture

There is single licence for the culture of salmon in net pens in Mannin Bay. The site (T09-140A) is approximately 4ha in size and the water depth is approximately 15m. There are up to six pens on site and the site is accessed from the pier at Curhownagh, directly north of the site. The site is used to finish salmon from March to July in each year. The site is fallowed thereafter. Approximately 200 Tonnes of salmon are produced at the site each year.

3 Appropriate Assessment - Screening Summary

The Stage 1 AA Screening has been undertaken by the Marine Institute and is detailed in the *Report supporting Appropriate Assessment Screening of Aquaculture in Slyne Head Peninsula SAC*, dated October 2023. This report documented the Stage 1 screening process of the Appropriate Assessment of the proposed activities as specified under the Habitat Directive (European Community (EC) Directive 92/43/EEC).

The proposed aquaculture activities are found within the Slyne Head Peninsula SAC and were also considered adjacent to 14 SACs (within 15km) and 6 SPAs (within 15km).

Based on the location, nature and zone of impact of potential effects, and the best scientific information available, this screening assessment has identified QIs or associated conservation features in the Natura sites that the proposed activities will spatially overlap with for which likely significant effects cannot be discounted.

On the basis that likely significant effects (i.e. spatial overlap, see Table 3-1) of the proposed activity on the European sites cannot be ruled out, it was recommended the following QIs from Slyne Head Peninsula SAC (Figure 3-1) be brought forward for Stage 2 Appropriate Assessment:

- Annex I Habitat 1160 - Large shallow inlets and bays
- Annex I Habitat 1170 – Reefs

Figure 3-1 The extent of Slyne Head Peninsula SAC with constituent qualifying interests (QI).

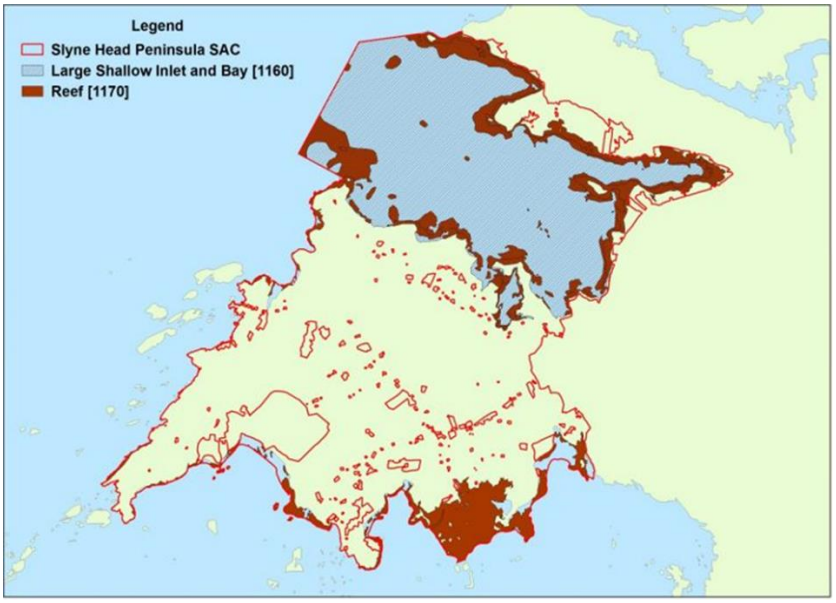


Table 3-1 Spatial extent of aquaculture activities overlapping with the qualifying interests (QI, 1160-Large shallow inlets and bays and 1170-Reefs in Slyne Head Peninsula SAC, presented according to culture species, license status and tidal zone location.

Site ID	Status	Species	Location	1160 - Large Shallow Inlets and Bays 1,540 ha		1170 - Reefs 571 ha	
				Area (ha)	*% QI*	Area (ha)	*% QI*
T09-522A	**Application**	**Pacific Oyster**	**Intertidal**	**0.96**	**0.06**	**0.88**	**0.15**
T09-417A	Licensed	Pacific Oyster	Subtidal	4.00	0.26	0.05	0.01
T09-417B	Licensed	Pacific Oyster	Intertidal	5.04	0.33	4.39	0.77
T09-417C	Licensed	Pacific Oyster	Intertidal	3.12	0.20	2.6	0.46
T09-517A	Licensed	Pacific Oyster	Intertidal	7.93	0.51	5.71	1.00
T09-140A	Licenced	Finfish	Subtidal	4.09	0.27	0	0
Access Routes				0.13	0.01	0.13	0.02

It was also concluded that no animal (e.g., bird, mammal or fish) species are likely to interact with the existing and proposed intertidal culturing such that significant effects could not be discounted.

Furthermore, the risk of naturalisation posed by the culture of the non-native species, the Pacific oyster (*Magallana gigas*) should be considered further in a full AA.

Finally, there are no likely non-aquaculture activities in the area that may act in-combination with the proposed aquaculture activity such that QIs screened out, may now screen in on foot of synergistic effects.

4 Appropriate Assessment - Natura Impact Statement

This NIS has been prepared as it was not possible at the Screening for AA stage to rule out, as a matter of scientific certainty, that the proposed projects will not have a likely significant effect on Natura sites. It will examine and analyse, in light of the best scientific knowledge, how the proposed operations could impact on the Qualifying Features of Natura sites and whether the predicted impacts would adversely affect the integrity of protected sites.

The potential ecological effects of activities on the CO for the site relate to the physical and biological effects of structures and human activities on designated species, intertidal and sub-tidal habitats and invertebrate communities, and biotopes within those broad habitat types. The overall effect on the conservation status will depend on the spatial and temporal extent of activities during the lifetime of the proposed plan and the nature of each of these activities in conjunction with the sensitivity of the receiving environment.

On the basis that likely significant effects of the proposed activity on the European sites cannot be ruled out, the following QIs are brought forward for Stage 2 Appropriate Assessment.

- Annex I Habitat 1160 - Large shallow inlets and bays
- Annex I Habitat 1170 – Reefs

4.1 Impact statement of proposed activities

Within the Slyne Head Peninsula SAC, the species currently being cultured and proposed for culture is:

- Pacific oyster, (*Magallana gigas*) on bags and trestles confined to intertidal areas.

In addition to existing culture of intertidal shellfish culture other methods and species of culture include:

- Subtidal on-bottom culture of the Pacific Oyster (*M. gigas*)
- Atlantic salmon (*Salmo salar*) in net pens.

The potential impacts of these culture practices are communicated below and are derived from published primary literature and review documents that have specifically focused upon the environmental interactions of mariculture and pressures deriving from these activities (e.g. Black 2001; McKindsey et al. 2007; NRC 2010; O'Beirn et al 2012; Cranford et al 2012; Wilding and Huges 2010; Wilding et al 2012; Wilding 2012; Wilding and Nickell 2013; ABPMer 2013a-h; Gallardi 2014; Forde et al., 2015; O'Carroll et al., 2016; Callier et al., 2017).

Intertidal shellfish culture

Filter feeding organisms, for the most part, feed at the lowest trophic level, usually relying primarily on ingestion of phytoplankton. The process is extractive in that it does not rely on the input of feedstuffs in order to produce growth. Suspension feeding bivalves such as oysters and mussels can modify their filtration to account for increasing loads of suspended matter in the water and can increase the production of faeces and pseudofaeces (non-ingested material) which result in the transfer of both organic and inorganic particles to the seafloor. This process is a component of benthic-

pelagic coupling. The degree of deposition and accumulation of biologically derived material on the seafloor is a function of a number of factors discussed below.

