



Annex I

**Report supporting Appropriate Assessment of Aquaculture in North
Inishowen Coast SAC (Site code: 002012)**

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1 PREFACE

In Ireland, the implementation of Article 6 of the Habitats Directive in relation to aquaculture and fishing projects and plans that occur within designated sites is achieved through sub-Article 6(3) of the Directive. Fisheries not coming under the scope of Article 6.3, i.e. those fisheries not subject to secondary licencing are subject to risk assessment. Identified risks to designated features can then be mitigated and deterioration of such features can be avoided as envisaged by sub-article 6.2.

Fisheries, other than oyster fisheries, and aquaculture activities are licenced by the Department of Agriculture, Food and Marine (DAFM). Oyster fisheries (in fishery order areas) are licenced by the Department of Communications Energy and Natural Resources (DCENR). The Habitats Directive is transposed in Ireland in the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). Appropriate assessments (AA) of aquaculture and risk assessments (RA) of fishing activities are carried out against the conservation objectives (COs), and more specifically on the version of the COs that are available at the time of the Assessment, for designated ecological features, within the site, as defined by the National Parks and Wildlife Service (NPWS). NPWS are the competent authority for the management of Natura 2000 sites in Ireland. Obviously, aquaculture and fishing operations existed in coastal areas prior to the designation of such areas under the Directives. Ireland is thereby assessing both existing and proposed aquaculture and fishing activities in such sites. This is an incremental process, as agreed with the EU Commission in 2009, and will eventually cover all fishing and aquaculture activities in all Natura 2000 sites.

The process of identifying existing and proposed activities and submitting these for assessment is, in the case of fisheries projects and plans, outlined in S.I. 290 of 2013. Fisheries projects or plans are taken to mean those fisheries that are subject to annual secondary licencing or authorization. Here, the industry or the Minister may bring forward fishing proposals or plans which become subject to assessment. These Fishery Natura Plans (FNPs) may simply be descriptions of existing activities or may also include modifications to activities that mitigate, prior to the assessment, perceived effects to the ecology of a designated feature in the site. In the case of other fisheries, that are not projects or plans, data on activity are collated and subject to a risk assessment against the COs. Oyster fisheries, managed by DCENR, do not come under the remit of S.I. 290 of 2013 but are defined as projects or plans as they are authorized annually and are therefore should be subject to AA.

In the case of aquaculture, DAFM receives applications to undertake such activity and submits a set of applications, at a defined point in time, for assessment. The FNPs and aquaculture applications are then subject to AA. If the AA or the RA process finds that the possibility of significant effects cannot be discounted or that there is a likelihood of negative consequence for designated features then such activities will need to be mitigated further if they are to continue. The assessments are not explicit on how this mitigation should be achieved but rather indicate whether mitigation is required or not and what results should be achieved.

2 EXECUTIVE SUMMARY

2.1 THE SAC

The North Inishowen Coast situated on the north Donegal coast is designated as a Special Area of Conservation (SAC) under the Habitats Directive. The marine area is designated for Mudflats and sand flats not covered by seawater at low tide (1140) which support a variety of soft sedimentary communities and community complexes. The area is also designated for otter. Conservation Objectives for marine habitats and constituent communities (within the North Inishowen Coast SAC) were identified by NPWS (2014a) and relate primarily to the requirement to maintain habitat distribution, structure and function, as defined by characterizing (dominant) species in these habitats. For designated species the objective is to maintain various attributes of the populations including population size, habitats quality and the distribution of the species.

2.2 AQUACULTURE ACTIVITIES IN THE SAC

Current aquaculture activities within the North Inishowen SAC occur at Trawbreaga Bay and focus primarily on the cultivation of the Pacific oyster *Crassostrea gigas* on trestles in intertidal areas. The profile of the aquaculture industry in the Bay, used in this assessment, was prepared by BIM and is derived from the list of licence applications received by DAFM and provided to the MI for assessment in February 2015.

2.3 THE APPROPRIATE ASSESSMENT PROCESS

The function of an appropriate assessment and risk assessment is to determine if the ongoing and proposed aquaculture and fisheries activities are consistent with the Conservation Objectives for the Natura site or if such activities will lead to deterioration in the attributes of the habitats and species over time and in relation to the scale, frequency and intensity of the activities. NPWS (2014a) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in the SAC. This guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with long term maintenance of certain sensitive habitats while other habitats can tolerate a range of activities. For the practical purpose of management of sedimentary habitats a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance. Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the characterizing species of the habitat (which may also indicate change in structure and function). Such disturbance may be temporary or persistent in the sense that change in characterizing species may recover to pre-disturbed state or may persist and accumulate over time.

The appropriate assessment and risk assessment process is divided into a number of stages consisting of a preliminary risk identification, and subsequent assessment (allied with mitigation measures if necessary) which are covered in this report. The first stage of the process is an initial screening wherein activities which cannot have, because they do not spatially overlap with a given habitat or have a clear pathway for interaction, any impact on the conservation features and are therefore excluded from further consideration. The next phase is the Natura Impact Statement (NIS) where interactions (or risk of) are identified. Further to this, an assessment on the significance of the likely interactions between activities and conservation features is conducted. Mitigation measures (if

necessary) will be recommended in situations where the risk of significant disturbance is identified. In situations where there is no obvious mitigation to reduce the risk of significant impact, it is advised that caution should be applied in licencing decisions. Overall the Appropriate Assessment is both the process and the assessment undertaken by the competent authority to effectively validate a Screening Report and/or NIS. It is important to note that the screening process is considered conservative in that other activities which may overlap with habitats but which may have very benign effects are retained for full assessment.

2.4 DATA SUPPORTS

Distribution of habitats and species population data are provided by NPWS¹. Scientific reports on the potential effects of various activities on habitats and species have been compiled by the MI and provide the evidence base for the findings. The profile of aquaculture activities was provided by BIM. The data supporting the assessment of individual activities vary and provides for varying degrees of confidence in the findings.

2.5 FINDINGS

In the North Inishowen Coast SAC there are 23 valid oyster production licences with a further 44 new applications. The likely interaction between aquaculture activity and conservation features (habitats and species) of the site was considered. An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration. None of the aquaculture activities (existing and/or proposed) overlaps or likely interacts with the following features or species, and therefore these 5 habitats and 1 species were excluded from further consideration in the assessment:

- 1220 Perennial vegetation of stony banks
- 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)
- 21A0 Machairs (*priority habitat in Ireland)
- 4030 European dry heaths
- 1014 Narrow-mouthed Whorl Snail *Vertigo angustior*

Of the four constituent community types recorded within the qualifying interest of Mudflats and sandflats not covered by seawater at low tide (1140) two were shown to have no overlap with aquaculture activities and were excluded from further analysis. These community types are:

- Fine to medium sand with *Eurydice pulchra* community complex
- *Zostera*-dominated community

¹ NPWS Geodatabase Ver: April 2015 - <http://www.npws.ie/mapsanddata/habitatspeciesdata/>

A full assessment was carried out on the likely interactions between current and proposed aquaculture operations and the feature Annex 1 habitat Mudflats and sandflats not covered by seawater at low tide (1140). The likely effects of existing and proposed aquaculture activities were considered in light of the sensitivity of the constituent communities of the Annex 1 habitat.

The appropriate assessment finds that existing and proposed activities do not pose a risk of significant disturbance to the conservation of the designated habitat feature of Mudflats and sandflats not covered by seawater at low tide (1140) or constituent community of Muddy sand to coarse sediment with *Pygospio elegans* community complex, and Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex. However, in one instance (T12/492A), the risk of significant disturbance cannot be dismissed as the hydrodynamics of the inner part of the bay (and subsequently, the structure of the constituent community types) may be impacted by the scale of the proposed operation.

Finally, the aquaculture activities did not present a barrier to migration and on the (freshwater) attributes for the Otter (*Lutra lutra*) and therefore was excluded from further analysis.

3 INTRODUCTION

This document assesses the potential ecological interactions of aquaculture and fisheries activities within the North Inishowen SAC (Site code 002012) on the Conservation Objectives (COs) of the site. The information upon which this assessment is based is a list of applications and extant licences for aquaculture activities administered by the Department of Agriculture Food and Marine (DAFM) and forwarded to the Marine Institute as of February 2015; as well as aquaculture and fishery profiling information provided on behalf of the operators by Bord Iascaigh Mara. The spatial extent of aquaculture licences is derived from a database managed by the DAFM² and shared with the Marine Institute.

4 CONSERVATION OBJECTIVES FOR NORTH INISHOWEN SAC

The appropriate assessment of aquaculture and fisheries in relation to the Conservation Objectives for the North Inishowen Coast SAC is based on Version 1.0 of the objectives (NPWS 2014a - Version 1 November 2014) and supporting documentation (NPWS 2014b - Version 1 March 2014; NPWS 2014c - Version 1 March 2014). The spatial data for conservation features was provided by NPWS³.

4.1 THE SAC EXTENT

North Inishowen Coast SAC is a large site on the north coast of Ireland. The SAC stretches from Crummies Bay in the west up to Malin Head and back down to Inishowen Head to the East (**Figure 4.1**). It includes a variety of coastal habitats including high rocky cliffs, offshore islands, sand dunes, salt marsh, a large intertidal bay and rocky, shingle and sand beaches. North Inishowen Coast SAC is designated for the marine Annex I qualifying interest of Mudflats and sandflats not covered by seawater at low tide (1140). A number of Annex I coastal habitats can also be found in the SAC, including Perennial vegetation of stony banks, Vegetated sea cliffs of the Atlantic and Baltic coasts, Fixed coastal dunes with herbaceous vegetation (grey dunes), Machairs and European dry heaths. The SAC is also considered an important site for the Otter (*Lutra lutra*). The extent of the SAC is shown in **Figure 4.1** below.

4.2 QUALIFYING INTERESTS (SAC)

The SAC is designated for the following habitats and species (NPWS 2014a), as listed in Annex I and Annex II of the Habitats Directive:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1220 Perennial vegetation of stony banks
- 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

² DAFM Aquaculture Database version Aquaculture: February 4, 2015

³ NPWS Geodatabase Ver: Jan 2015 - <http://www.npws.ie/mapsanddata/habitatspeciesdata/>

-
- 21A0 Machairs (*priority habitat in Ireland)
 - 4030 European dry heaths
 - 1014 Narrow-mouthed Whorl Snail *Vertigo angustior*
 - 1355 Otter *Lutra lutra*

The spatial extent of the qualifying interest Annex 1 marine habitat 1140 - Mudflats and sandflats not covered by seawater at low tide) is illustrated in **Figure 4.2** (from NPWS (2014c).

Constituent communities and community complexes recorded within the qualifying interest Annex 1 marine habitats (i.e. 1140 - Mudflats and sandflats not covered by seawater at low tide) are listed in NPWS (2014c) and illustrated in **Figure 4.3** and consist of:

- *Zostera*-dominated community
- Fine to medium sand with *Eurydice pulchra* community complex
- Muddy sand to coarse sediment with *Pygospio elegans* community complex
- Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex

The North Inishowen Coast SAC is designated for the Otter, *Lutra lutra*. The species is listed in Annex IV(a) of the habitats directive and is afforded strict protection. According to the NPWS (2009) although otter numbers have declined from 88% in 1980/81 to 70% in 2004/05, otters remain widespread in Ireland.

