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

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Preface

This Report assesses the potential effects of oyster trestle aquaculture activities, fishing activity and seaweed harvesting within Trawbreaga Bay on the North Inishowen Coast Special Area of Conservation (**SAC**) (Site code: 002012) and adjacent SACs. This preface provides the legislative context in which this report was drafted.

Articles 3 - 11 of the European Community (**EC**) Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (**Habitats Directive**) provide the legislative means to protect habitats and species of Community Interest through the conservation of an EU-wide network of protected sites known as Natura 2000 sites.

There are two types of designated sites within the Natura 2000 site network, SACs which are designated under the Habitats Directive and Special Protected Areas (**SPAs**) which are designated under EC Directive EC 79/409/EEC (**Birds Directive**). Natura 2000 sites are designated due to their significant ecological importance for habitats and species protected under Annex I and Annex II respectively of the Habitats Directive and for the protection of populations and habitats of bird species protected under the Birds Directive. The features for which SACs and SPAs are designated are respectively termed as Qualifying Interests and Special Conservation Interests, which are collectively referred to as Conservation Features.

The Department of Agriculture Food and Marine (**DAFM**) is the aquaculture licensing authority under the Fisheries (Amendment) Act (1997) and determines applications for new aquaculture licences and applications for renewal of existing aquaculture licences. DAFM is also the competent authority responsible for undertaking AA of aquaculture licence applications. The AA in this report is part of an ongoing programme of AA of aquaculture activities in Ireland, as agreed with the EU Commission in 2009, and will eventually cover all aquaculture activities in all Natura 2000 sites. DAFM is responsible for licencing of aquaculture in Ireland. As part of this process DAFM must determine if the proposed aquaculture activities individually or in-combination with other activities are likely to significantly impact the Conservation Status of Qualifying interests and the integrity of the North Inishowen Coast SAC. DAFM must base its' determination on an AA and is also responsible for ensuring that an AA is carried out.

Executive Summary

Applications for 14 new aquaculture licences have been lodged with the Department for Agriculture Food and the Marine (**DAFM**) under the Fisheries (Amendment) Act (1997). These aquaculture licences are sought for intertidal oyster trestle cultivation in Trawbreaga Bay in the North Inishowen Coast Special Area of Conservation (**SAC**). In January 2021, DAFM requested the Marine Institute for an Appropriate Assessment (**AA**) report on the 14 licence application proposals as required under Article 6(3) of EC Directive 92/43/EEC (**Habitats Directive**).

The North Inishowen Coast Special Area of Conservation

The North Inishowen Coast Special Area of Conservation (**SAC**) is designated under the Habitats Directive. The site is situated on the northern coast of Donegal. The SAC is designated for a range of Qualifying Interests and the most relevant to this assessment is the habitat *mudflats and sand flats not covered by seawater at low tide (1140)*.

Activities in the SAC

The aquaculture activity in the SAC is comprised solely of intertidal trestle cultivation of the Pacific oyster *Crassostrea gigas* (**aquaculture activity[ies]**) and occurs in Trawbreaga Bay. Cockle dredging, pot fishing, seaweed harvesting and point sources of pollution are the pre-existing activities in the SAC that have the potential to combine with the effects of the aquaculture activities and degrade the integrity of the SAC.

Appropriate Assessment of Aquaculture Activities

The purpose of this report is to undertake an AA of the ongoing and proposed aquaculture activities to determine if they will be carried out in combination with incumbent fishing activities in a way that would be consistent with the Conservation Objectives for the SAC. The AA process comprises:

- Stage 1: Screening for Appropriate Assessment
    - The screening for AA is undertaken to identify potential likely significant effects to conservation features of Natura 2000 site. Where the screening exercise cannot exclude on the basis of objective information that the proposed development, individually or in combination with other plans or projects, will have a significant effect, the conservation feature of the Natura 2000 site is brought forward for further consideration in Stage 2 AA.
- Stage 2: Stage 2: Appropriate Assessment – Natura Impact Statement

- This stage considers in greater detail the aspects of the proposed project with potential for significant effects to conservation feature of a European site. If adverse effects cannot be excluded then permission/ approval for the plan or project cannot be granted.

Findings

The screening resulted in six Qualifying Interests being excluded from further consideration, five Annex I habitats and one Annex II species, by virtue of the fact no significant effects were expected to occur.

The habitats excluded screened out 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

Two of the four community complexes within the habitat 1140 Mudflats and sandflats not covered by seawater at low tide were screened out:

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

The species screened out were:

- 1014 Narrow-mouthed Whorl Snail *Vertigo angustior*
- 1335 Otter *Lutra lutra*

A full assessment was carried out on the likely interactions between existing and proposed aquaculture activities and two of the four community complexes within Qualifying Interest 1140 (*Mudflats and sandflats not covered by seawater at low tide*):

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

The risk of significant adverse depositional and organic enrichment effects of aquaculture sites on the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex **can be discounted**, because this community complex has been shown to be resilient to depositional and organic enrichment effects.