Suspended culture, may result in faecal and pseudo-faecal material falling to the seabed. In addition, the loss of culture species to the seabed is also a possibility. The degree to which the material disperses away from the location of the culture system (longlines or trestles) depends on the density of culture stock above the seafloor, the depth of water, and the current regime in the vicinity. Cumulative impacts on the seabed, especially in areas where dispersion of pseudofaeces is low, may occur over time. A number of features of the site and culture practices will govern the speed at which pseudofaeces are assimilated or dispersed by the site. These relate to:

- Hydrography - will govern how quickly the wastes disperse from the culture location and the density at which they will accumulate on the seafloor.
- Turbidity in the water - the higher the turbidity the greater the production of faeces and pseudo-faeces by the filter feeding animal and the greater the risk of accumulation on the seafloor.
- Density of culture - suspended mussel culture is considered a dense culture method with high densities of culture organisms over a small area. The greater the density of organisms the greater the risk of accumulations of material. The density of culture organisms is a function of:
    - Clearance between bottom of culture systems and seafloor. The culture systems located very close to the seabed will result in greater impact as a result of accumulation of organic matter, impeded water flow likely resulting in hypoxia and impact on biota.
    - the husbandry practices - appropriate maintenance will ensure optimum densities in the culture bags in order to maximise growth rates.
    - Thinning practices such that loss of culture animals to the seafloor is negated.

Pacific oyster is typically cultured in the intertidal zone using a combination of plastic mesh bags and trestles. Their specific location in the intertidal is dependent upon the level of exposure of the site, the stage of culture and the accessibility of the site. Any habitat impact from oyster trestle culture is typically localised to areas directly beneath the culture systems. The physical presence of the trestles and bags may reduce water flow and allowing suspended material (silt, clay as well as faeces and pseudo-faeces) to fall out of suspension to the seafloor. The build-up of material will typically occur directly beneath the trestle structures and can result in accumulation of fine, organically rich sediments. These sediments may result in the development of infaunal communities distinct from the surrounding areas. Whether material accumulates beneath oyster trestles is dictated by a number of factors, including:

- Hydrography – low current speeds (or small tidal range) may result in material being deposited directly beneath the trestles. Under normal circumstances, i.e. where trestles are held 0.5-1m above the seafloor and where tidal height is high resulting in large volumes of water moving through the culture area an acceleration of water flow can occur beneath the trestles and bags, resulting in a scouring effect or erosion and little to no accumulation of material. However, culture systems that are located very close to the seabed will result in impeded water flow and thus, greater impact as a result of accumulation of organic matter all of which will likely result in hypoxia and impact on biota. Structures held close together

will also likely impede water flow through the site. Any hindrance in water flow can also impact oyster production levels as well as benthic communities.

- Turbidity of water – oysters have very plastic response to increasing suspended matter in the water column with a consequent increase in faecal or pseudo-faecal production. As euryhaline species, oysters can be cultured in estuarine areas (given their tolerance to a wide salinity ranges) and as a consequence can be exposed to elevated levels of suspended matter. If currents in the vicinity are generally low, elevated suspended matter can result in an increase build-up of material beneath culture structures.
- Density of culture – the density of oysters in a bag and consequently the density of bags on a trestle will increase the likelihood of accumulation on the seafloor. In addition, if the trestles are located in close proximity a greater dampening effect can be realised with resultant accumulations. Close proximity may also result in impact on shellfish performance due to competitive interactions for food.
- Exposure of sites - the degree to which the aquaculture sites are exposed to prevailing weather conditions will also dictate the level of accumulated organic material in the area. As fronts move through culture areas increased wave action will re-suspend and disperse material away from the trestles, this is particularly relevant in intertidal areas.
- Other husbandry related aspects that may impact on habitats are, periodic thinning which may result in the loss of culture animals to the seafloor.

Shellfish filter feed phytoplankton and other suspended material (zooplankton and seston) and the outputs are typically, organic matter (as outlined above) and dissolved nutrients in the form of ammonium, orthophosphate and silicates. As with organic material the fate of these dissolved matter is a function of the density of the cultured species and the hydrograhy of the system or perhaps a combination of these factors (Burkholder and Shumway, 2011). The production and recycling of these nutrients in combination with poorly flushed systems have been implicated in eutrophication events (Burkholder and Shumway 2011). However, the vast majority of studies have documented only very negligible or localised impacts from nutrients derived from shellfish culture operations.

The trestles and bags, used for intertidal shellfish culture, if held relatively close to the seabed may limit light penetration to the sea bed and may therefore, present a risk to production of photosynthesising species (Jernakoff 2001; Eyres 2005). This is likely important for biogenic habitats e.g. Maërl and seagrasses, which need sun light for production.

Activities associated with the culture of intertidal shellfish include the travel to and from the culture sites and within the culture sites using tractors and trailers as well as the activities of workers within the site boundaries. Physical disturbance associated with compaction of sediments as a result of persistent vehicular traffic, to and from oyster trestle culture sites, have resulted in biological impact (Forde et al 2015).

One aspect to consider in relation to the culture of shellfish is the potential risk of alien species arriving into an area among consignments of seed or stock sourced from outside of the area under consideration or as a consequence of the stock itself reproducing. When the seed is sourced locally (e.g. mussel culture) the risk is likely zero. When seed is sourced at a small size from hatcheries in Ireland the risk is also small. When seed is sourced from hatcheries outside of Ireland (this represents the majority of cases particularly for oyster culture operations) the risk is also considered small, especially if the nursery phase has been short. When ½-grown stock (oysters and mussels) is

introduced from another area (e.g. France, UK) the risk of introducing alien species (hitchhikers) is considered greater given that the stock will have been grown in the wild (open water) for a prolonged period (i.e. ½-grown stock). Furthermore, the culture of a non-native species (e.g. the Pacific Oyster – *M. gigas*) may also presents a risk of establishment of this species in the SAC. Recruitment of *M. gigas* has been documented in a number of Bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann et al 2012; 2013) and may compete with the native species for space and food. To date, no settlement of Pacific oysters has been reported in Slyne Head Peninsula SAC (F.O'Beirn, Marine Institute - personal observation).

Sub-tidal shellfish culture i.e. bottom culture of oysters

This activity involves relaying shellfish on the seabed. In addition to many of the effects identifies above in relation to intertidal shellfish culture, bottom culture is also subject to a number of additional impacts. There may be increased enrichment due to production of faeces and pseudofaeces. The existing in-faunal community may be changed as a result. Seabed habitat change may also result as a result of dredging during maintenance and harvesting (Stokesbury et al., 2011). High density of uncontained sub-tidal shellfish culture may lead to change in community structure and function through the addition, at high percentage cover, of an epi-benthic species (living on the seabed) to an infaunal sedimentary community.

The activities associated with this culture practice (dredging of the seabed) are considered disturbing which can lead to removal and/or destruction of infaunal species and changes to sediment composition. In addition, the location of large numbers of a single epifaunal species onto what is, in essence, an infaunal dominated system will likely result in a change to the habitat.

Due to the nature of the culture methods (high-density), the risk of transmission of disease within cultured stock is high. However, given that *M. gigas* does not appear to occur in the wild the risk of disease transmission to 'wild' stock is considered low. The risk of disease transmission from cultured oysters to other species is unknown.

Finfish Culture

Within the Slyne Head Peninsula SAC, there is 1 licenced marine finfish culture site assigned for the culture of salmon. The one effect resulting from finfish aquaculture that will act cumulatively with shellfish aquaculture is release of organic material or nutrients into the water. Finfish culture differs from shellfish culture in that there is an input of feed into the system and therefore a net input of organic matter to the system. This organic material will be found in the system in the form of waste feed (on the seafloor), solid waste (faeces), waste because of net cleaning all of which usually accumulates on the seafloor and dissolved material (predominantly fractions rich in nitrogen). For the most part, the majority of organic material builds up on the seabed generally in and around the footprint of the salmon cages with a 'halo' effect evident in areas where dispersion occurs driven by local hydrographic conditions. This is typically referred to near-field effects. Similar to shellfish, the quantity of material that might accumulate on the seabed will be a function of the quantity of fish held in cages, the stage of culture, the health of the fish (unhealthy fish will generally eat less), husbandry practices (are the fish fed too much too quickly?), the physical characteristic of the solid particles and, as mentioned above, hydrographic conditions.