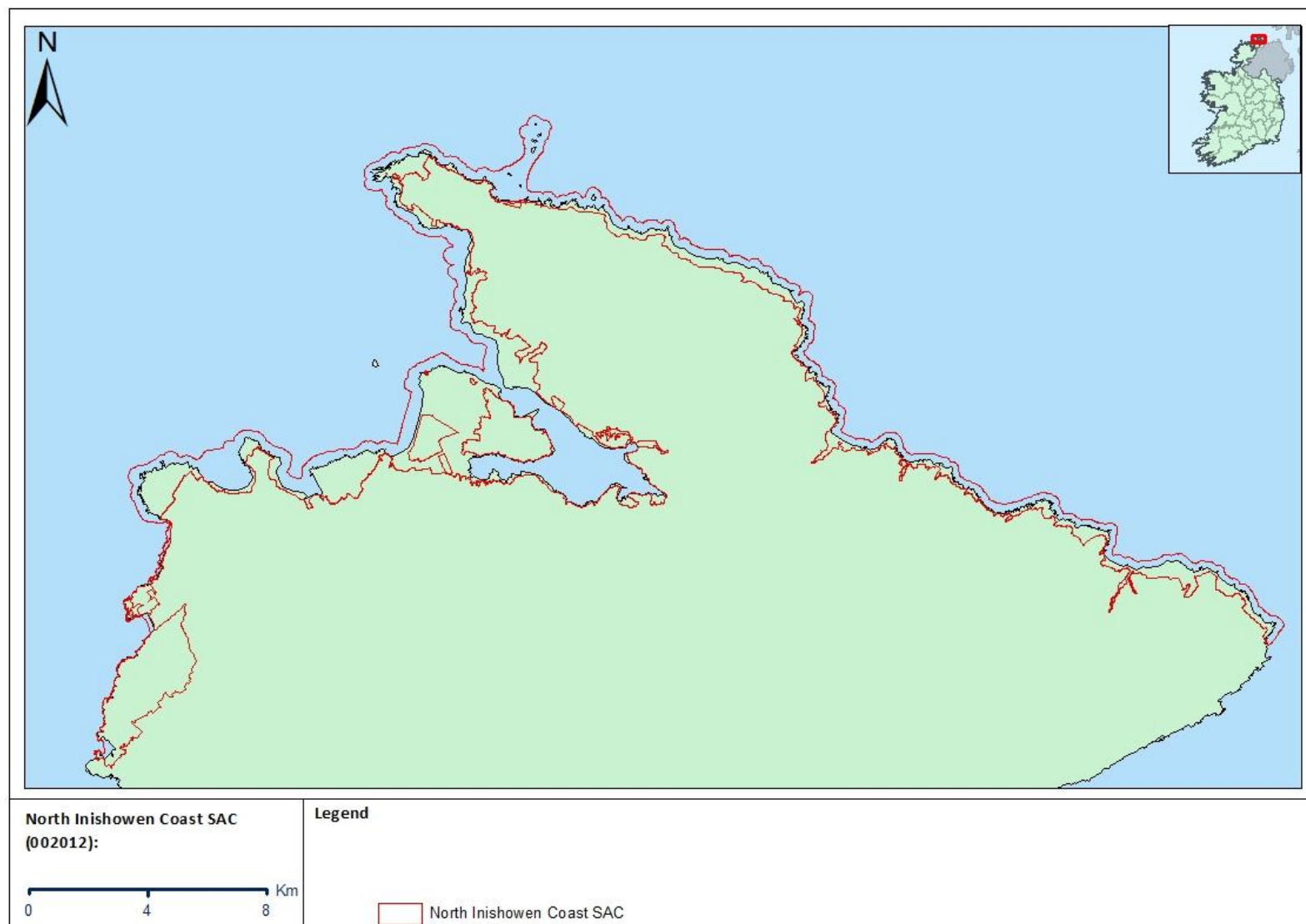


Figure 4-1 - The extent of the North Inishowen Coast SAC (NPWS 2013c).

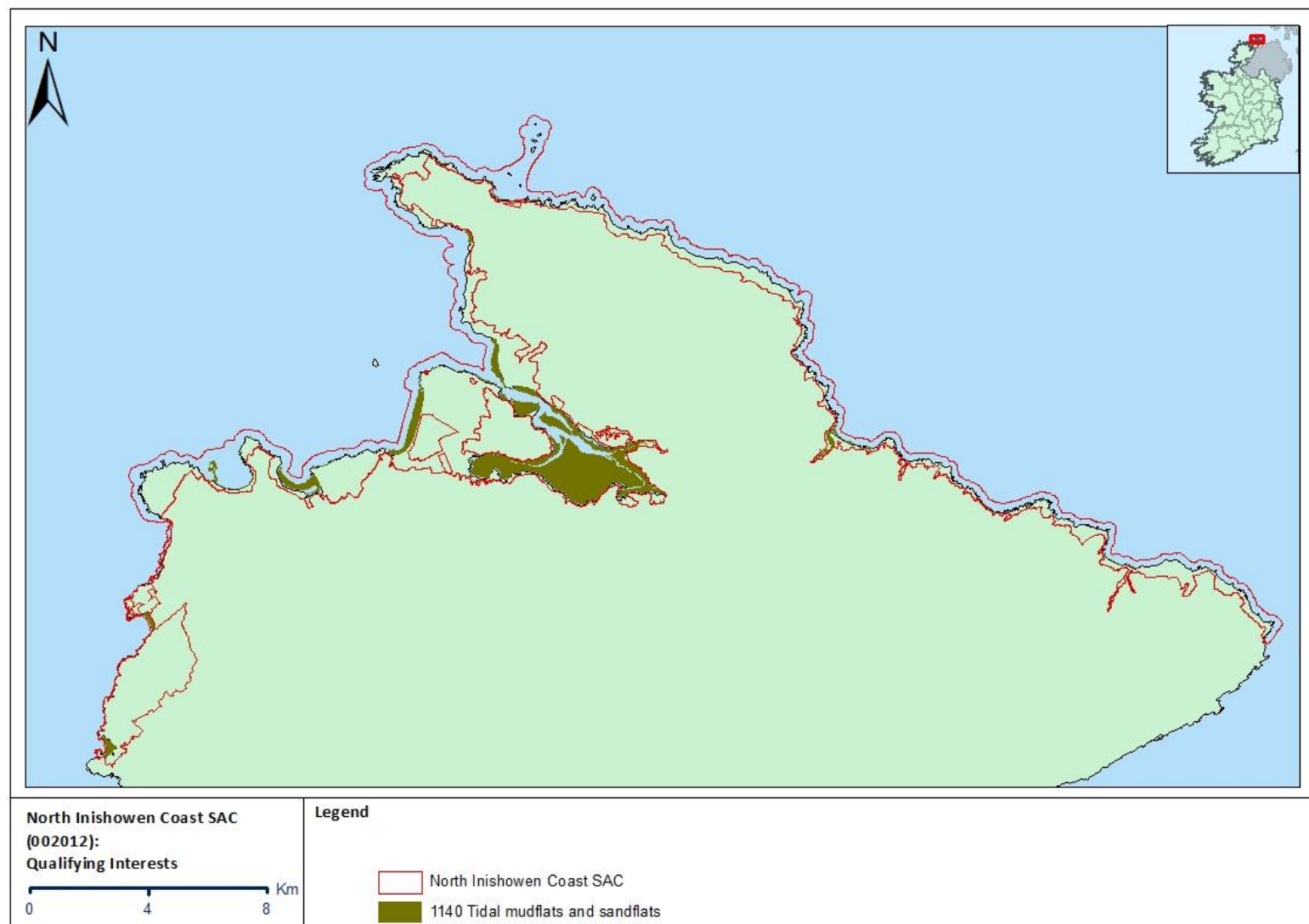


Figure 4-2 - Marine Annex I qualifying interest of Mudflats and sandflats not covered by seawater at low tide (1140) within the North Inishowen Coast SAC (NPWS 2014c).

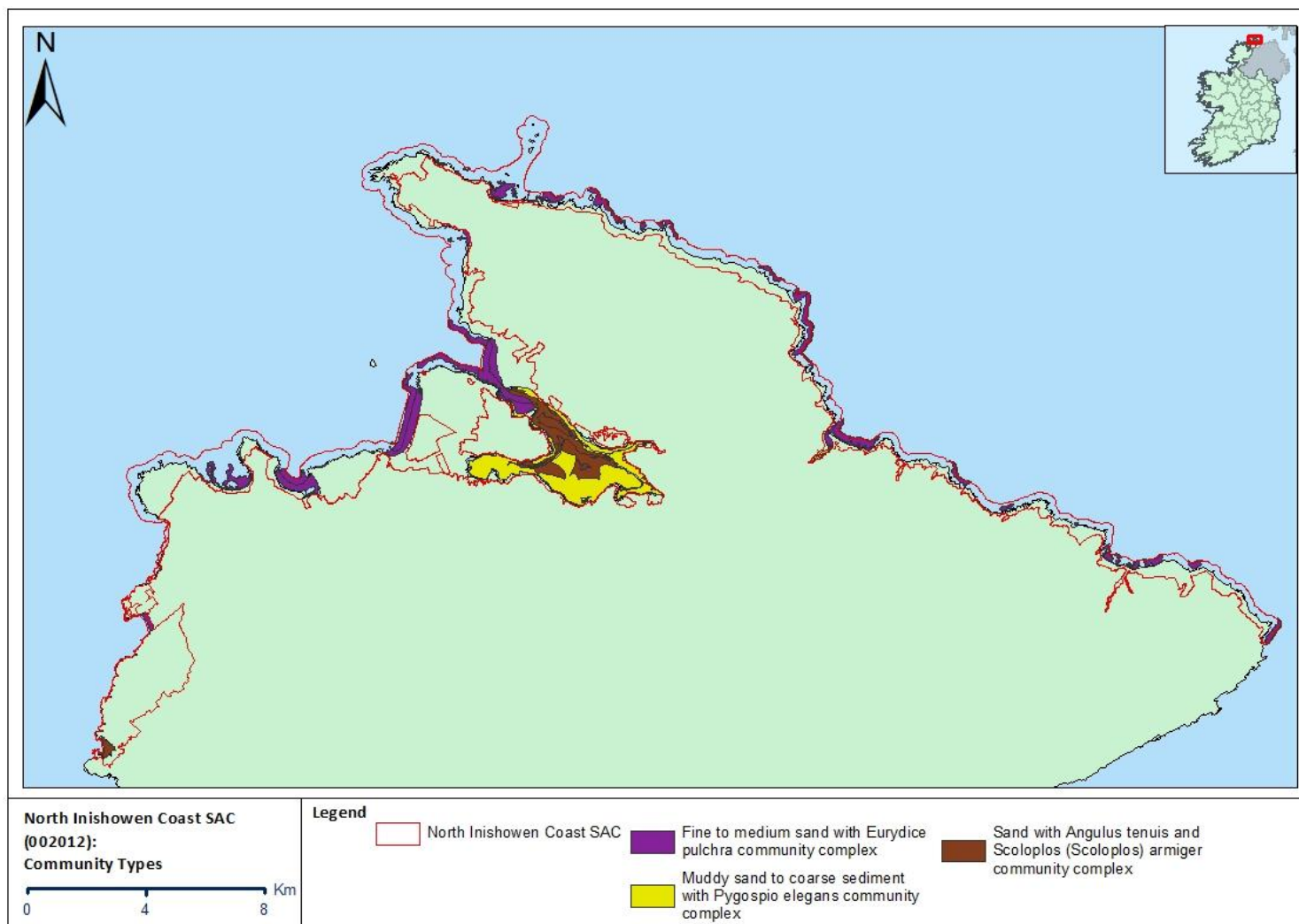


Figure 4-3 - Principal benthic communities recorded within the marine Annex I qualifying interest of Mudflats and sandflats not covered by seawater at low tide (1140) within the North Inishowen Coast SAC (NPWS 2014c).

4.3 CONSERVATION OBJECTIVES FOR NORTH INISHOWEN COAST SAC

The conservation objectives for the qualifying interests (SAC) were identified in NPWS (2014a). The natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution. Habitat availability should be maintained for designated species and human disturbance should not adversely affect such species. The features, objectives and targets of each of the qualifying interests within the SAC are listed in **Table 4.1** below.

Table 4.1 - Conservation objectives and targets for marine habitats and species in North Inishowen Coast SAC (NPWS 2014a, 2014b, 2014c). Annex I and II features listed in **bold**.