The risk of significant adverse sediment compaction effects along access routes on the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex **cannot be discounted**.

However, the current levels of effect along access routes are below the 15% disturbance threshold for this community complex.

The risk of significant adverse depositional and organic enrichment effects of aquaculture sites on the Muddy sand to coarse sediment with Pygospio elegans community complex **cannot be discounted**, because this community complex has never been studied in relation to the effects of oyster trestle cultivation.

The risk of significant adverse sediment compaction effects along access routes on the Muddy sand to coarse sediment with Pygospio elegans community complex **cannot be discounted**. However, the current levels of effect are below the 15% disturbance threshold for this community complex.

Recommendations

It is recommended that targeted monitoring exercises are carried out so that the effects of oyster trestle cultivation on the constituent communities of the conservation feature mudflats and sandflats not covered by high tide are carried out because:

1. No benthic monitoring exercise has been carried out in Trawbreaga previously and monitoring is required for the purpose of continuing to make evidence informed decisions in relation to oyster trestle cultivation licensing;
2. The Muddy sand to coarse sediment with Pygospio elegans community complex has not been previously studied and should be before the 15% overlap threshold is reached or exceeded by oyster trestle cultivation activities in Trawbreaga Bay.

It is also recommended that ecological carrying capacity of Trawbreaga Bay is investigated so that future licensing decisions can take this aspect of the ecological interactions of oyster trestle cultivation into account.

1. Introduction

This report sets out the Appropriate Assessment (**AA**) of the potential effects of oyster trestle cultivation activities (**aquaculture activities**) on the Qualifying Interests within the North Inishowen Coast Special Area of Conservation (**Site 002012**: See **Figure 1.1**). The AA focuses on the implications for the affected Qualifying Interests in view of their Conservation Objectives (see **Section 2.1**).

Site 002012 is a large site on the north coast of Ireland. Site 002012 stretches from Crummies Bay in the west, northeast to Malin Head and southeast to Inishowen Head. 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.

The aquaculture activities subject to this AA are carried out exclusively within Trawbreaga Bay a large shallow inlet on the western side of Malin Head in the centre of Site 002012. The aquaculture activities are described in detail in **Section 2.2**.

1.1. Legislative Context

Articles 3 - 11 of the European Community (**EC**) Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (**Habitats Directive**) provide the legislative means to protect habitats and species of Community Interest through the conservation of an EU-wide network of protected sites known as Natura 2000 sites.

There are two types of designated sites within the Natura 2000 site network, SACs which are designated under the Habitats Directive and Special Protected Areas (**SPAs**) which are designated under EC Directive EC 79/409/EEC (**Birds Directive**). The requirements of the Habitats Directive and the Birds Directive were transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011) as amended.

Natura 2000 sites are designated due to their significant ecological importance for habitats and species protected under Annex I and Annex II respectively of the Habitats Directive and for the protection of populations and habitats of bird species protected under the Birds Directive. The features for which SACs and SPAs are designated are respectively termed as Qualifying Interests and Special Conservation Interests, which are collectively referred to as Conservation Features. This report focuses on Annex I habitats and Annex II species of the Habitats Directive and so the term Qualifying Interest will be used throughout.

Under Article 6(3) of the Habitats Directive any plan or project likely to significantly affect the integrity of a Natura 2000 site must be subject to an AA. AA focuses on the likely significant effects of a plan or project on a Natura 2000 site and considers the implications for the site in view of its' conservation objectives. Every Natura 2000 site has Conservation Objectives which are set out by the National Parks and Wildlife Service a competent authority for the management of Natura 2000 sites in Ireland. The AA process also must consider any plan or proposal in combination with other activities that have the potential to significantly affect the integrity of the Natura 2000 site.

The Department of Agriculture Food and Marine (**DAFM**) is the aquaculture licensing authority under the Fisheries (Amendment) Act (1997) and determines applications for new aquaculture licences and applications for renewal of existing aquaculture licences. DAFM is also the competent authority responsible for undertaking AA of aquaculture licence applications. The AA in this report is part of an ongoing programme of AA of aquaculture activities in Ireland, as agreed with the EU Commission in 2009, and will eventually cover all aquaculture activities in all Natura 2000 sites. DAFM is responsible for licencing of aquaculture in Ireland. As part of this process DAFM must determine if the proposed aquaculture activities individually or in-combination with other activities are likely to significantly impact the Conservation Status of Qualifying interests and the integrity of the North Inishowen Coast SAC. DAFM must base its' determination on an AA and is also responsible for ensuring that an AA is carried out.