Wildish et al. (2004) and Silvert and Cromey (2001) both summarize the factors (listed above) that govern the level of dispersion of material from the cages to the seafloor. Many of the factors are

subsequently incorporated into modelling efforts, which are used to predict likely levels of impact. The impact of organic matter on sedimentary seafloor habitat typically evolves after the gradient defined by Pearson-Rosenberg (1978), whereby as the level of organic enrichment increases the communities (macrofaunal species number and abundance) found within the sedimentary habitats will also change. Typically, low levels of enrichment facilitates an increase in species abundance and biomass followed by a decrease in all biological metrics as enrichment increases to a point where azoic conditions prevail and no biota are found. The impact on biota is a consequence of the decrease in oxygen and a build-up of by-products such as ammonia and sulphides brought about by the breakdown of the organic particles, which are considered toxic to marine biota. The shift from an oxygenating to reducing environment in the sediment could be such that the effect is mirrored in the water column as well (i.e. reduction in oxygen levels). The output of dissolved material resulting from finfish cages is typically in the form of ammonia, phosphorous and dissolved organic carbon (DOC) originating directly from the culture organisms, or from the feed and/or faecal pellets. Similar to particulate waste, the impact of dissolved material is a function of the extent (intensity) of the activity and properties of the receiving environment (e.g., temperature, flushing time). While elevated levels of nutrient have been reported near fish farms, it has been concluded that poorly flushed systems are vulnerable to nutrient emission which may result in the accumulation of excess nutrients and severe eutrophication (Sarà et al., 2018). As with shellfish culture systems, no significant effect on chlorophyll levels, has been demonstrated from fish farms (Pearson and Black, 2000).

5 Appropriate Assessment - Overview of Habitat Impact Assessment Method

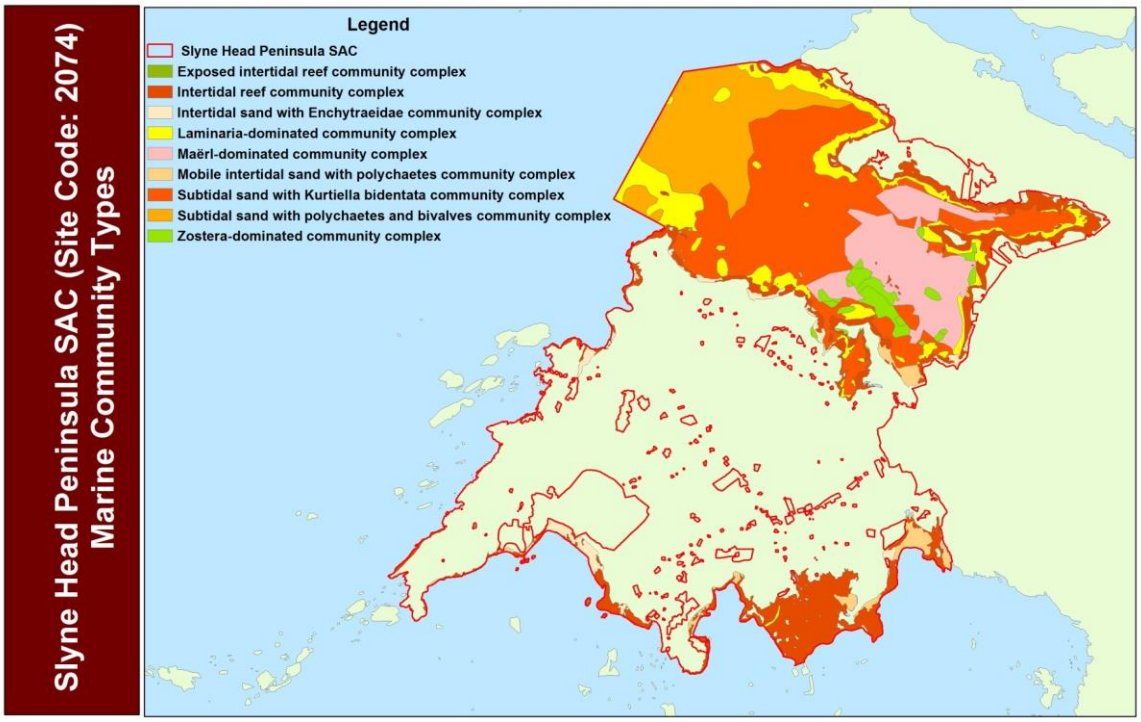
The significance of adverse effects is determined on the basis of scientific studies on likely impacts of proposed activities on conservation features allied with Conservation Objective guidance for constituent community types of 1160 and 1170 and Annex II species in NPWS guidance documents. The guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by activities. Some activities are deemed to be wholly inconsistent with long term maintenance of certain habitats while other habitats can tolerate a range of activities. For the practical purpose of management of seabed habitats other than sensitive habitats, (e.g. Maërl-dominated communities), a 15% threshold of overlap between disturbing activities and both the QI and community types is established in the NPWS guidance (NPWS, 2015b.). Below this threshold, disturbance is deemed to be non-significant.

Disturbance, in this instance, is defined as that which leads to a change in the characterising species of the habitat or marine community type. In the case of shellfish culture the changes are most likely as a result of organic enrichment from faeces and/or compaction as a result of transport vehicles across intertidal habitats. Such disturbance may be temporary or permanent, in the sense that change in characterising species may recover to a pre-disturbed state or may persist. The degree of change is likely a function of the sensitivity of the receiving environment to organic loading, which in turn may be influenced by hydrodynamic conditions in addition to the density of the organisms in culture at the site. The rationale adopted to apply this threshold is that, while there may be persistent disturbance as a result of an activity (e.g. organic loading) which may result in a response/change to the structure of the marine community type, it is expected, however, that (some level of) function will be retained. Function is considered the process whereby the animals living on and in the seafloor, by virtue of their activities, influence benthic dynamics (reflective of) related to system health (Bolam et al 2002; Solam et al 2004). Such activities or traits are considered in relation to, among others, the organisms feeding type (e.g., scavenger, filter, deposit feeders), mobility, body size, ability to bioturbate (i.e. introduce oxygen into the sediment). All such traits can result in the removal or conversion of organic matter to biomass (i.e. secondary production). However, by virtue of the fact that the composite species may change, the result is considered a disturbance. The confidence around the measure of spatial overlap is considered high because much published literature and monitoring outputs identifies that the effect of shellfish and finfish culture is, for the most part, confined to the footprint of the activity in question (cage or longline).

No activity is likely to be allowed or result in the total exclusion or extirpation of a marine community type within the SAC. In addition, habitats and species that are key contributors to biodiversity and which are sensitive to disturbance should be afforded a high degree of protection i.e. thresholds for impact on these habitats is low and any significant anthropogenic disturbance should be avoided. In Slyne Head Peninsula SAC, there are three such community types found within the feature Large shallow inlets and Bays (1160) (Figure 5-1). These sensitive habitats include:

1. *Zostera*-dominated community
2. Maërl-dominated community

Figure 5-1 Principal benthic marine community types (MCT) recorded within the qualifying interests of the Slyne Head Peninsula SAC (site code 002074) (NPWS 2015a).