Feature (Community Type)	Objective	Target(s)
Mudflats and sandflats not covered by seawater at low tide 1140	Maintain favourable conservation condition	987.89ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species
(<i>Zostera</i> -dominated community)	Maintain favourable conservation condition	1.91ha; Maintain natural extent and high quality of <i>Zostera</i> dominated communities
(Fine to medium sand with <i>Eurydice pulchra</i> community complex)	Maintain favourable conservation condition	234.69ha; Maintain in a natural condition
(Muddy sand to coarse sediment with <i>Pygospio elegans</i> community complex)	Maintain favourable conservation condition	542.76ha; Maintain in a natural condition
(Sand with <i>Angulus tenuis</i> and <i>Scoloplos (Scoloplos) armiger</i> community complex)	Maintain favourable conservation condition	208.53ha; Maintain in a natural condition
Perennial vegetation of stony banks 1220	Maintain favourable conservation condition	Area unknown; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
Vegetated sea cliffs of the Atlantic and Baltic coasts 1230	Maintain favourable conservation condition	>68.0km; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
Fixed coastal dunes with herbaceous vegetation (grey dunes) 2130	Maintain favourable conservation condition	496.06ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity

Feature (Community Type)	Objective	Target(s)
		of favourable species and managing levels of negative species.
Machairs (*priority habitat in Ireland) 21A0	Maintain favourable conservation condition	17.96ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
European dry heaths 4030	Maintain favourable conservation condition	Total area of this habitat has not been calculated, but estimated to cover more than 10% of the SAC; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
Narrow-mouthed Whorl Snail <i>Vertigo angustior</i> 1040	Maintain favourable conservation condition	There are two known sites for this species and targets relate to maintaining adult and sub-adult densities and overall habitat quality.
Otter <i>Lutra lutra</i> 1355	Maintain favourable conservation condition	Maintain distribution - 88% positive survey sites.

4.4 SCREENING OF ADJACENT SACs OR FOR *EX-SITU* EFFECTS

In addition to the North Inishowen Coast SAC there are a number of other SAC sites proximate to the proposed activities (**Figure 4.4**). The characteristic features of these sites are identified in **Table 4.2** where a preliminary screening is carried out on the likely interaction with aquaculture activities based primarily upon the likelihood of spatial overlap. As it was deemed that there are no ex situ effects and no effects on features in adjacent SACs all qualifying features of the adjacent SACs sites were screened out.

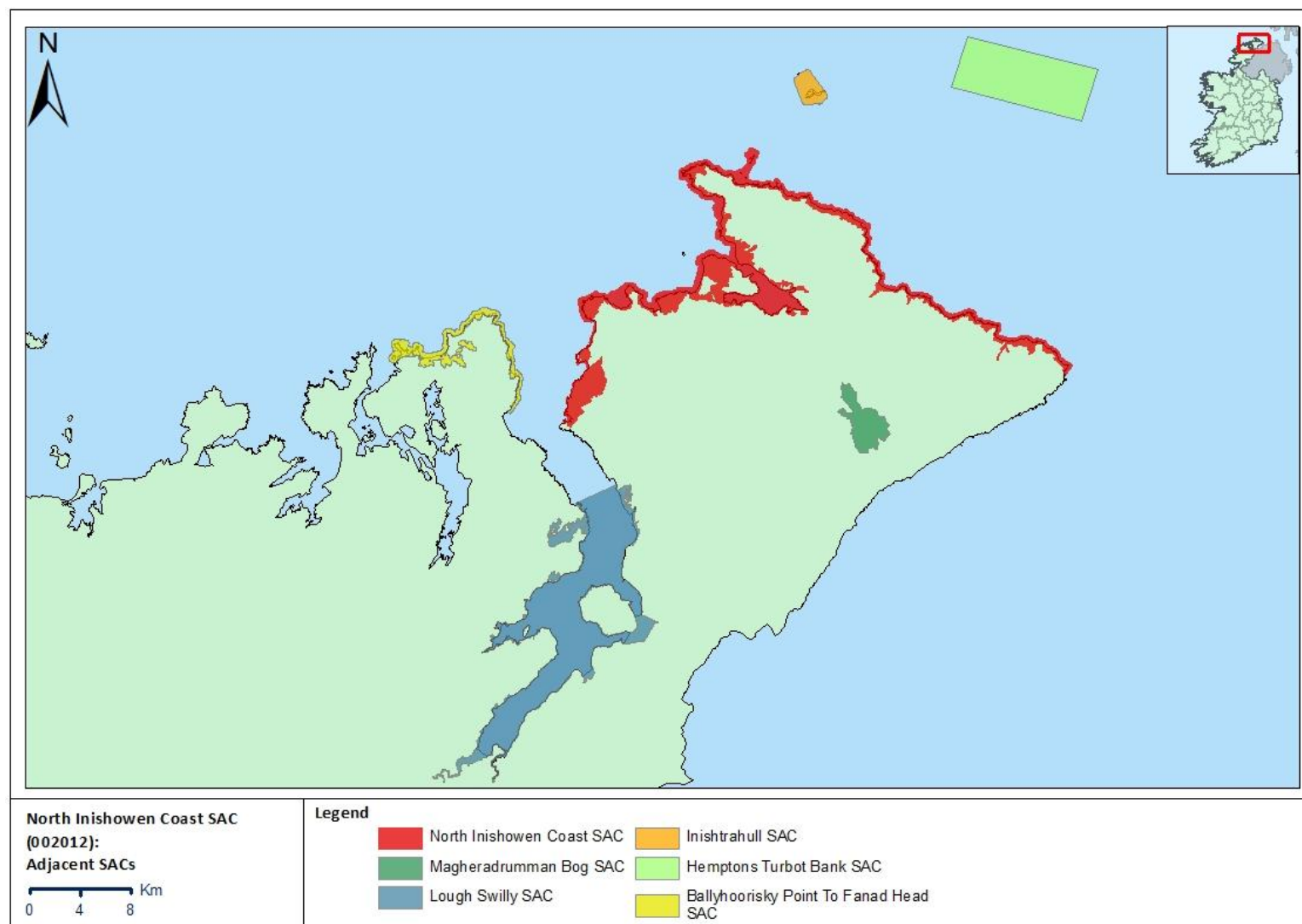


Figure 4-4 – SACs adjacent to the North Inishowen Coast SAC.

Table 4.2 - SAC sites adjacent to the North Inishowen Coast SAC and qualifying features with initial screening assessment on likely interactions with aquaculture activities. * denotes priority habitat.

Natura site	Qualifying features (habitat/species code)	Aquaculture initial screening
Magheradrumman Bog SAC	Northern Atlantic wet heaths with <i>Erica tetralix</i> (4010)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Blanket bogs (* if active bog) (7130)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
Lough Swilly SAC	Estuaries (1130)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Coastal lagoons (1150)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>) (1330)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Old sessile oak woods with Ilex and Blechnum in the British Isles (91A0)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	<i>Lutra lutra</i> (Otter) (1355)	Otter may migrate into the North Inishowen Coast SAC and could interact with aquaculture activities – carry forward to Section 8 .
Inishtrahull SAC	Vegetated sea cliffs of the Atlantic and Baltic coasts (1230)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
Hempton's Turbot Neck SAC	Sandbanks which are slightly covered by sea water all the time (1110)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
Ballyhoorisky SAC	Perennial vegetation of stony banks (1220)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Vegetated sea cliffs of the Atlantic and Baltic coasts (1230)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (3110)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (3140)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	<i>Vertigo angustior</i> (Narrow-mouthed Whorl Snail) (1014)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.
	<i>Najas flexilis</i> (Slender Naiad) (1833)	No spatial overlap with aquaculture activities within North Inishowen Coast SAC – excluded from further analysis.

5 DETAILS OF THE PROPOSED PLANS AND PROJECTS

5.1 DESCRIPTION OF AQUACULTURE ACTIVITIES

This assessment focuses on aquaculture activities which occur within the qualifying interest of Mudflats and sandflats not covered by seawater at low tide (1140) for which the North Inishowen Coast SAC is designated. Aquaculture activities within the SAC occur at Trawbreaga Bay, focussing primarily on the cultivation of the Pacific oyster *C. gigas*. Descriptions of spatial extents of existing and proposed aquaculture activities within the qualifying interest were calculated using coordinates of activity areas in a GIS (Figure 5.1). The spatial extent of the cultivation activities (current and proposed) overlapping the habitat features is presented in Table 5.1 (data provided by DAFM).

Oyster production has been operational in Trawbreaga Bay since the late 1990's, however it was not until the early noughties that licenses were first issued for the area. In 2001 there were 26 licences to farm oysters in the Trawbreaga Bay area. Currently there are 23 valid oyster production licences with a further 44 new applications.

5.1.1 Intertidal Oyster Cultivation

5.1.1.1 Current Activity

Current oyster cultivation within North Inishowen Coast SAC is a form of intensive culture with oyster seed cultivated using the bag and trestle method within the intertidal zone, either to half-grown or fully-grown size. The bag and trestle method uses steel table-like structures which rise from the shore to just above knee height on the middle to lower intertidal zone, arrayed in double rows with wide gaps between the paired rows to allow for access. Trestles used are made from steel and typically between 3 in length, are approximately 1 metre in width and stand between 0.5 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 2 and 5 hours exposure depending on location, tidal and weather conditions. The trestles hold 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 in North Inishowen Coast SAC when G4 to G8 (6 – 10mm, respectively) oyster seed is brought to the service site either in spring or late summer of each year. Oyster bags vary in mesh size (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 1000 to 1500 seed per bag. Both Diploid and Triploid oysters are grown in Trawbreaga Bay. Though the majority of producers are now moving into triploid production of all their stock as it appears to perform well in the area. The oyster seed is bought in from oyster nurseries in France or the UK and include;

- GrainOcean
- France Turbot
- Satmar
- France Nissian

Oysters are thinned out and graded as the oysters grow. As the oysters grow, they will be taken to the handling / sorting facility twice per year for grading and re-packing, and 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 or 80 to the kilo. At reaching market size oysters are in bags of about 120. Some farmers also take in half grown hatchery produced oysters (from Dungloe, Co. Donegal) and grow under contract for local farmers in the area.

There are three main pacific oyster production areas within Trawbreaga Bay; the North and South of the bay, with one producer farming in the West of the bay. Farms on the intertidal area are typically accessed during spring tides (at low tide) using vans or tractors. Preparatory work is always conducted in the service areas in the intervening periods, including grading and packing, preparation of bags and trestles and general maintenance work which includes shaking and turning of bags, and hand removal of fouling and seaweed to ensure maintenance of water flow through the bags when submerged. In the North of the Bay, eight of the producers observe one access route from the shore to their farm area, with a maximum of five tractors active in the area at any one time. In the south of the Bay six active producers observe access growing areas using one dedicated access route from the shore. At any one time depending on times of grading and selling stock there can be up to three tractors and trailers operating across the area. In the west of the bay one producer uses a dedicated access route to the farm. This access route is a public road.

5.1.1.2 Proposed Oyster Cultivation Activity

New (oyster) applicants, have indicated their source of seed will be from hatcheries currently used by existing farms within the Bay. All new applicants are to use bag and trestles (intensive) as the method of cultivating their oysters. There will be both diploid and triploid (if available) seed used on site. All new proposed cultivation sites are located within the existing licenced areas and will be serviced using existing access routes (see **Section 5.1.1.4** and **Figure 5.2** below).

5.1.1.3 Access Routes

There are a number of access routes in Trawbreaga (**Figure 5.2**) used to access each of the main growing areas. Tractors and trailers will be used, for all sites within the SAC.

Calculation of area of access routes in the SAC is linear length (in metres) by a putative route width of 10m, which is considered a sufficiently precautionary estimate. The spatial coverage of access routes is presented in **Tables 5.1, 7.1** and **8.4**.