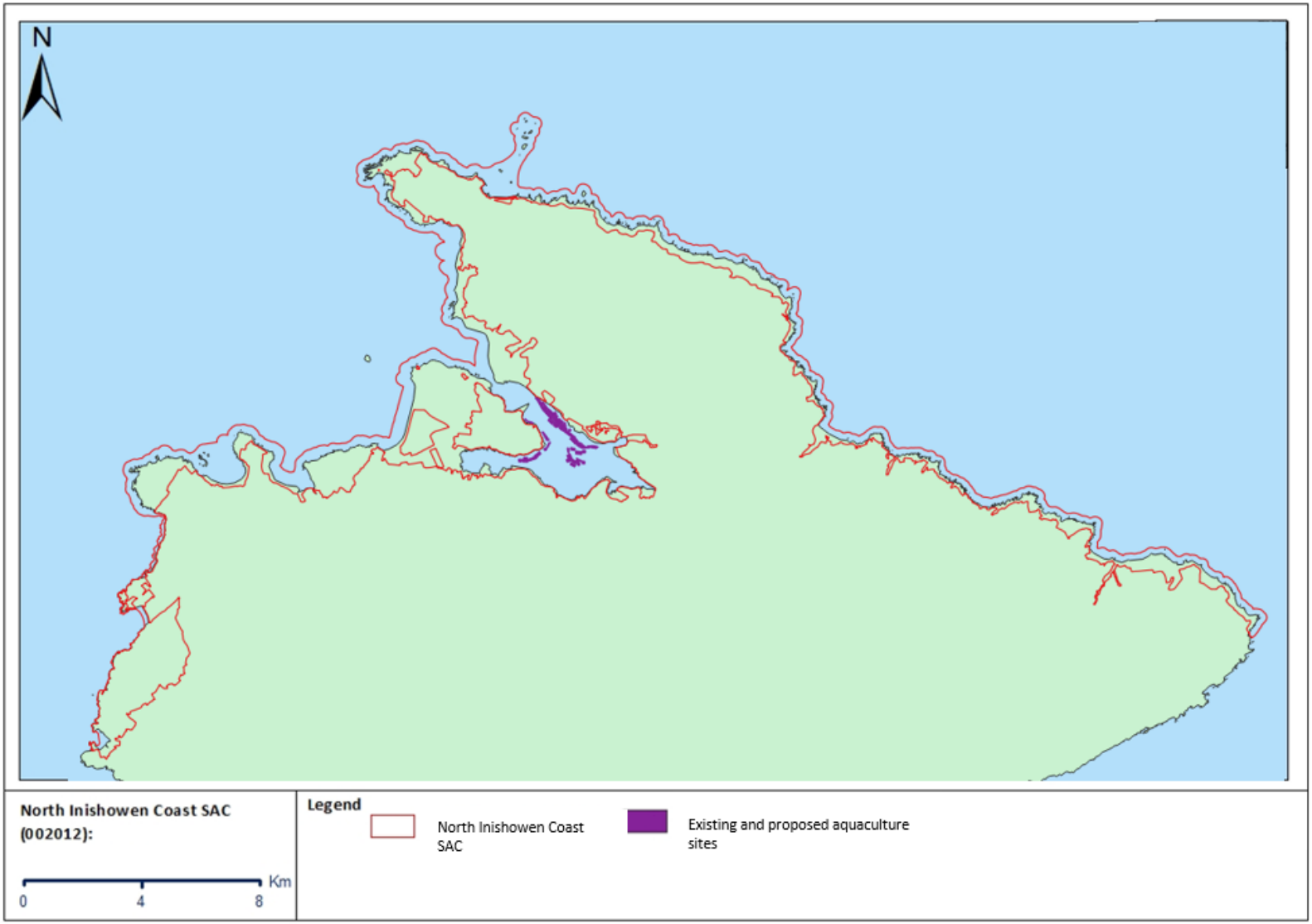

Figure 1.1: Existing and proposed aquaculture sites at Trawbreaga Bay within the North Inishowen Coast SAC (Site code: 002012).

1.2. *Appropriate Assessment Process*

The requirements for AA derive directly from Article 6(3). Articles 6(3) outlines the decision-making tests for considering plans and projects that may have a significant effect on a Natura 2000 site. No definition of the content or scope of AA is given in the Habitats Directive but the concept and approach are set out in European Commission (**EC**) guidance (EC 2000, 2002, 2006, 2018).

National guidance on Appropriate Assessment of plans and projects in Ireland was published by the Department of Environment, Heritage and Local Government (**DEHLG**) in 2009 (DEHLG, 2009). The DEHLG (2009) guidance sets out how AA of plans or proposals in in Natura 2000 sites in Ireland should be carried out in alignment with EC guidance.