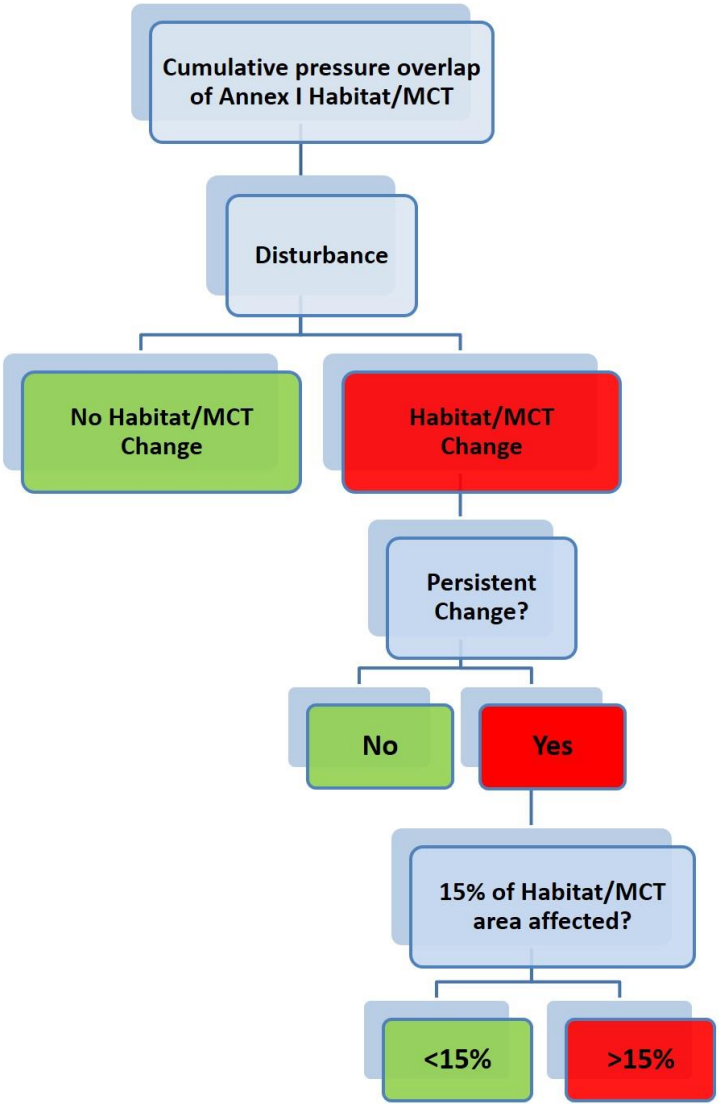
5.1.1 Determining Significance

A schematic outlining the determination of significant effects on marine habitats and marine community types is presented in **Error! Reference source not found.**2. For the Annex I habitats and their constituent community types, potential effects are identified in relation to, first and foremost, spatial overlap. Subsequent disturbance and the persistence of disturbance are considered as follows:

1. The degree to which the activity will disturb the Annex I habitat – as indicated above, disturbance is meant as a change in the characterising species, as listed in the Conservation Objective guidance of the constituent marine community types. The likelihood of change depends on the sensitivity of the characterising species to the activities in question. Sensitivity results from a combination of intolerance to the activity and/ or recoverability from the effects of the activity.
2. The persistence of the disturbance in relation to the intolerance of the community - If the activities are persistent (high frequency, high intensity) and the receiving community has a high intolerance to the activity (i.e., the characterising species of the communities are sensitive and consequently impacted) then such communities could be said to be persistently disturbed.
3. It is expected that in spite of the potential change in characterising species that certain functions are retained by the benthic communities, such that effects deriving from the aquaculture activities are alleviated.
4. In the event that disturbance is greater than 15% of the defined area of Habitat QI or Marine Community Type, it is deemed to be significant.

For the assessment, the 15% threshold detailed in Point 4 above applies to the habitats or constituent community types that are overlapped by likely disturbing aquaculture activities considered in-combination with all other likely disturbing activities (e.g. fisheries, dredging).

Figure 5-2: Schematic outlining the determination of likely significant effects on habitats and marine community types (MCT) (following NPWS 2015b). MCT- Marine Community Type.



5.1.2 Sensitivity and Assessment Rationale

This assessment used a number of sources of information in assessing the sensitivity of the characterising species of the community types recorded within the QIs 1160 and 1170.

One source of information is a series of reviews commissioned by the Marine Institute which identify habitat and species sensitivity to a range of pressures that are likely to result from aquaculture and fishery activities (ABPMer, 2013a – h). These reviews draw from the broader literature, including the MarLIN Sensitivity Assessment (Marlin.ac.uk) and the AMBI Sensitivity Scale (Borja et al., 2000; 2009) and other primary literature. Subsequent literature and reports have also provided more recent sources of information on likely interactions including, MarESA (Tyler-Walters et al 2018; 2022).

It must be noted that the NPWS have acknowledged that given the wide range of community types that can be found in marine environments, the application of conservation targets to these would be difficult. On this basis, they have proposed broad community complexes as management units. These complexes (for the most part) are very broad in their description and do not have clear surrogates which might have been considered in targeted studies and thus reported in the scientific literature. On this basis, the confidence assigned to likely interactions of the community types with anthropogenic activities are, by necessity, relatively low, with the exception of community types dominated by sensitive taxa, e.g. maërl and *Zostera sp*. Directed research investigating the effect of aquaculture on the benthic environment does provide a greater degree of confidence in conclusions; for example, the output of Forde et al. (2015) and O'Carroll et al (2016) has provided greater confidence in terms of assessing likely interactions between intertidal oyster culture and marine habitats. Similarly, Wilding and Hughes (2010) and Wilding et al (2012) provide greater confidence in benthic assessments for finfish farming.

Furthermore, the sensitivity of a species to a given pressure is the product of the intolerance (the susceptibility of the species to damage, or death, from an external factor) of the species to the particular pressure and the time taken for its subsequent recovery (recoverability is the ability to return to a state close to that which existed before the activity or event caused change). Life history and biological traits are important determinants of sensitivity of species to pressures from aquaculture.

In the case of species, habitats, and communities the separate components of sensitivity (intolerance, recoverability) are relevant to the persistence of the pressure:

- For persistent pressures (i.e. activities that occur frequently and throughout the year) recovery capacity may be of little relevance except for species/ habitats that may have extremely rapid (days/weeks) recovery capacity or whose populations can reproduce and recruit in balance with population damage caused by aquaculture. In all but these cases, and if sensitivity is moderate or high, then the species/ habitats may be negatively affected and will exist in a modified state. Such interactions between aquaculture and species/ habitat/ community represent persistent disturbance.
- In the case of episodic pressures (i.e. activities that are seasonal or discrete in time) both the intolerance and recovery components of sensitivity are relevant. If sensitivity is high but recoverability is also high relative to the frequency of application of the pressure, then the species/ habitat/ community will be in favourable conservation status (FCS) for at least a proportion of time.

The sensitivities of the community types (or surrogates) found within the Slyne Head Peninsula SAC to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are identified Table 5-2. The sensitivities of species which are characteristic (as listed in the Conservation Objective supporting document) of benthic communities to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are identified, where available, from the literature (ABPMer, 2013a – h; Tyler-Walters et al 2018; 2022). The following guidelines broadly underpin the analysis and conclusions of the species and habitat sensitivity assessment:

- Sensitivity of certain taxonomic groups such as emergent sessile epifauna to physical pressures is expected to be generally high or moderate because of their form and

structure (Roberts et al., 2010). Sensitivity is also expected to be high for species with large bodies and with fragile shells/ structures, but low for those with smaller body size. Body size (Bergman and van Santbrink, 2000) and fragility are regarded as indicative of a high intolerance to physical abrasion caused by fishing gears (i.e. dredges). However, even species with a high intolerance may not be sensitive to the disturbance if their recovery is rapid once the pressure has ceased.