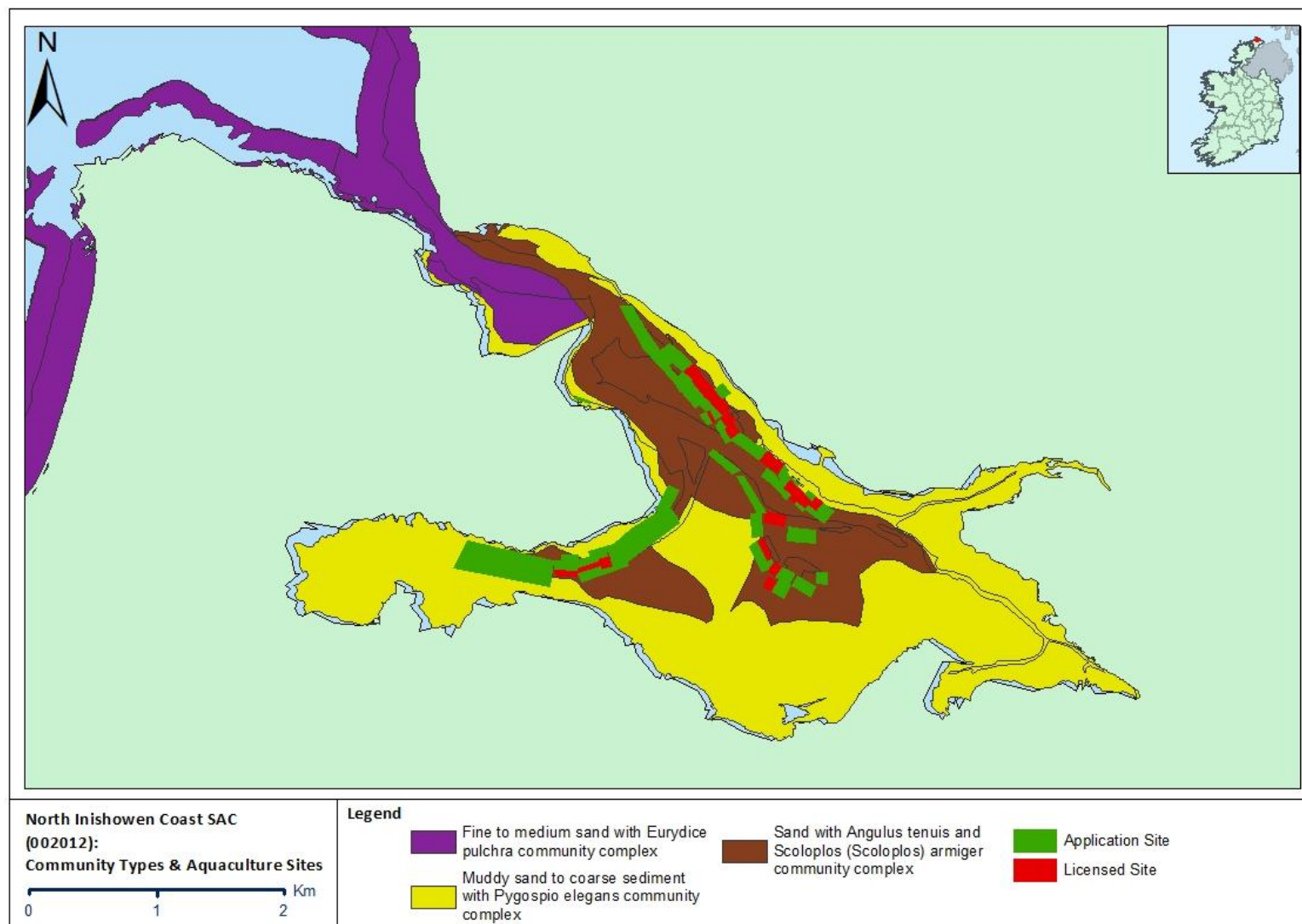


Figure 5-1 - Aquaculture sites (licenced and applications) at Trawbreaga Bay relative to principal benthic communities recorded within the marine Annex I qualifying interest of Mudflats and sandflats not covered by seawater at low tide (1140) of North Inishowen Coast SAC (NPWS 2014c).

North Inishowen Coast SAC (2012) Access Routes

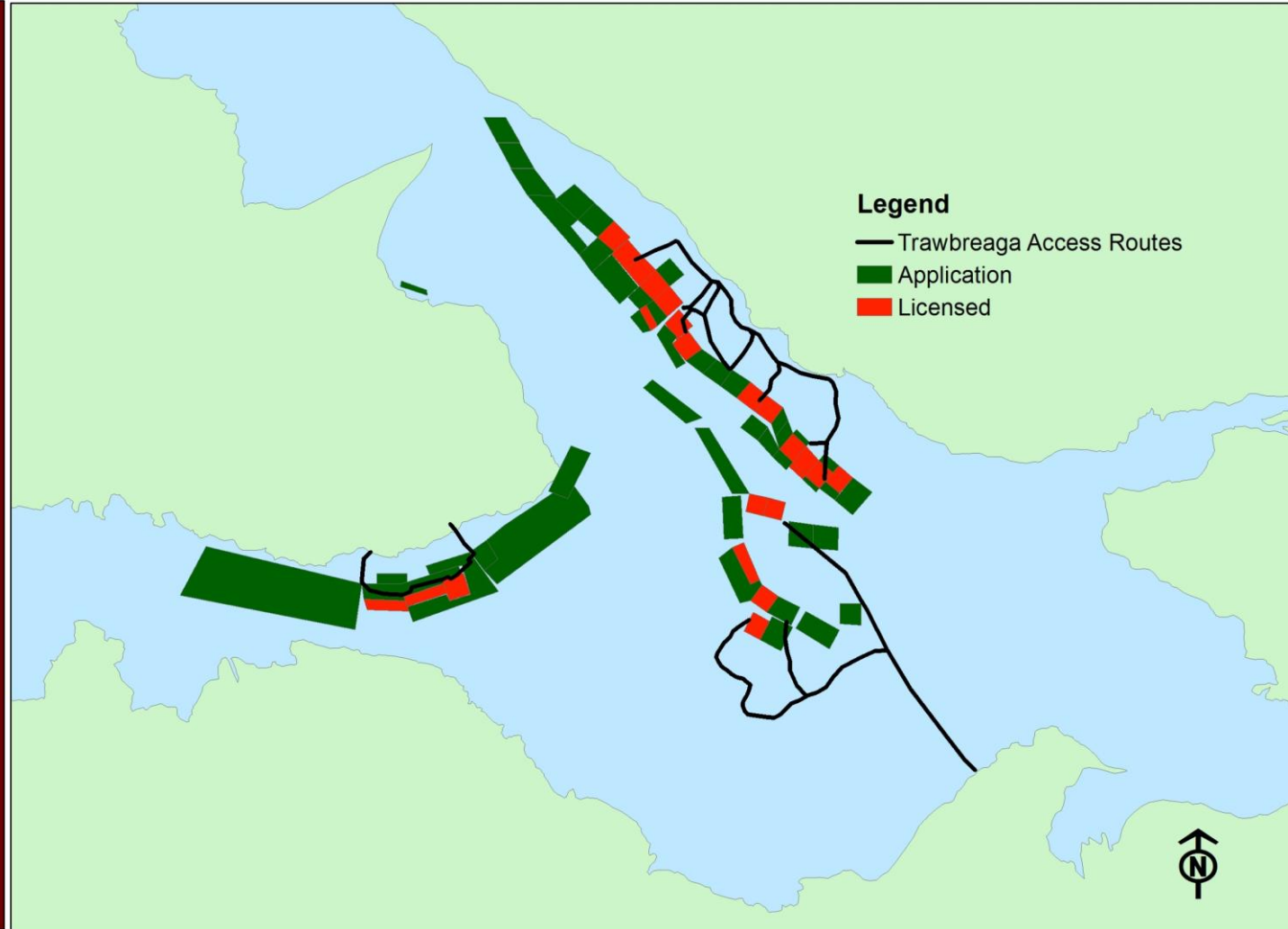


Figure 5-2 - Access routes to aquaculture sites within North Inishowen Coast SAC.

Table 5.1 - Spatial extent of aquaculture activities and access routes overlapping with the qualifying interest (1140 Mudflats and sandflats not covered by seawater at low tide) in North Inishowen Coast SAC. Aquaculture activities presented according to culture type, method and license status.

				1140 - Mudflats and sandflats not covered by seawater at low tide	
Culture Type	Method	Status	No of Licences	Area (ha)	% Feature
Oysters	Intensive	Licensed	23	7.55	0.77
Oysters	Intensive	Application	44	43.92	4.44
Access Routes				6.67	0.67
Grand total				58.14	5.88

6 NATURA IMPACT STATEMENT FOR THE PROPOSED ACTIVITIES

The potential ecological effects of activities on the conservation objectives for the site relate to the physical and biological effects of fishing gears, aquaculture cultivation structures and activities and human activities on designated species, intertidal 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 fishing and aquaculture activities during the lifetime of the proposed plans and projects and the nature of each of these activities in conjunction with the sensitivity of the receiving environment.

6.1 AQUACULTURE

Within the qualifying interest of the North Inishowen Coast SAC the species cultured is the Pacific oyster *C. gigas* in bags & trestles in the intertidal area.

Details of the potential biological and physical effects of these aquaculture activities on the habitat features, their sources and the mechanism by which the impact may occur are summarised in **Table 6.1** below. The impact summaries identified in the table are derived from published primary literature and review documents that have specifically focused upon the environmental interactions of mariculture (e.g. Black 2001; McKindsey et al 2007; NRC 2010; O’Beirn et al 2012; Cranford et al 2012; ABPMer 2013a-h).

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.

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. 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 – *C. gigas*) may also presents a risk of establishment of this species in the SAC. Recruitment of *C. 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.

Intertidal shellfish culture: Oysters are 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. Similar to suspended culture above, 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. If tidal height is high and large volumes of water moved through the culture area an acceleration of water flow can occur beneath the trestles and bags, resulting in a scouring effect or erosion and no accumulation of material.
- Turbidity of water – as with suspended mussel culture, oysters have very plastic response to increasing suspended matter in the water column with a consequent increase in faecal or pseudo-faecal production. Oysters can be cultured in estuarine areas (given their polyhaline tolerance) 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 increased 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 resuspend and disperse material away from the trestles.

Shading may be an issue as a consequence of the structures associated with intertidal oyster culture. The racks and bags are held relatively close to the seabed and as a consequence may shade sensitive species (e.g. seagrasses) found underneath.

Physical disturbance caused by compaction of sediment from foot traffic and vehicular traffic. 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.

Intertidal culture of clam species is typically carried out in the sediment covered with netting to protect the stock from predators. The high density of the culture organisms can lead to exclusion of native biota and the ground preparation and harvest methods (by mechanical means or by hand) can lead to considerable disturbance of biota characterising the habitat.

Other considerations: Due to the nature of the (high density) of shellfish culture methods the risk of transmission of disease within cultured stock is high. However, given that *C. 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.

Oyster culture poses a risk in terms of the introduction of non-native species as the Pacific oyster (*C. gigas*) is a non-native species. Recruitment of *C. 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. The culture of large volumes of Pacific oysters may increase the risk of successful reproduction in North Inishowen Coast SAC. The use of triploid (non-reproducing) stock is the main method employed to manage this risk. Furthermore, the introduction of non-native species as 'hitchhikers' on and among culture stock is also considered a risk, the extent of which is dependent upon the duration the stock has spent 'in the wild' outside of North Inishowen Coast SAC. Half-grown stock (15 - 30g oysters) which would have been grown for extended periods in places (in particular outside of Ireland) present a higher risk. Oysters grown in other bays in Ireland and 'finished' in North Inishowen Coast SAC, would not appear to present a risk of introduction of non-native species assuming best practice is applied (e.g. <http://invasivespeciesireland.com/cops/aquaculture/>).

Table 6.1 - Potential indicative environmental pressures of aquaculture activities within the qualifying interest (Mudflats and sandflats not covered by seawater at low tide (1140)) of the North Inishowen Coast SAC.

Activity	Pressure category	Pressure	Potential effects	Equipment / Gear	Duration (days)	Time of year	Factors constraining the activity
Intertidal Oyster Culture	Physical	Current alteration	Structures may alter the current regime and resulting increased deposition of fines or scouring.	Trestles and bags and service equipment	365	All year	At low tide only
		Surface disturbance	Ancillary activities at sites, e.g. servicing, transport increase the risk of sediment compaction resulting in sediment changes and associated community changes.				
		Shading	Prevention of light penetration to seabed potentially impacting light sensitive species				
	Biological	Non-native species introduction	Potential for non-native species (<i>C. gigas</i>) to reproduce and proliferate in SAC. Potential for alien species to be included with culture stock (hitch-hikers).				
		Disease risk	In event of epizootic the ability to manage disease in uncontained subtidal oyster populations is compromised.				
		Organic enrichment	Faecal and pseudofaecal deposition on seabed potentially altering community composition				

7 SCREENING OF AQUACULTURE ACTIVITIES

A screening assessment is an initial evaluation of the possible impacts that activities may have on the qualifying interests. The screening, is a filter, which may lead to exclusion of certain activities or qualifying interests from appropriate assessment proper, thereby simplifying the assessments, if this can be justified unambiguously using limited and clear cut criteria. Screening is a conservative filter that minimises the risk of false negatives.