- Recoverability of species depends on biological traits (Tillin et al., 2006) such as reproductive capacity, recruitment rates and generation times. Species with high reproductive capacity, short generation times, and high mobility or dispersal capacity may maintain their populations even when faced with persistent pressures; but such environments may become dominated by these (r-selected) species. Slow recovery is correlated with slow growth rates, low fecundity, low and/or irregular recruitment, limited dispersal capacity and long generation times. Recoverability, as listed by MarLIN, assumes that the impacting factor has been removed or stopped and the habitat returned to a state capable of supporting the species or community in question. The recovery process is complex and therefore the recovery of one species does not signify that the associated biomass and functioning of the full ecosystem has recovered (Anand and Desrocher, 2004; cited in Hall et al., 2008).
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Table 5-1 Codes of sensitivity and confidence applying to species and pressure interactions presented in Table 5-1.

Species x Pressure Interaction Codes for Table 5-1	
NA	Not Assessed
Nev	No Evidence
NE	Not Exposed
NS	Not Sensitive
L	Low
M	Medium
H	High
VH	Very High
*	Low confidence
**	Medium confidence
***	High Confidence

Pressure Type	Physical Damage								Change in Habitat Quality										Biological Pressures				Chemical - Physical Pressures			
Community Type (EUNIS code)	Surface Disturbance	Shallow Disturbance	Deep Disturbance	Trampling-Access by foot	Trampling-Access by vehicle	Extraction	Siltation (addition of fine sediments, pseudofaeces, fish food)	Smothering (addition of materials biological/non-biological to the surface)	Changes to sediment composition- increased coarseness	Changes to sediment composition- increased fine sediment proportion	Changes to water flow	Increase in turbidity/suspended sediment	Decrease in turbidity/suspended sediment	Organic enrichment-water column	Organic enrichment of sediments-sedimentation	Increased removal of primary production-phytoplankton	Decrease in oxygen levels- sediment	Decrease in oxygen levels-water column	Introduction of non-native species	Removal of Target Species	Removal of Non-target species	Ecosystem Services-Loss of biomass	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
Subtidal Sand with polychaetes and bivalves community complex (A5.4)	H (*)	M (*)	M (*)	NE	NE	N-L (*)	L-M (*)	L-M (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	M (*)	M (*)	L (*)	H (*)	H (*)	NA	H (*)	H (*)	M (*)	H (*)
Subtidal sand with *Kurtiella bidentata* (A5.4)	H (*)	M (*)	M (*)	NE	NE	N-L (*)	L-M (*)	L-M (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	M (*)	M (*)	L (*)	H (*)	H (*)	NA	H (*)	H (*)	M (*)	H (*)
Maërl-dominated community (A5.51)	H (***)	H-VH (***)	H (***)	H (***)	H (***)	H-VH (***)	H-VH (***)	H-VH (***)	NS (*)	NS (*)	NS (*)	H (*)	NS (*)	H (*)	H (***)	NS (*)	H (**)	H (**)	H (***)	VH (***)	NS (*)	NE	NE	NE	NE	VH (*)
Zostera dominated community complex (A2.6, A5.5)	M-H (***)	M-VH (***)	M-VH (***)	M-H (***)	M-H (***)	M-VH (***)	VH (***)	VH (***)	M (*)	M (***)	M (*)	H (***)	NS (*)	H (***)	H (***)	NS (*)	H-VH (*)	H-VH (*)	H (**)	NS (*)	NS (*)	NA	NEv	NEv	NS (***)	H-VH (**)
Fucoid-dominated intertidal reef community complex (A1.21)	NS (*)	NA	NA	NS (*)	NE	NA	L (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	NS (*)	NS (*)
Laminaria-dominated community complex (A3.21)* Scoring for A3.22	NS (*)	NA	NA	NE	NE	NA	NS (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	NS (*)	NS (*)

Table 5-2 Matrix showing the characterising habitats sensitivity scores x pressure categories for habitats in Slyne Head Peninsula SAC (ABPMer 2013a-h). Table 5-1 provides the code for the various categorisation of sensitivity and confidence

6 Assessment

Aquaculture pressures on a given habitat are related to its vulnerability (spatial overlap or exposure of the habitat to the equipment/culture organism combined with the sensitivity of the habitat) to the pressures induced by culture activities. To this end, the location and orientation of structures, the density of culture organisms, the duration of the culture activity and the type of activity are all important considerations when considering risk of disturbance to habitats and species. The significance of the possible effects of the proposed activities on habitats, as outlined in the Natura Impact statement (Section 4) and habitat impact assessment method (Section 5), is determined here in the assessment. The significance of effects is determined on the basis of Conservation Objective guidance for constituent habitats and species (Figure 1-3 and NPWS 2015a, b).

Within the Slyne Head Peninsula SAC, the qualifying interests carried further, from the screening exercise, (Marine Institute, 2023) in this assessment are:

- 1160 Large shallow inlets and bays
- 1170 Reefs

6.1 1160 - Large shallow inlets and bays

The qualifying interest, Large shallow inlets and bays (1160) has a number of attributes (with associated targets) relating to the following broad habitat features as well as its constituent community types within the Slyne Head Peninsula SAC (NPWS, 2015 a, b).

1. **Habitat Area** – it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Large shallow inlets and bays. The habitat area is likely to remain stable.
2. **Community Distribution** – (conserve a range of community types in a natural condition).

The constituent communities identified in the Annex 1 feature (Figure 5-1), Large shallow inlets and bays (1160) are:

1. Maërl-dominated community
2. *Zostera*-dominated community
3. Intertidal sand with Enchytraeidae community complex;
4. Mobile intertidal sand with polychaetes community complex;
5. Subtidal sand with polychaetes and bivalves community complex;
6. Subtidal sand with *Kurtiella bidentata* community complex;
7. Intertidal reef community complex;
8. *Laminaria* dominated community complex.

On the basis of spatial analysis, it is considered, given the localised nature of potential impacts of intertidal shellfish culture activities, that those MCT not subject to spatial overlap are unlikely to result in any significant effect from intertidal shellfish culture activities (however, see Section 6.4 re: non-native species below). To this end, the following MCT are excluded from further consideration, these are:

1. Maërl-dominated community

2. Zostera-dominated community
3. Intertidal sand with Enchytraeidae community complex;
4. Mobile intertidal sand with polychaetes community complex;
5. Subtidal sand with polychaetes and bivalves community complex;

The following community types are overlapped by existing and proposed extensive (shellfish) operations (Table 6-2). These community type will be exposed to differing ranges of pressures from intertidal oyster aquaculture activities. This activity may alter the current regime, cause surface disturbance and shading, introduce non-native species, and organic enrichment (Section 4).

1. Subtidal sand with *Kurtiella bidentata* community complex;
2. Intertidal reef community complex;
3. *Laminaria* dominated community complex.

Table 5-1 lists the marine community types (or surrogates) found within this SAC and provides an estimate of sensitivity to a range of pressures. The risk scores in Table 5-2 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Slyne Head Peninsula SAC.

Identified access routes are considered disturbing as a result of the compaction of sediments by vehicles on the shore. The likely extent of access route disturbance on this community is 0.13ha. This represents a likely disturbance of 0.008%, and 0.08% over Habitat 1160 and community Intertidal reef community complex, respectively.

Tables 3-1 and 6-2 provide an estimate of spatial overlap of aquaculture activities over marine habitat 1160 and its constituent community types, respectively.

A number of sedimentary community types over which intertidal oyster bag and trestle culture are proposed within the SAC are considered likely to be disturbed by the shellfish culture activities, e.g., Subtidal sand with *Kurtiella bidentata* community complex. This is on the basis the predominant subtidal nature and lack of evidence to the contrary from, say, targeted studies. Furthermore, a number of MCT (e.g. reef communities) are considered wholly unsuited for such activities, given the uneven, heterogenous and sometimes subtidal nature of these MCT. On this basis, the proposed activities are considered likely disturbing.