In this assessment screening of the qualifying interests against the proposed activities is based primarily on spatial overlap i.e. if the qualifying interests overlap spatially with the proposed activities then significant impacts due to these activities on the conservation objectives for the qualifying interests is not discounted (not screened out) except where there is absolute and clear rationale for doing so. Where there is relevant spatial overlap full assessment is warranted. Likewise if there is no spatial overlap and no obvious interaction is likely to occur, then the possibility of significant impact is discounted and further assessment of possible effects is deemed not to be necessary. **Table 5.1** provides spatial overlap extent between designated habitat qualifying interest feature of Mudflats and sandflats not covered by seawater at low tide (1140) and aquaculture activities within the qualifying interests of the North Inishowen Coast SAC.

7.1 SCREENING OF NORTH INISHOWEN COAST SAC

Where the overlap between an aquaculture activity (intensive bag and trestle culture of shellfish only) and a habitat community type and/or a feature of interest is zero it is screened out and not considered further. Therefore, the following habitats and one species are also excluded from further consideration of aquaculture interactions:

- 1220 Perennial vegetation of stony banks
- 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)
- 21A0 Machairs (*priority habitat in Ireland)
- 4030 European dry heaths
- 1014 Narrow-mouthed Whorl Snail *Vertigo angustior*

Furthermore, of the four community types (see **Table 4.1**) listed under the habitat features (1140), two (i.e. Fine to medium sand with *Eurydice pulchra* community complex and *Zostera*-dominated community) have no spatial overlap between them and any aquaculture activities. On this basis, the community types, Fine to medium sand with *Eurydice pulchra* community complex and *Zostera*-dominated community are excluded from further analysis of aquaculture interactions.

When overlap between aquaculture activity and a community habitat type and/or a feature of interest was observed it was quantified in a GIS application and presented on the basis of coverage of specific activity (representing different pressure types), licence status (licensed or application) intersecting with designated conservation features and/or sub-features (community types). **Table**

5.1 highlights the spatial overlap between (existing and proposed) aquaculture activities and qualifying habitat feature of Mudflats and sandflats not covered by seawater at low tide (1140) while **Table 7.1** below provides an overview of overlap of aquaculture activities and specific marine community types (identified from Conservation Objectives (i.e. NPWS 2014a)) within the broad habitat feature 1140. A full assessment (see **Section 8**) was carried out on the likely interactions of aquaculture activities with the community types presented in (**Table 7.1**).

Given the wide spatial distribution of Otter (*Lutra lutra*) [1355] within the North Inishowen Coast SAC it is possible the species may interact with aquaculture activities. Consequently, a full assessment was carried out on the likely interactions (see **Section 8**).

Table 7.1 - Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activity over community types within the qualifying interest 1140 (i.e. Mudflats and sandflats not covered by seawater at low tide) in North Inishowen Coast SAC. Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2014c.

			1140 - Mudflats and sandflats not covered by seawater at low tide; 987.89ha	
Culture Type	Method	Status	Muddy sand to coarse sediment with <i>Pygospio elegans</i> community complex; 542.76ha	Sand with <i>Angulus tenuis</i> and <i>Scoloplos (Scoloplos) armiger</i> community complex; 208.53 ha
Oysters	Intensive	Licensed	1.34 (0.25)	6.21 (2.98)
Oysters	Intensive	Application	13.55 (2.5)	30.37 (14.56)
Access Routes			2.86 (0.53)	3.04 (1.46)
Grand total			17.75 (3.28)	39.62 (19.00)

8 ASSESSMENT OF AQUACULTURE ACTIVITIES

8.1 DETERMINING SIGNIFICANCE

The significance of the possible effects of the proposed activities on habitats, as outlined in the Natura Impact Statement ([Section 6](#)) and subsequent screening exercise ([Section 7](#)), is determined here in the assessment. The significance of effects is determined on the basis of Conservation Objective guidance for qualifying habitats and constituent habitats and species ([Figures 4.2, 4.3](#) and NPWS 2014a, 2014b, 2014c).

Within the North Inishowen Coast SAC the qualifying habitats/species considered subject to potential disturbance and therefore, carried further in this assessment are:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1355 Otter - *Lutra lutra*

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 the North Inishowen Coast SAC relevant sensitive key habitats/species include

- *Zostera*-dominated community - ***Screened out of further assessment based on no spatial overlap of the feature with aquaculture activities***

For broad habitats and community types ([Figures 4.2, 4.3](#)) significance of impact is determined in relation to, first and foremost, spatial overlap (see [Section 7](#); [Tables 7.1](#)). Subsequent disturbance and the persistence of disturbance are considered as follows:

1. The degree to which the activity will disturb the qualifying interest. By disturb is meant change in the characterising species, as listed in the Conservation Objective guidance (NPWS 2014c) for constituent communities. 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 (see [Section 8.2](#) below).
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. The area of communities or proportion of populations disturbed. In the case of community disturbance (continuous or ongoing) of more than 15% of the community area it is deemed to be significant. This threshold does not apply to the sensitive habitat *Zostera* where any spatial overlap of activities should generally be avoided.

Effects will be deemed to be significant when cumulatively they lead to long term change (persistent disturbance) in broad habitat/features (or constituent communities) resulting in an impact greater than 15% of the area.

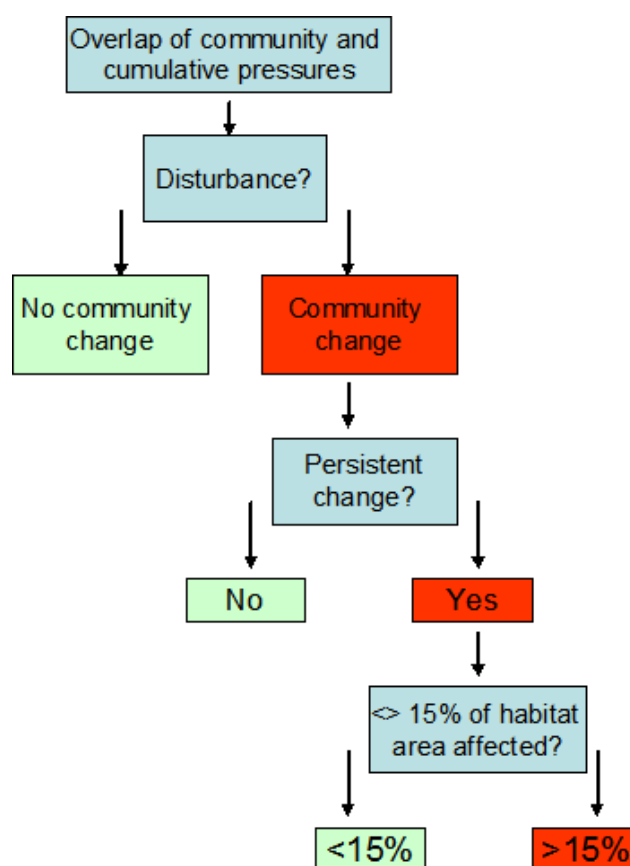


Figure 8-1 - Determination of significant effects on community distribution, structure and function for sedimentary habitats (following NPWS 2013c).

In relation to the designated species Otter, *Lutra lutra* the capacity of the population to maintain itself in the face of anthropogenic induced disturbance or mortality at the site will need to be taken into account in relation to the Conservation Objectives (COs) on a case by case basis.

8.2 SENSITIVITY AND ASSESSMENT RATIONALE

This assessment used a number of sources of information in assessing the sensitivity of the characterising species of each community recorded within the benthic habitats of the North Inishowen Coast SAC. 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 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) and other primary literature. It must be noted that NPWS have acknowledged that given the wide range of community types that can be found in marine environments, they application of conservation targets to these would be difficult (NPWS 2014c). 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. *Maerl* and *Zostera*. Other literature cited in the assessment does provide a greater degree of confidence in the conclusions. For example, the output of a recent study has provided greater confidence in terms of assessing likely interactions between intertidal oyster culture and marine habitats (Forde et al 2015). 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, communities and habitats of conservation interest, the separate components of sensitivity (intolerance, recoverability) are relevant in relation 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. They become significantly disturbing if more than 15% of the community is thus exposed (NPWS 2014c).
- 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 for at least a proportion of time.

The sensitivities of the community types (or surrogates) found within the North Inishowen Coast SAC to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are identified in **Table 8.1**. 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, in **Table 8.2**. 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). Also high for those 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.
- Sensitivity of certain taxonomic groups to increased sedimentation is expected to be low for species which live within the sediment, deposit and suspension feeders; and high for those sensitive to clogging of respiratory or feeding apparatus by silt or fine material.

- 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, 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).

8.3 ASSESSMENT OF THE EFFECTS OF AQUACULTURE PRODUCTION ON THE CONSERVATION OBJECTIVES FOR HABITAT FEATURES IN THE NORTH INISHOWEN COAST SAC.

Aquaculture pressures on a given habitat are related to 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 associated with the culture organism, 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.

NPWS (2014a) provide lists of species characteristic of benthic communities that are defined in the Conservation Objectives. The species defined are typical of fine sedimentary intertidal habitats (tolerant of desiccation and physical stress). For the most part, these intertidal communities are typically impoverished with low numbers of species and overall abundances.

The constituent communities identified in the broad Annex 1 feature 1140 - Mudflats and sandflats not covered by seawater at low tide) are:

- *Zostera*-dominated community - **(No overlap with aquaculture)**
- Fine to medium sand with *Eurydice pulchra* community complex - **(No overlap with aquaculture)**
- Muddy sand to coarse sediment with *Pygospio elegans* community complex
- Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex

For Mudflats and sandflats not covered by seawater at low tide (1140) there are a number of attributes (with associated targets) relating to the following broad habitat features as well as constituent community types;

1. **Habitat Area** - it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Mudflats and sandflats not covered by seawater at low tide (1140). The habitat area is likely to remain stable.

2. **Community Distribution - (conserve a range of community types in a natural condition)**

- this attribute considered interactions with three of the community types listed above and exclude the sensitive community *Zostera*-dominated community. Of the three communities, one had no overlap with aquaculture activities (i.e. Fine to medium sand with *Eurydice pulchra* community complex). Therefore, the following two community types, found within the qualifying interest 1140 of the SAC have overlap with aquaculture activities:

- Muddy sand to coarse sediment with *Pygospio elegans* community complex
- Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex

The community types listed above are predominantly sandy-muddy habitat types and given they are intertidal, will be exposed to a range of physical and hydrodynamic pressures. **Table 8.1** lists the habitats (or surrogates) and **Table 8.2** lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores are derived from a range of sources identified above. The pressures are listed as those likely to result from intertidal oyster within the SAC (see **Table 6.1**).

Table 8.4 below identifies the likely interactions between the existing and proposed aquaculture activities and the broad habitat feature (1140) and the constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistence disturbance on the habitat. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS 2014c).

Based on assessment of existing licenses current scale, frequency and intensity of the aquaculture activities The function of an appropriate assessment and risk assessment is to determine if the ongoing and proposed aquaculture and fisheries activities are consistent with the Conservation Objectives for the Natura site or if such activities will lead to deterioration in the attributes of the habitats and species over time and in relation to the scale, frequency and intensity of the activities. NPWS (2014a) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in the SAC. This guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with long term maintenance of certain sensitive habitats while other habitats can tolerate a range of activities. For the practical purpose of management of sedimentary habitats a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance. Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the characterizing species of the habitat (which may also indicate change in structure and function). Such disturbance may be temporary or persistent in the sense that change in characterizing species may recover to pre-disturbed state or may persist and accumulate over time.

Existing and proposed cultivation and access route activity was shown to overlap with 5.88% of the qualifying interest Mudflats and sandflats not covered by seawater at low

tide (1140). As this value is below the 15% threshold adverse impact on the qualifying feature **can be discounted** (Table 7.1).

While existing and proposed cultivation sites extend over 17.54% and 2.75% of the constituent community types of Muddy sand to coarse sediment with *Pygospio elegans* community complex and Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex and Muddy sand to coarse sediment with *Pygospio elegans* community complex, respectively (Table 7.1), published literature (Forde et al 2015; Carroll et al, in prep) suggests that activities occurring at trestle culture sites are not considered disturbing. However, the access routes used in intertidal areas, presumably by virtue of persistent compaction of the sedimentary habitats, are considered disturbing (De-Grave et al 1998; Forde et al., 2015) and the total spatial overlap over which the access routes fall is 0.53% and 1.46% for Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex and Muddy sand to coarse sediment with *Pygospio elegans* community complex, respectively. Given that these values individually and combined are less than 15% threshold significant adverse impacts of activities on these community type **can be discounted**.

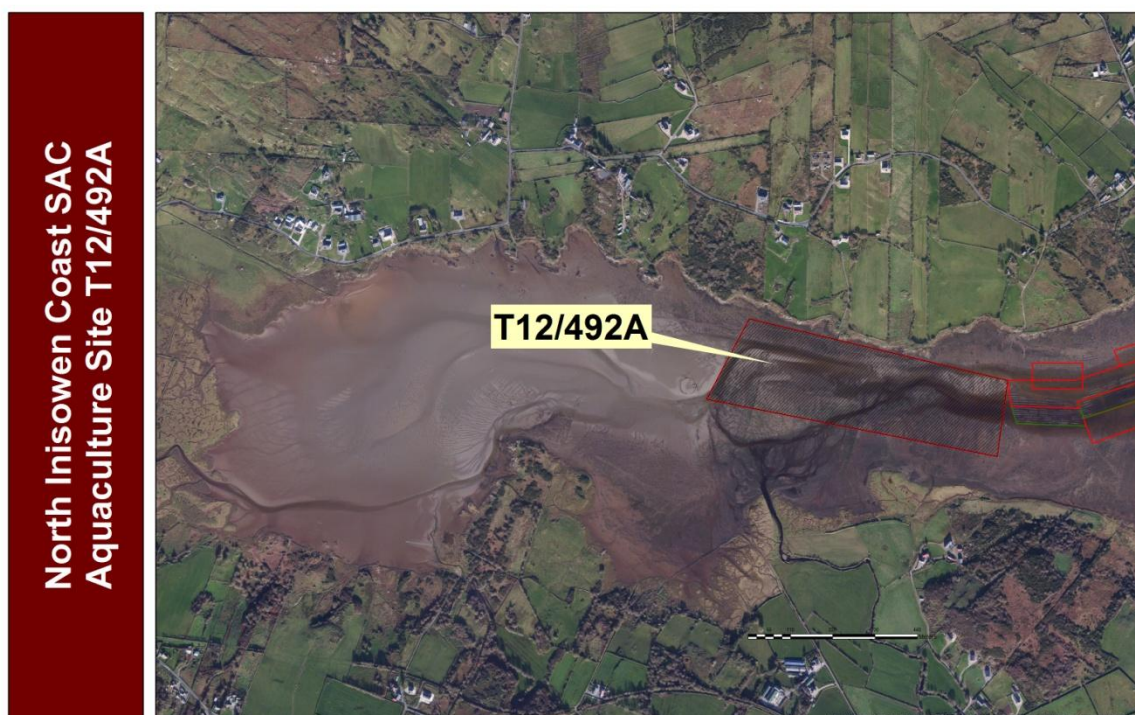
3. ***Zostera*-dominated community Extent and Structure** – *Zostera*-dominated communities are considered highly diverse and sensitive habitat types which host a wide range of taxa. Given the highly sensitive natures of the community types and constituent taxa it is highly likely that aquaculture activities of any type which overlap the community type and the pressures may result in long-term or permanent change to the extent of these community types and impact upon their structure and function. In North Inishowen Coast SAC, however, existing or proposed aquaculture activity (individually or combined) does not overlap with *Zostera*-communities. Consequently, adverse impacts of existing and proposed aquaculture on the *Zostera* community complex **can be discounted**.

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 (*Crassostrea gigas*) itself is a non-native species. Recruitment of *C. 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 long residence times (>21 days) and large intertidal areas as factors likely contributing to the successful recruitment of oysters in Irish bays. In addition, a recent study (Kochmann and Crowe, 2014) has identified heavy macroalgal cover as a potential factor governing recruitment, with higher cover resulting in lower recruitment. Oyster production in the North Inishowen Coast SAC does not fulfil these criteria in that, the residence time is approximately 10 days (Dabrowski 2011) and there is heavy cover of macroalgae in intertidal areas. Furthermore the use of triploid oysters reduces the risk of successful spawning and establishment of viable non-native oyster populations. Therefore the risk of successful establishment of the pacific oyster in Trawbreaga Bay portion of in North Inishowen Coast SAC is considered low. However, Trawbreaga Bay (oyster culture area within the SAC) effectively flows into the broader Lough Swilly this presents a risk to the Lough Swilly SAC (Code: 2287) and the factors identified by Kochmann et al (2013) facilitating the successful establishment of populations has been identified for Lough Swilly and indeed, non-native oysters have established in this bay. Therefore, it is important that triploid oysters continue to be used in North Inishowen Coast SAC (Code: 2012) in order to minimise the risk to Lough Swilly SAC (Code: 2237).

The movement of ½-grown oysters from one location to another has been identified as an ecological risk with the potential introduction of non-native species into a novel area. Half-grown oysters are moved into Trawbreaga Bay from Dungloe. Given that the oysters moved, originate from hatchery seed and that Dungloe is within Co. Donegal the risk of disturbance caused by this activity is considered low and can be discounted.

Other considerations: While the direct impact of the trestles on habitat (1140) and constituent communities is considered non-disturbing, the presence of structures in tidal channels may influence the hydrodynamics of the system (Forrest et al 2009). In the case of North Inishowen Coast SAC this risk, for the most part, does not present as there is considerable habitat (and space) around trestles such that flow is unlikely to be impeded. However, in one instance (Site T12/492A), the proposed area (and presumably the trestle occupation) does appear to block the channel as well as majority of the opening to the inner part of the bay (Figure 8-2). This situation presents a risk of increased sedimentation in the inner part of the bay and result in a change to the community constituents. The risk of significant disturbance cannot be discounted.

Figure 8-2. Site T12/482A in North Inishowen Coast SAC.



8.3.1 Conclusion Summary

In summary, based upon the spatial overlap and sensitivity analysis it is concluded that existing and proposed aquaculture activities (including access route activity) individually and/or in-combination do not pose a direct risk of significant disturbance to the conservation of the habitat feature of Mudflats and sandflats not covered by seawater at low tide (1140) or the constituent community types of Muddy sand to coarse sediment with *Pygospio elegans* community complex and Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex (Table 8.4). However, in one instance (T12/492A), the risk of significant disturbance cannot be dismissed as the hydrodynamics of

the inner part of the bay (and subsequently, the structure of the constituent community types) may be impacted by the scale of the proposed operation.

Table 8.1 - Matrix showing the characterising habitats sensitivity scores x pressure categories for intertidal habitats (or surrogates) in North Inishowen Coast SAC (ABPMer 2013a-h) (Table 8.3 provides the code for the various categorisation of sensitivity and confidence.).

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 material's biological or 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	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
Muddy sand to coarse sediment with <i>Pygospio elegans</i> community complex (A2.23 – Polychaete/amphipod-dominated fine sand shore)	NS (*)	L (*)	L (*)	NS (*)	L-NS (*)	L-M (*)	L-M (*)	L-M (*)	L-M (*)	M (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	L-NS (*)	L-NS (*)	NS (***)	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	NS (*)
Sand with <i>Angulus tenuis</i> and <i>Scoloplos (Scoloplos) armiger</i> community complex (A2.24 – Polychaete/bivalve dominated fine sand shores)	NS (***)	L (*)	L (***)	NS (*)	L (*)	L-M (*)	L-M (*)	L-M (*)	L-M (*)	NS (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	L (*)	H (***)	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	NS (*)

Table 8.2 - Matrix showing the characterising species sensitivity scores x pressure categories for taxa (or surrogates) in North Inishowen Coast SAC (ABPMer 2013a-h) (Table 8.3 provides the code for the various categorisation of sensitivity and confidence.)

Species	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 or 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	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
<i>Angulus tenuis</i>	NS (*)	L (*)	L (***)	NS (*)	L (*)	M (*)	NS (*)	H (*)	M-H (*)	NS (*)	L-M (*)	L (*)	NS (*)	NS (*)	NEv	L-NS (*)	NEv	NEv	M (*)	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Arenicola marina</i>	NS (*)	NS ***	L-M ***	NS ***	NS ***	L-M (*)	NS (*)	L-M (*)	L-M (***)	L-M (***)		NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS ***	NS ***	M (*)	L-M (*)	NS (*)	NS ***	L (**)		NS (*)
<i>Capitella</i> sp.	L (*)	L (**)	L (**)	L ***	L (*)	L (*)	L (*)	NS (*)	NS (*)	NS (***)	NS (*)	NS (*)	NS (*)	NS ***	NS ***	NS *	L ***	L ***	NS (*)	NS (*)	NS (*)	NS ***	L ***	NS ***	NS (*)
<i>Cerastoderma edule</i>	L (*)	L-M (*)	L-M (***)	L-M ***	L-M (*)	L-H (*)	L ***	L-M (*)	L-H (*)	NS (*)	L (*)	NS (*)	NS (*)	NS (*)	NS (**)	L-NS (*)	L-M (*)	L-M (*)	M (*)	M (*)	NS (*)	NS (*)	NEv	L-M (*)	NS (*)
<i>Corophium volutator</i>	L ***	L ***	L ***	L (*)	L (*)	L (*)	L ***	L ***	M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS **	NS **	NS (*)	L ***	L ***	NEv	NS (*)	NS (*)	NA	NEv	L ***	NS (*)
<i>Hediste diversicolor</i>	NS (*)	L-M (**)	L-H (**)	NS (*)	L (*)	L-H (*)	NS ***	L-M (*)	M-H (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (**)	NS (**)	NS (*)	NS (**)	NS (**)	L-M (*)	L-M (*)	NS (*)	NS (*)	M-H (**)	M-H (**)	NS (*)
<i>Lanice conchilega</i>	NS (*)	NS-L ***	NS-L (***)	NS (*)	NS-L (*)	M-H (*)	NS (*)	M-H (*)	NS (*)	NS (***)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	M (*)	M-H (*)	NS (*)	NS (*)	NS (*)	NEv	L ***	NS (*)
Nemtda	NS ***	NS ***	NS (***)	NS ***	NS (*)	L (*)	NS (*)	NS ***	NS (***)	NS (***)	NS (*)	NS (*)	NS (*)	NS (*)	NS ***	NS (*)	L ***	L ***	NS ***	NS (*)	NS (*)	NS ***	NEv	L ***	NS (*)
<i>Pygospio elegans</i>	L (*)	L (**)	M (***)	L (*)	L (*)	L-M (*)	L ***	L-M ***	L-M (*)	NS (**)	L-M (*)	NS (*)	NS (*)	NS (*)	NS ***	NS (*)	L (**)	L (**)	M (*)	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Scoloplos (Scoloplos) armiger</i>	NS (*)	L (*)	L-M (*)	NS (*)	L (*)	H (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS ***	NS ***	NS (*)	M ***	M ***	M (*)	M (**)	NS (*)	NS (*)	NEv	NEv	NS (*)

Table 8.3 - Codes of sensitivity and confidence applying to species and pressure interactions presented in Tables 8.1 and 8.2.

Pressure interaction codes for Table 8.1 and 8.2	
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

Table 8.4 - Interactions between the relevant aquaculture activities and the habitat feature Mudflats and sandflats not covered by seawater at low tide (1140) constituent communities with a broad conclusion on the nature of the interactions.