Those Marine Community Types within QI 1160 considered subject to combined disturbance from existing and proposed aquaculture activities (Table 6-1), in addition to access route disturbance (with likely disturbance percentage) as described above are:

1. **Subtidal sand with *Kurtiella bidentata* community complex (2.99%);**
2. **Intertidal reef community complex (4.71%);**
3. ***Laminaria*-dominated community complex (3.19%).**

The total combined disturbance resulting from existing and proposed oyster culture over the QI Large shallow inlets and Bays (1160) in Slyne Head Peninsula SAC is 1.57%.

Table 6-1 Habitat utilisation i.e. spatial overlap in hectares and percentage of Aquaculture activity over relevant Marine Community Types (MCT) within the qualifying interest 1160 – Large Shallow Inlet and Bays of Slyne Head Peninsula SAC. (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS– supporting docs marine and coastal).

				Large Shallow Inlet and Bays (1160) - 1540 ha					
Site ID	Species	Status	Area (ha)	Intertidal reef community complex - 159 ha		*Laminaria*-dominated community -198 ha		Subtidal sand with *Kurtiella bidentata* community complex - 574 ha	
				Area	%	Area	%	Area	%
T9/522A	Pacific Oyster	Application	0.96	0.37	0.23	0.51	0.26	0.08	0.013
T9/517A	Pacific Oyster	Licensed	7.93	4.15	2.61	1.57	0.79	1.7	0.3
T9/417A	Pacific Oyster	Licensed	4.00	-	-	0.05	0.02	3.95	1.37
T9/417B	Pacific Oyster	Licensed	5.04	1.35	0.85	3.04	1.54	0.65	0.23
T9/417C	Pacific Oyster	Licensed	3.12	1.50	0.94	1.1	0.56	0.14	0.05
T9/140	Salmon	Licensed	4.09	-	-	0.038	0.02	2.96	1.03
Access Routes			0.13	0.13	0.08	-	-	-	-

6.2 1170 – Reefs

The qualifying interest, Reef (1170) has a number of attributes (with associated targets) relating to the following broad habitat features as well as its constituent community types (NPWS 2015a,b);

1. **Habitat Area** – it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Reefs. The habitat area is likely to remain stable (however, see point below re: removal of substrate).
2. **Community Distribution** – (conserve a range of community types in a natural condition). The constituent communities identified in the Annex 1 feature (Figure 6-1), Reefs (1170) are:
    - Intertidal reef community complex
    - *Laminaria*-dominated community

Tables 3-1 and 6-2 provide an estimate of spatial overlap of proposed extensive (shellfish) aquaculture activities over marine habitat 1170 and its constituent community types, respectively. This QI and community types will be exposed to differing ranges of pressures from intertidal oyster aquaculture activities. This activity may alter the current regime, cause surface disturbance (due to transport), shading, as well as organic enrichment (Section 4).

In addition, the reef community types are considered largely unsuited for bag and trestle culture, given the subtidal nature (in parts) as well as the presence of a mosaic of predominantly bedrock, cobble and boulders. It is likely that any structures would result in shading on the dominant macro-algae species. In addition, movement of substrate (e.g., boulder, cobble) might be considered necessary in order to locate trestles. This would be considered a highly disturbing activity. On this basis, the proposed activities are considered likely disturbing.

Those Marine Community Types considered subject to disturbance from existing and proposed shellfish culture activities in QI 1170, in addition to access route disturbance (with likely disturbance percentage) as described above are:

1. **Intertidal reef community complex (4.71%);**
2. ***Laminaria*-dominated community complex (3.19%).**

The total combined likely disturbance resulting from existing and proposed aquaculture activities over the QI Reefs (1170) in Slyne Head Peninsula SAC is 2.42%.

Table 6-2 Habitat utilisation i.e. spatial overlap in hectares and percentage of Aquaculture activity over relevant Marine Community Types (MCT) within the qualifying interest 1170 – Reefs of Slyne Head Peninsula SAC. (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS– supporting docs marine and coastal).

				Reefs (1170) - 571 ha			
Site ID	Species	Status	Area (ha)	Intertidal reef community complex - 159 ha		*Laminaria*-dominated community -198 ha	
				Area	%	Area	%
T9/522A	Pacific Oyster	Application	0.96	0.37	0.23	0.51	0.26
T9/517A	Pacific Oyster	Licensed	7.93	4.15	2.61	1.57	0.79
T9/417A	Pacific Oyster	Licensed	4.00	-	-	0.05	0.02
T9/417B	Pacific Oyster	Licensed	5.04	1.35	0.85	3.04	1.54
T9/417C	Pacific Oyster	Licensed	3.12	1.50	0.94	1.1	0.56
T9/140	Salmon	Licensed	4.09	-	-	0.038	0.02
Access Routes			0.13	0.13	0.08	-	-

6.3 Introduction of non-native species

As already outlined oyster culture may present a risk in terms of the introduction of non-native species as the Pacific oyster (*Magallana gigas*) itself is a non-native species. Recruitment of *M. gigas* has been documented in a number of Bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann et al., 2012; 2013) and may compete with the native species for space and food. In addition to having large number of oysters in culture, Kochmann et al., (2013) identified short residence times and large intertidal areas as factors likely contributing to the successful recruitment of oysters in Irish bays. Furthermore, increased recruitment of *M gigas* has been recorded in other bays in Ireland in more recent years (Marine Institute).

The residence time in Mannin Bay (within Slyne Head Peninsula SAC) is 21 days. Consequently, there is a risk of Pacific oysters naturalising in the area. However, it is noted that the condition associated with licenced oyster sites is that they source their seed directly from hatcheries and that it will be 100% triploid. Triploid oysters have a considerably lower reproductive potential that diploid oysters and therefore, the risk of establishment of this non-native species will be reduced.

While the risk of introduction of hitchhiker species with hatchery reared oyster seed is considered minimal, the risk posed by the introduction of '½-grown' or 'wild' seed originating from another jurisdiction (e.g. Britain, France) cannot be discounted.

7 In-combination effects of aquaculture, fisheries and other activities

The risk posed by aquaculture operations are identified in Section 6 above. There are potentially a number of other disturbing activities that are carried out within the Slyne Head Peninsula SAC that may act in combination with the proposed shellfish culture operations.

7.1 In-combination effects with Inshore fishing

Inshore fishing occurs in the Slyne Head Peninsula SAC. Information and Figure 7-1 are derived from Inshore Fishing Maps (Ireland's Marine Atlas - http://atlas.marine.ie/#?c=53.9108:-15.9082:6: Accessed: 27/07/2023). Fisheries activities occurring in the Slyne Head Peninsula SAC are potting for a range of species and tangle netting for crayfish. Table 7-1 presents the spatial extent of these fishing activities overlapping the Annex 1 feature 1160 – Large Shallow inlets and bays and 1170-Reefs, in addition to their constituent community types.

Fishery overlaps between 13-57% of QI habitat 1170 – Reefs. Of the two community types associated with 1170-Reef, spatial coverage ranges from 3% to 88% for shrimp and crab potting, respectively. For the QI 1160 Large shallow inlets and bays, fishing activities ranged from 17-96% spatial overlap. For some community types (Mearl and Zostera), coverage was 100%

Figure 7-1 Fishing activity by vessels under 15m in the vicinity of Slyne Head Peninsula SAC.