			1140 - Mudflats and sandflats not covered by seawater at low tide	
Culture Type	Method	Status	Muddy sand to coarse sediment with <i>Pygospio elegans</i> community complex	Sand with <i>Angulus tenuis</i> and <i>Scoloplos (Scoloplos) armiger</i> community complex
Oysters	Intensive	Licensed	Disturbing: No Justification: The high density of stock will impact on seafloor due to organic enrichment (faeces and pseudofaeces). However the species have high recoverability and are tolerant. The stock is confined in bags, is sourced from hatcheries and is typically diploid/triploid. This activity overlaps 0.25% of this habitat type.	Disturbing: No Justification: The high density of stock will impact on seafloor due to organic enrichment (faeces and pseudofaeces). However the species have high recoverability and are tolerant. The stock is confined in bags, is sourced from hatcheries and is typically diploid/triploid. This activity overlaps 2.98% of this habitat type.
Oysters	Intensive	Application	Disturbing: No Justification: The high density of stock will impact on seafloor due to organic enrichment (faeces and pseudofaeces). However the species have high recoverability and are tolerant. The stock is confined in bags, is sourced from hatcheries and is typically diploid/triploid. This activity overlaps 2.5% of this habitat type.	Disturbing: No Justification: The high density of stock will impact on seafloor due to organic enrichment (faeces and pseudofaeces). However the species have high recoverability and are tolerant. The stock is confined in bags, is sourced from hatcheries and is typically diploid/triploid. This activity overlaps 12.56% of this habitat type.
Access Routes			Disturbing: No Justification: While the compaction of sediments on access routes can lead to long-term disturbance the maximum disturbance by this activity is 0.53% (<15% threshold).	Disturbing: No Justification: While the compaction of sediments on access routes can lead to long-term disturbance the maximum disturbance by this activity is 1.46% (<15% threshold).
Cumulative Impact of existing and proposed aquaculture activity			Disturbing: No Justification: Spatial overlap of existing and proposed oyster cultivation sites extends over 2.75% of this community; however, published literature (Forde et al 2015) indicates activities occurring at trestle culture sites are not disturbing to intertidal habitats and their constituent communities. The cumulative pressure of likely impacting aquaculture activities (i.e. access route activity) on this habitat is 0.53%, less than the 15% threshold	Disturbing: No Justification: Spatial overlap of existing and proposed oyster cultivation sites extends over 17.54% of this community; however, published literature (Forde et al 2015) indicates activities occurring at trestle culture sites are not disturbing to intertidal habitats and their constituent communities. The cumulative pressure of likely impacting aquaculture activities (i.e. access route activity) on this habitat is 1.46%, less than the 15% threshold

8.4 ASSESSMENT OF THE EFFECTS OF AQUACULTURE PRODUCTION ON THE CONSERVATION OBJECTIVES FOR OTTER *LUTRA LUTRA*.

As the aquaculture production activities within the SAC spatially overlap with otter (*Lutra lutra*) territory, these activities may have negative effects on the abundance and distribution of populations of the species. The North Inishowen Coast SAC is designated for the otter (*Lutra lutra*); the conservation objectives for such are listed in **Table 4.1**. The risk of negative interactions between aquaculture operations and aquatic mammal species is a function of:

1. The location and type of structures used in the culture operations- is there a risk of entanglement or physical harm to the animals from the structures?
2. The schedule of operations on the site – is the frequency such that they can cause disturbance to the animals?

Shellfish Culture: Shellfish culture operations are likely to be carried out in daylight hours. The interaction with the otter is likely to be minimal given that otter foraging is primarily crepuscular. It is unlikely that these culture types pose a risk to otter populations in the North Inishowen Coast SAC. Impacts can be discounted on the basis of the points below: The proposed activities will not lead to any modification of the following attributes for otter:

- Extent of terrestrial habitat,
- Extent of marine habitat or
- Extent of freshwater habitat.
- The activity involves net input rather than extraction of fish biomass so that no negative impact on the essential food base (fish biomass) is expected
- The number of couching sites and holts or, therefore, the distribution, will not be directly affected by aquaculture and fisheries activities.
- Shellfish production activities are unlikely to pose any risk to otter populations through entrapment or direct physical injury.
- The structures and activities associated this form of oyster culture structures are raised from the seabed (0.5m - 1m) and are oriented in rows, thus allowing free movement through and within the site.
- Disturbance associated with vessel and foot traffic could potentially affect the distribution of otters at the site. However, the level of disturbance is likely to be very low given the likely encounter rates will be low dictated primarily by tidal state and in daylight hours.

8.4.1 Conclusion

The current levels of licenced shellfish culture and applications are considered **non-disturbing** to otter.

9 IN-COMBINATION EFFECTS OF AQUACULTURE AND OTHER ACTIVITIES

9.1 FISHERIES

9.1.1 Habitats

Fisheries activities occurring in the SAC include pot fishing for crustaceans (lobster and crab) and hydraulic dredge fishing for cockles. **Table 9.1** presents the spatial extent of these fishing activities overlapping the habitat feature (1140) within the North Inishowen Coast SAC (data provided by DAFM), while **Table 9.2** present overlap with respect to the constituent marine community types within habitat 1140.

9.1.1.1 Hydraulic dredging

- Fishery overlaps with 15.34% of QI habitat 1140 and with the constituent marine community types within habitat 1140 as follows; 14.44% of Muddy sand to coarse sediment with *Pygospio elegans* community complex and 35.08% of Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex (see **Table 9.1** and **Table 9.2** and **Figure 9.1**).
- Soft sediment communities, particularly suspension feeders and crustaceans, are sensitive to fishing pressure from dredging but this depends on intensity of the fishing pressure. Recovery time is prolonged (measured in years) compared to coarser substrates due to the fact that such habitats are mediated by a combination of biological, chemical and physical processes compared to coarse substrates which are dominated by physical processes (ABPMer 2013e).

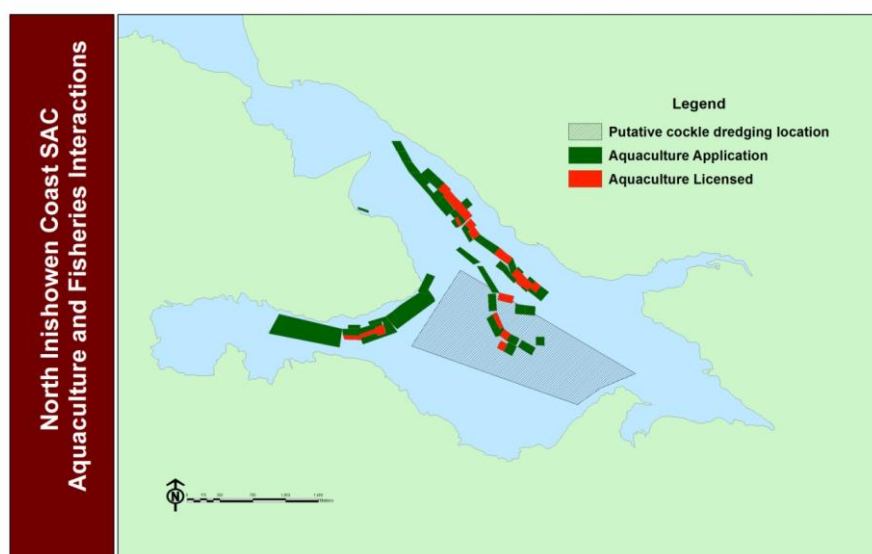


Figure 9-1. Overlap of putative cockle dredging location and aquaculture sites within North Inishowen Coast SAC.

9.1.1.2 Pot fishing

- Fishery overlaps with 0.26% of QI habitat 1140 and with 1.10% of the constituent marine community type Fine to medium sand with *Eurydice pulchra* community complex (see [Table 9.1](#) and [Table 9.2](#)).
- The actual footprint of static gear such as creel and pot is expected to be much lower than the percentage of the area over which the fishery might occur.
- Pot fisheries and static net fisheries may cause localized abrasion and disturbance to habitats which may be significant for habitats that are highly sensitive to such pressures (e.g. maërl and seagrass meadows). However, the risk posed by the crustacean pot fishery to muddy sand and sandy mud habitats is deemed to be low and insignificant. The habits and associated species are not sensitive to surface disturbance (ABPMer 2013e).

Table 9.1 - Spatial extent of fisheries activities overlapping with the qualifying interest (1140 Mudflats and sandflats not covered by seawater at low tide) in North Inishowen Coast SAC, presented according to equipment used.

Equipment Type	Species	Area (ha)	% Feature
Hydraulic Dredge	Cockle	151.50	15.34
Pot/creel	Lobster & Crab	2.59	0.26
Grand total		154.09	15.60

Table 9.2 - Spatial overlap of fisheries and constituent marine community types within the broad habitat qualifying of 1140 (Mudflats and sandflats not covered by seawater at low tide) in the North Inishowen SAC. Spatial overlap presented according to equipment used.

Feature (Community Type)	Hydraulic Dredge	Crustacean potting
Muddy sand to coarse sediment with <i>Pygospio elegans</i> community complex (542.28ha)	78.36 (14.44)	
(Sand with <i>Angulus tenuis</i> and <i>Scoloplos (Scoloplos) armiger</i> community complex [208.53ha])	73.14 (35.07)	
(Fine to medium sand with <i>Eurydice pulchra</i> community complex [234.69ha])		2.59 (1.10)

9.1.2 Species

All fisheries extract fish biomass which may reduce habitat quality for the designated species otter. Otters may be caught as by-catch in certain gears such as trammel nets set for bait in shallow water.

9.1.3 Conclusion

Based on the level of overlap and the sensitivity of the habitats (and associated species) to dredging, significant impacts could not be discounted for the following community types Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex and Muddy sand to coarse sediment with *Pygospio elegans* community complex.

Crustacean potting was shown to occur on the following community type Fine to medium sand with *Eurydice pulchra* community complex. Significant interaction between this community type and crustacean potting activity could be discounted based on low level of spatial overlap and the relative resilience of the community type to disturbances emanating from the fishery.

However, it is likely that ‘wild’ fisheries (i.e. hydraulic dredging – Figure 9.1 and pot fishing) activities will not occur in the aquaculture plots if they are actively maintained. Furthermore, the habitat is not consistent with dredging given the high abundance of boulders and rocks found in the (sedimentary) intertidal areas of the SAC. Consequently, in-combination effects with intertidal trestle aquaculture activities on designated habitats (and constituent community types) can be **discounted**.

With respect to the designated species *Lutra lutra* it was concluded that significant negative interactions were unlikely to occur due to fishing gear being deployed outside preferred dive range of otters. Consequently, in-combination effects with intertidal trestle aquaculture activities on the species can be **discounted**

9.2 INTERTIDAL SEAWEED HARVESTING

Other activities within the North Inishowen Coast SAC include intertidal harvesting of seaweed Trawbreaga Bay. Direct impacts of seaweed harvesting on intertidal habitats and communities can include the removal and damage of sedentary or encrusting invertebrates (Kelly et al. 2001). Direct impacts upon intertidal habitats may also occur as a consequence of travel across the shore to harvest sites. Removal of seaweed cover can alter local hydrodynamic conditions and change wave exposure regimes which, in turn, can modify sedimentation rates.

In general, intertidal seaweed harvesting occurs in reef areas. Consequently, the likely spatial overlap of seaweed harvesting activities, intertidal shellfish culture which is limited to the QI habitat 1140 constituent marine soft sediment community types is low.

9.2.1 Conclusion Summary

It is likely that seaweed harvesting will not occur in the aquaculture plots if they are actively maintained. Consequently, in-combination effects with intertidal trestle aquaculture can be **discounted**. It should be noted that there may be overlap between intertidal aquaculture and seaweed harvesting activities in terms of access routes used to service the sites. However, given current level of seaweed extraction in potential in-combination effects are considered to be **minimal or negligible**.

9.3 POLLUTION PRESSURES

There are a number of activities which are terrestrial in origin that might result in impacts on the conservation features of the North Inishowen Coast SAC. Primary among these are point source discharges from domestic sewage outfalls distributed along the harbour and a single municipal urban waste water treatment plant at Carndonagh in the southern extent of the SAC. The pressure

derived from these point sources may impact upon levels of dissolved nutrients, suspended solids and some elemental components e.g. aluminium in the case of water treatment facilities.

9.3.1 Conclusion Summary

Pressures resulting from aquaculture activities are primarily localised compaction of sediment along access routes. It was, therefore, concluded that given the pressure resulting from point discharge location such as the urban waste-water treatment and/or combined sewer outfalls would likely impact on physico-chemical parameters in the water column, any in-combination effects with aquaculture activities are considered to be **minimal or negligible**.

10 SAC AQUACULTURE APPROPRIATE ASSESSMENT CONCLUDING STATEMENT AND RECOMMENDATIONS

10.1 AQUACULTURE

In the North Inishowen Coast SAC oyster culture (using bags and trestles) is the only type of aquaculture currently occurring. Based upon this and the information provided in the aquaculture profiling carried out (Section 5), the likely interaction between this culture methodology and conservation features (habitats and species) of the site were considered.

10.1.1 Habitats

An initial screening exercise resulted in five features and one species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur. The habitats excluded from further consideration were 1220 Perennial vegetation of stony banks, 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts, 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes), 21A0 Machairs, 4030 European dry heaths and 1014 Narrow-mouthed Whorl Snail *Vertigo angustior*. A full assessment was carried out on the likely interactions between existing and proposed culture operations and the feature of the Annex 1 habitat 1140 (Mudflats and sandflats not covered by seawater at low tide). The likely effects of the aquaculture activities (Species, structures, transport routes) were considered in light of the sensitivity of two (of the four) constituent habitats and species of the Annex 1 habitat, i.e., Muddy sand to coarse sediment with *Pygospio elegans* community complex, Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex.

Based upon the scale of spatial overlap of current aquaculture activities and the relatively high tolerance levels of the habitats and associated species, the general conclusion is that current activities are non-disturbing to the Natura 2000 feature (1140) and its constituent community types. However, in one instance (T12/492A), the risk of significant disturbance cannot be dismissed as the hydrodynamics of the inner part of the bay (and subsequently, the structure of the constituent community types) may be impacted by the scale of the proposed operation.

The risk of establishment of non-native oyster species is considered low in the Trawbreaga Bay portion of North Inishowen Coast SAC. However, given that Trawbreaga Bay (oyster culture area within the SAC) effectively flows into the broader Lough Swilly this presents a risk to the Lough Swilly SAC (Code: 2287) and the factors identified by Kochmann et al (2013) facilitating the successful establishment of populations has been identified for Lough Swilly and indeed, non-native oysters have established in this bay (Lough Swilly). Therefore, it is important that triploid oysters continue to be used in North Inishowen Coast SAC (Code: 2012) in order to minimise the risk to Lough Swilly SAC (Code: 2237).

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 current levels. The movement of stock in and out of the North Inishowen Coast SAC should adhere to relevant fish health legislation and follow best practice guidelines (e.g. <http://invasivespeciesireland.com/cops/aquaculture/>).

10.1.2 Species

The likely interactions between the proposed aquaculture activities and the Annex II Species Otter were also assessed. The objectives for this species in the SAC focus upon maintaining the good conservation status of the population. The main aspect of the culture activities that could potentially impact otter is the physical presence of trestles that may restrict otter access to certain habitats. Given the nature of the structures and the likely timing of activities the risk of disturbance to otter features posed by aquaculture operations is considered low.

11 REFERENCES

- ABPMer. 2013a. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report VIII: Vegetation dominated communities (Saltmarsh and Seagrass). Report No. R. 2053 for Marine Institute, Ireland.
- ABPMer. 2013b. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report VI: Biogenic reefs (*Sabellaria*, Native oyster, Maërl). Report No. R. 2068 for Marine Institute, Ireland.
- ABPMer. 2013c. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report I: Intertidal and Subtidal Muds. Report No. R. 2069 for Marine Institute, Ireland.
- ABPMer. 2013d. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report II: Intertidal and Subtidal Sands. Report No. R. 2070 for Marine Institute, Ireland.
- ABPMer. 2013e. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report III: Intertidal and Subtidal muddy sands and sandy muds. Report No. R. 2071 for Marine Institute, Ireland.
- ABPMer. 2013f. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report IV: Intertidal and Subtidal mixed sediments. Report No. R. 2072 for Marine Institute, Ireland.
- ABPMer. 2013g. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report IV: Intertidal and Subtidal coarse sediments. Report No. R. 2073 for Marine Institute, Ireland.
- ABPMer. 2013h. Tools for appropriate assessment of fisheries and aquaculture activities in Marine and Coastal Natura 2000 sites. Report VII: Intertidal and Subtidal reefs. Report No. R. 2074 for Marine Institute, Ireland.
- Bergman, M.J.N. and van Santbrink, J.W. 2000. Mortality in megafaunal benthic populations caused by trawl fisheries on the Dutch continental shelf in the North Sea 1994. ICES Journal of Marine Science 57(5), 1321-1331.

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- Black, K.D. (2001). Environmental impacts of aquaculture. Sheffield Biological Sciences, 6. Sheffield Academic Press: Sheffield. 214 pp
- Borja, A., Franco, J. & Pérez, V. 2000. A marine biotic index of establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. Marine Pollution Bulletin. 40: 1100 – 1114.
- Cranford, Peter J., Pauline Kamermans, Gesche Krause, Alain Bodo, Joseph Mazurié, Bela Buck, Per Dolmer, David Fraser, Kris Van Nieuwenhove, Francis X. O’Beirn, Adoración Sanchez-Mata, Gudrun G. Thorarinsdóttir, and Øivind Strand. 2012. An Ecosystem-Based Framework for the Integrated Evaluation and Management of Bivalve Aquaculture Impacts. Aquaculture Environment Interactions. 2:193-213
- Dabrowski, T. 2011. Short report on residence times calculations of coastal embayments. Marine Institute Report. 5pp
- De Grave, S., Moore, S.J., Burnell, G. 1998. Changes in benthic macrofauna associated with intertidal oyster, *Crassostrea gigas* (Thunberg) culture. Journal of Shellfish Research, 17, 1137- 1142.
- EC (2012). Common methodology for assessing the impact of fisheries on marine Natura 2000. Service Contract No. 070307/2010/578174/SER/B. DGEnv Brussels.
- EC (2012). Common methodology for assessing the impact of fisheries on marine Natura 2000. Service Contract No. 070307/2010/578174/SER/B. DGEnv Brussels.
- Fletcher 2005. The application of qualitative risk assessment methodology to prioritize issues for fisheries management. ICES J. Mar. Sci. 62, 1576-1587
- Fletcher 2005. The application of qualitative risk assessment methodology to prioritize issues for fisheries management. ICES J. Mar. Sci. 62, 1576-1587
- Fletcher, W. J., Chesson, J., Fisher, M., Sainsbury, K. J., Hundloe, T., Smith, A. D. M., and Whitworth, B. (2002). National ESD Reporting Framework for Australian Fisheries: The ‘How To’ Guide for Wild Capture Fisheries. FRDC Project 2000/145, Canberra, Australia. 120 pp
- Fletcher, W. J., Chesson, J., Fisher, M., Sainsbury, K. J., Hundloe, T., Smith, A. D. M., and Whitworth, B. (2002). National ESD Reporting Framework for Australian Fisheries: The ‘How To’ Guide for Wild Capture Fisheries. FRDC Project 2000/145, Canberra, Australia. 120 pp
- Forde, J., F. O’Beirn, J. O’Carroll, A. Patterson, R. Kennedy. 2015. Impact of intertidal oyster trestle cultivation on the Ecological Status of benthic habitats. Marine Pollution Bulletin 95, 223–233. [doi:10.1016/j.marpolbul.2015.04.013](https://doi.org/10.1016/j.marpolbul.2015.04.013)
- Forrest, B.M., N.B. Keeley, G.A. Hopkins, S.C. Webb, D.M. Clement. 2009. Bivalve aquaculture in estuaries: Review and synthesis of oyster cultivation effects. Aquaculture 298: 1-15

-
- Hall, K., Paramor, O.A.L., Robinson L.A., Winrow-Giffin, A., Frid C.L.J., Eno, N.C., Dernie, K.M., Sharp, R.A.M., Wyn, G.C. and Ramsay, K. 2008. Mapping the sensitivity of benthic habitats to fishing in Welsh waters- development of a protocol. CCW [Policy Research] Report No: [8/12], 85pp.
- Kelly L., Collier, L., Costello, M. J., Diver, M., McGarvey, S., Kraan, S., Morrissey, J. and Guiry, M. D. 2001. Impact assessment of hand and mechanical harvesting of *Ascophyllum nodosum* on regeneration and biodiversity, Marine Resource Series, Vol 19. Marine Institute, Dublin, Ireland/
- Kochmann J, Carlsson J, Crowe TP, Mariani S (2012) Genetic evidence for the uncoupling of local aquaculture activities and a population of an invasive species—a case study of Pacific oysters (*Crassostrea gigas*). *Journal of Hereditary* 103:661–671
- Kochmann, J. F. O’Beirn, J. Yearsley and T.P. Crowe. 2013. Environmental factors associated with invasion: modeling occurrence data from a coordinated sampling programme for Pacific oysters. *Biological Invasions* 15:2265-2279.
- Marine Institute (2013). A risk assessment framework for fisheries in Natura 2000 sites in Ireland: with case study assessments. Version 1.3. Marine Institute, Rinville, Oranmore, Galway, 31pp.
- McKindsey, CW, Landry, T, O’Beirn, FX & Davies, IM. 2007. Bivalve aquaculture and exotic species: A review of ecological considerations and management issues. *Journal of Shellfish Research* 26:281-294.
- National Research Council, 2010. Ecosystems Concepts for Sustainable Bivalve Culture. National Academy Press, Washington, DC.
- NPWS. 2009. Threat Response Plan: Otter (2009-2011). National Parks & Wildlife Service, Department of the Environment, Heritage & Local Government, Dublin.
- NPWS. 2014a. Conservation Objectives for North Inishowen SAC (Site code: 002012). Version 1.0. Department Arts, Heritage and the Gaeltacht. Version 1 (24 November, 2014); 19pp.
- NPWS. 2014b. North Inishowen Coast SAC (Site code: 002012) Conservation objectives supporting document - coastal habitats. Department Arts, Heritage and the Gaeltacht. Version 1 (November 2014); 127pp.
- NPWS. 2014c. North Inishowen Coast SAC (Site code: 002012) Conservation objectives supporting document - marine habitats. Department Arts, Heritage and the Gaeltacht. Version 1 (November 2014); 13pp.
- O’Carroll, J., Quinn, C., Forde, J., Patterson, A., O’Beirn, F.X., Kennedy, R. *In prep* Impact of prolonged storm activity on the Ecological Status of intertidal benthic habitats within oyster (*Crassostrea gigas*) trestle cultivation sites. Submitted Marine Pollution Bulletin (Oct 2015).
- O’Beirn, F.X., C. W. McKindsey, T. Landry, B. Costa-Pierce. 2012. Methods for Sustainable Shellfish Culture. 2012. pages 9174-9196 In: Myers, R.A. (ed.), *Encyclopedia of Sustainability Science and Technology*. Springer Science, N.Y.

Roberts, C., Smith, C., Tillin, H., Tyler-Walters, H. 2010. Evidence. Review of existing approaches to evaluate marine habitat vulnerability to commercial fishing activities. Report SC080016/R3. Environment Agency,UK. ISBN 978-1-84911-208-6.

Shellfish Pollution Reduction Programme, DECLG. Shellfish Pollution Reduction Programme. Characterisation Report Number 29, Trawbreaga Shellfish Area, County Donegal.
<http://www.environ.ie/en/Publications/Environment/Water/PublicConsultations-ShellfishWatersDirective/FileDownload,21897,en.pdf>

Tillin, H.M., Hiddink, J.G., Jennings, S and Kaiser, M.J. 2006. Chronic bottom trawling alters the functional composition of benthic invertebrate communities on a sea basin scale. Marine Ecology progress Series, 318, 31-45