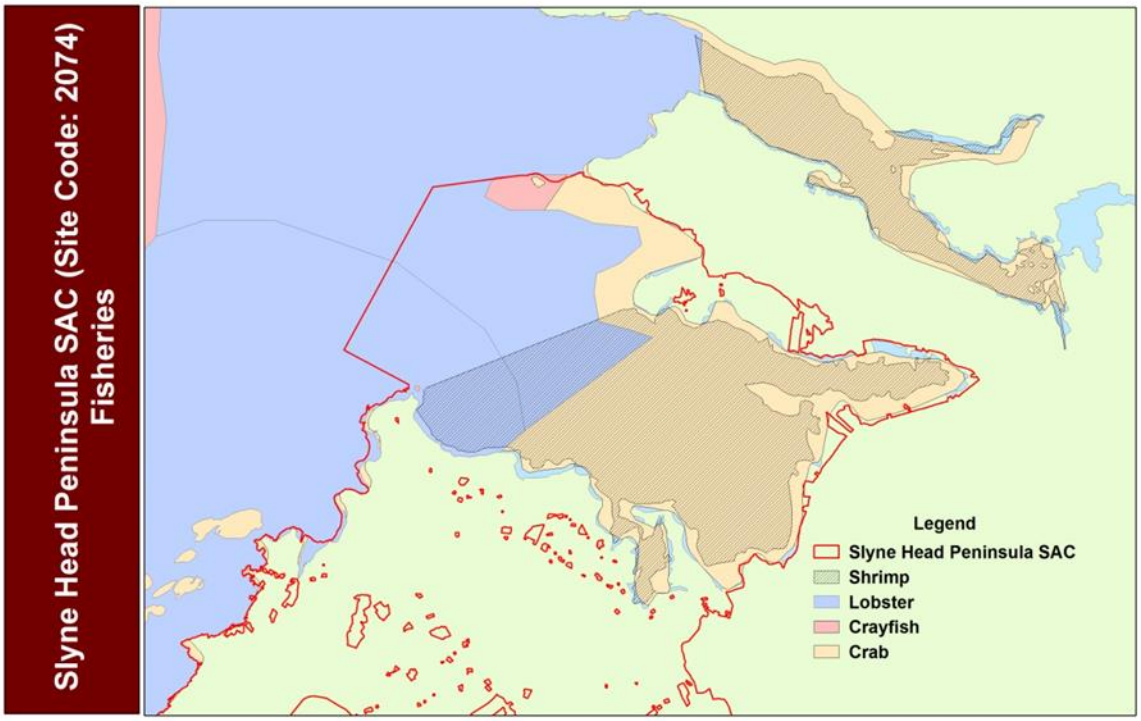

Table 7-1 Spatial extent of fisheries activities overlapping within the broad habitat qualifying interest of 1160 and 1170 and constituent community types in Slyne head Peninsula SAC. Spatial overlap presented according to target fisheries species and equipment used.

	Fishery Type					
	Crayfish (Tangle net)		Shrimp (Creel)		Lobster/Crab (Creel)	
	Overlap (ha)	% Overlap	Overlap (ha)	% Overlap	Overlap (ha)	% Overlap
Reef (571 ha)	**76.46**	**13.39**	**87.38**	**15.30**	**330.25**	**57.84**
Intertidal reef community complex (350 ha)	19.99	5.71	10.25	2.93	136	38.86
Laminaria-dominated community complex (220 ha)	56.24	25.56	77.13	35.06	194	88.18
Large Shallow Inlet and Bay (1540 ha)	**274.88**	**17.85**	**807.19**	**52.41**	**1493.59**	**96.99**
Intertidal sand with Enchytraeidae community complex (14 ha)	-	-	0.59	4.21	6.67	47.64
Mobile intertidal sand with polychaetes community complex (11 ha)	-	-	0.34	3.09	9.67	1.69
Zostera-dominated community complex (33 ha)	-	-	32.77	99.30	32.82	99.45
Maërl-dominated community complex (261 ha)	-	-	261.03	100.00	261	100.00
Subtidal sand with polychaetes and bivalves community complex (288 ha)	213.13	74.00	2.28	0.79	288	100.00
Subtidal sand with *Kurtiella bidentata* community complex (574 ha)	-	-	422.79	73.66	572.29	99.70
Intertidal reef community complex (159 ha)	5.57	3.50	10.25	6.45	127.43	80.14
Laminaria-dominated community complex (198 ha)	56.17	28.37	77.13	38.95	194.09	98.03

Pot fisheries for shrimp, crab and lobster occurs extensively in Slyne Head Peninsula SAC.

Specific fishery details and assessment

Shrimp fisheries.

The shrimp fishery overlaps with 52% of large shallow inlet and bay and 15% on reefs. The fishery overlaps extensively with sedimentary habitats, sensitive Maërl and *Zostera* communities and with various reef communities.

Given the weight of the creels tend to be lighter that lobster or crab pots, the risks to sedimentary habitats from shrimp pot fisheries is considered low. Shrimp pots and associated ropes and anchors may impact Maërl and Seagrass.

Lobster and crab fisheries

Lobster and crab fisheries occur extensively within the SAC. The fishery overlaps with 97% of large shallow inlet and bay and 57% of reef mainly on *Laminaria*-dominated reef complex. Lobster/Crab pots and associated ropes and anchors may impact Maërl and Seagrass. Given they are heavier than

Shrimp pots, lobster pots and associated ropes and anchors could degrade epifauna of reef depending on the sensitivity of associated fauna and on the intensity of the activity.

Tangle netting for crayfish

These nets generally target crayfish (*Palinurus elephas*) and Turbot (*Psetta maximus*). The impact of tangle netting on benthic habitats is considered minor.

Aquaculture and fisheries in-combination effects

Shellfish aquaculture does not overlap with any of the identified sensitive biogenic community types and therefore, there are no likely in-combination with fisheries activities overlapping these MCT.

Both intertidal aquaculture and pot fishing for lobster/crab are considered disturbing to reef habitat. Putative coverage of combined activities is 60% of QI Reef (1170) and approx. 99% of *Laminaria*-dominated community within QI 1160, which could be considered disturbed. It would be important that any licenced activity be managed such that disturbance is minimised, as much as possible.

7.2 In-combination effects with other activities

Another activity leading to potential impacts on conservation features relate to harvest of seaweed on intertidal reef communities. There is little known concerning the level of harvest from these intertidal reef communities. The impact is likely two-fold, direct impact upon the reefs by removal of a constituent species and impact upon substrates as a consequence of travel across the shore to the harvest sites. The likely overlap between these activities and intertidal shellfish culture is considered small as the (reef) habitat is not considered suitable for shellfish culture. Seaweed harvesting requires a foreshore licence administered by the Department of Environment, Community and Local Government. At the time of this report there are no known foreshore applications for the removal of seaweed from intertidal areas in Mannin Bay or the wider SAC. In addition, on the basis of an examination of the Department of Housing, Local Government and Heritage foreshore database (https://www.gov.ie/en/foreshore-notices/ - Accessed: 27/07/2023) identified no existing or proposed activities on the foreshore or adjacent to the foreshore that may interact with the likely effects resulting from the proposed shellfish culture activities resulting in in-combination effects. Similarly, a review of other licencing body databases identified no existing or potential activities likely to interact with the proposed aquaculture activities e.g., Galway County Council planning (Map Viewer Accessed: 27/07/2023) and EPA pressures maps (www. https://gis.epa.ie/EPAMaps/Water: Accessed: 27/07/2023).

The Shellfish Water Characterisation Study prepared by the relevant Government Department for Mannin Bay[10] was consulted in order to identify any pressures that might result in additive or synergistic pressures to those identified as originating from aquaculture activities. No direct discharge points or other pressures were identified that might act in-combination with aquaculture activities. No other activities resulting in pressures that could act in-combination with the proposed shellfish culture operations were identified.

[10] https://www.gov.ie/pdf/?file=https://assets.gov.ie/128861/284fdf84-4421-4e04-8926-ad07c906136c.pdf#page=null

8 Aquaculture Appropriate Assessment Summary Mitigation (and Recommendations) and Conclusion.

8.1 Summary of Assessment

In the Slyne Head Peninsula SAC, intertidal and sub-tidal oyster culture at four sites and a single finfish culture site are the only aquaculture activities currently being carried out. A single application is considered for intertidal oyster culture. Based upon this and the information provided in the aquaculture profiling (Section 2), the likely interaction between the culture methodologies employed and conservation features (habitats) of the Natura 2000 site, among others were considered. The proposed aquaculture activities were also considered in light of adjacent Natura sites, i.e., 14 SACs (within 15km) and 6 SPAs (within 15km).

Based on the location, nature and zone of impact of potential effects, and the best scientific information available, this screening assessment has identified QIs or associated conservation features in the Natura sites that the proposed activities will spatially overlap with for which likely significant effects cannot be discounted.

On the basis that likely significant effects (i.e. spatial overlap, see Table 3-1) of the proposed activity on the European sites cannot be ruled out, it was recommended the following QIs from Slyne Head Peninsula SAC (Figure 3-1) be brought forward for Stage 2 Appropriate Assessment:

- Annex I Habitat 1160 - Large shallow inlets and bays
- Annex I Habitat 1170 – Reefs

No other qualifying interest from Slyne Head Peninsula SAC and other Natura sites were considered to have likely significant effects resulting from extensive aquaculture operations alone or in-combination with other pressures and therefore, were screened out from further consideration.

Furthermore, the risk of naturalisation posed by the culture of the non-native species, the Pacific oyster (*Magallana gigas*) is considered further in a full AA.

Finally, there are no likely non-aquaculture activities in the area that may act in-combination with the proposed aquaculture activity such that QIs screened out, may now screen in on foot of synergistic effects.

It is important to note the spatial extent of conservation features (i.e. Annex I – habitats and Marine Community Types) are based upon mapping provided by NPWS and presented in the relevant conservation objective documentation (NPWS 2015 a, b). The extent of aquaculture sites is derived from mapping derived from the DAFM database. The appropriate assessment is carried out using mapping derived from these sources only.

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the features of the Annex 1 habitats 1160 (Large Shallow Inlets and Bay) and 1170 (Reefs). In addition, the likely effects of the aquaculture activities (Species, structures, transport routes) were considered in light of the sensitivity of the marine community types found within these Annex 1 habitats.

Those Marine Community Types within QI 1160 considered subject to combined disturbance from existing and proposed aquaculture activities (Table 6-2), in addition to access route disturbance (with likely disturbance percentage) as described above are:

1. Subtidal sand with *Kurtiella bidentata* community complex (2.99%).
2. Intertidal reef community complex (4.71%).
3. *Laminaria*-dominated community complex (3.19%).

The total combined disturbance resulting from existing and proposed oyster culture over the QI Large shallow inlets and Bays (1160) in Slyne Head Peninsula SAC is 1.57%.

The sedimentary habitat, Subtidal sand with *Kurtiella bidentata* community complex is likely to be subject to disturbance from **the proposed sites**. This community types are considered primarily subtidal and therefore, not likely considered suitable for the proposed oyster culture methods. The overlap with reef community types is discussed below.

Those Marine Community Types considered subject to disturbance from existing aquaculture and proposed shellfish culture activities in QI 1170, in addition to access route disturbance (with likely disturbance percentage) as described above are:

1. Intertidal reef community complex (4.71%);
2. *Laminaria*-dominated community complex (3.19%).

The total combined likely disturbance resulting from existing and proposed aquaculture activities over the QI Reefs (1170) in Slyne Head Peninsula SAC is 2.42%.

Oyster culture using bags and trestles is wholly incompatible with any reef habitat (1170) or constituent community types. The substrate which for both MCT are mosaics of predominantly bedrock, cobble and boulders cannot easily facilitate the placement of trestles and access. In addition, the MCT *Laminaria*-dominated community is primarily subtidal.

The risk of potential recruitment of the culture organism, *M. gigas,* in Slyne Head Peninsula SAC was identified. However, it is noted that the majority of sites will source their seed directly from hatcheries and that it will be 100% triploid. Triploid oysters have a considerably lower reproductive potential that diploid oysters and therefore, the risk of establishment of this non-native species will be reduced. This assessment is based upon the seed source being triploid from hatcheries and, as such, does not present a major risk to conservation features from recruitment of non-native oysters (i.e. *M. gigas*) and other hitchhiker species. If the source or type of seed were to change this would require a separate assessment.

In-combination effects between proposed aquaculture activities occurs with pot fisheries for lobster and crab. There are no other activities identified that may act in combination with extensive aquaculture operations and result in disturbance to qualifying interests in the Slyne Head Peninsula SAC.

8.2 Mitigation Measures and Recommendations

As noted above all of the proposed shellfish culture activities will likely result in some disturbance on QIs of the Slyne Head Peninsula SAC. It is likely that some of the potential disturbance can be mitigated and these actions are summarised below and present for each of the applications in Table 8-1.

In summary, it is recommended that for those proposed aquaculture sites with reef habitat (and reef MCT) overlap, that the site boundaries be redrawn to remove any of these habitats and relevant MCT. This is on the basis that the practicality of carrying out shellfish culture without modifying the sites considerably in reef habitats is questioned. Any such modification would likely result in greater harm to the feature. In addition, the in-combination effects with potentially disturbing fishing activities (potting for lobster/crab) result in relatively high coverage of disturbance of reef habitats (and MCT) such that it is approaching the 15% threshold requiring action.

Finally, the exclusive use of hatchery sourced triploid oysters will mitigate the risks of recruitment (and potentially naturalisation) of the non-native culture species, the Pacific Oyster (*M. gigas*). It is recommended that all applicants use triploid seed.

Site ID	***Area (Ha)***	***Disturbance effect***	***Mitigation measure(s)***
T09-522A	0.96	- Overlap with reef MCT and subtidal MCT - Non-native species recruitment	- Redraw boundaries of site to remove all reef and subtidal MCT overlap - Exclusive use of triploid hatchery sourced seed
T09-417A	4.00	- Non-native species recruitment	- Exclusive use of triploid hatchery sourced seed
T09-417B	5.04	- Overlap with reef MCT and subtidal MCT - Non-native species recruitment	- Redraw boundaries of site to remove all reef and subtidal MCT overlap - Exclusive use of triploid hatchery sourced seed
T09-417C	3.12	- Overlap with reef MCT and subtidal MCT - Non-native species recruitment	- Redraw boundaries of site to remove all reef and subtidal MCT overlap - Exclusive use of triploid hatchery sourced seed
T09-517A	7.93	- Overlap with reef MCT and subtidal MCT - Non-native species recruitment	- Redraw boundaries of site to remove all reef and subtidal MCT overlap - Exclusive use of triploid hatchery sourced seed

Table 8-1 Oyster application sites in Slyne Head Peninsula SAC and recommended mitigation measures to facilitate licencing. MCT – Marine Community Type.

For some sites the full implementation of the mitigation measures may present operational difficulties that may call into question the viability of using the site for oyster production and therefore, facilitate a positive recommendation in relation to licencing.

8.3 Conclusion

In summary, assuming the mitigation measures are implemented, the general conclusions relating to the interaction between current and proposed aquaculture activities with QIs is that consideration can be given to licencing (new applications) in the Annex 1 habitats – 1160 (Large Shallow Inlets and Bays) and 1170 – Reefs.

It is recommended that there be strict adherence to the access routes identified and that density of culture structures within the sites be maintained at normal levels.

The potential impacts have been assessed and it has been objectively concluded following best available information, objective criteria, best scientific knowledge and expert judgement as well as the application of appropriate mitigation measures, that the proposed extensive aquaculture sites will not pose a risk of adversely affecting (either directly or indirectly) the integrity of Natura sites, either alone or in-combination with other plans and projects.

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