DEHLG (2009) promotes a two stage process to complete the AA and outlines the issues and tests at each stage. The key procedures involved in completing the stages of the AA process follows in **Section 1.2.1** and **Section 1.2.2** below.

1.2.1. Stage 1: Screening for Appropriate Assessment

Stage I AA Screening is the process that addresses and records the reasoning and conclusions in relation whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a European site in view of its conservation objectives.

If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to Stage 2 (AA). Screening should be undertaken without the inclusion of mitigation. The greatest level of evidence and justification will be needed in circumstances when the process ends at screening stage on grounds of no impact.

1.2.2. Stage 2: Appropriate Assessment – Natura Impact Statement

This stage considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a European site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. This stage requires the targeted scientific examination of the plan or project and the relevant European sites, to identify and characterise any possible implications for the site in view of the site's conservation objectives, taking account of in-combination effects. If the assessment is negative, *i.e.* adverse effects on the integrity of a site cannot be excluded, then permission/ approval for the plan or project in its current form cannot be granted.

1.3. Structure of this Report

The AA process followed in this report adheres closely with the DEHLG (2009) guidance document and follows worse-case scenario principles as it is assumed that all licence areas in Site 002012 (including extant, proposed and those that are licenced but not being utilised) contain ongoing aquaculture activities. In addition, other activities (pot fishing, cockle dredging and seaweed harvesting) are considered for the purpose of assessing in-combination effects.

The report is divided into the following :

- **Section 2 -** Stage 1: Screening for Appropriate Assessment
    - Screening for AA is undertaken to identify potential likely significant effects to conservation features of Natura 2000 site. Where the screening exercise cannot exclude on the basis of objective information that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a conservation feature of a Natura 2000 site is brought forward for further consideration in Stage 2 AA.
- **Section 3 -** Stage 2: Appropriate Assessment - Natura Impact Statement
    - This considers in greater detail the aspects of the proposed project with potential for significant effects to conservation feature of a European site. If adverse effects cannot be excluded, and where there is no obvious mitigation to reduce the risk of significant effects, it is advised that caution be applied in licencing decisions.
- **Section 4 – Appropriate Assessment Concluding Statement and Recommendations**
    - This section sets out the findings of the AA process and make recommendations on any further monitoring or investigations that may be necessary and, where possible, also recommends any mitigation measures. In situations where there is no obvious mitigation to reduce the risk of significant effects, it is advised that caution be applied in licencing decisions (DEHLG, 2009).

This AA has followed relevant DEHLG (DEHLG, 2009) guidance and has drawn on information from a number of sources, the principal sources being:

- The 14 applications for new aquaculture licences;
    - T12/554A
    - T12/555A
    - T12/557A
    - T12/558A
    - T12/560A
    - T12/561A
    - T12/562A
    - T12/563A
    - T12/566A
    - T12/568A
    - T12/570A
    - T12/571A

  - T12/572A
  - T12/573A

- Information on extant licences for aquaculture activities within Trawbreaga Bay (BIM, 2014, 2019, 2021).
- NPWS (2014a) Conservation Objectives Series. North Inishowen Coast SAC 002012.
- NPWS (2014b) North Inishowen Coast SAC (Site Code: 002012) Conservation objectives supporting document - Marine Habitats.
- NPWS (2014c) Site Synopsis Report for the North Inishowen Coast SAC; and
- NPWS Spatial data[1] for designated sites.

[1] NPWS spatial data. https://www.npws.ie/maps-and-data/habitat-and-species-data (accessed 23 February 2021)

2. Stage 1: Screening for Appropriate Assessment

2.1. Qualifying Interests and Associated Conservation Objectives in Site 002012

This section outlines all Qualifying Interests within Site 002012 and their associated Conservation Objectives (**Section 2.1**).

2.1.1. Qualifying Interests

The Annex I Qualifying Interest habitats and Annex II Qualifying Interest species of the Habitats Directive for which Site 002012 is designated are listed in NPWS (2014a). The Qualifying Interests are:

- Annex I Qualifying Interest Habitats
    - Marine Habitats
        - Mudflats and sandflats not covered by seawater at low tide (1140)
    - Coastal Habitats
        - Perennial vegetation of stony banks (1220)
        - Vegetated sea cliffs of the Atlantic and Baltic coasts (1230)
        - Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130)
        - Machairs (21A0)
        - European dry heaths (4030)
- Annex II Qualifying Interest Species
    - Invertebrate species
        - Narrow-mouthed Whorl Snail (*Vertigo angustior*) (1014)
    - Vertebrate species
        - Otter (*Lutra lutra*) (1355)

2.1.2. Conservation Objectives

The Conservation Objectives for the Qualifying Interests identified for the Site 002012 state that the natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution (NPWS 2014a). The Conservation Objectives and targets of the Qualifying Interests of Site 002012 are listed in **Table 2.1** below.

Table 2.1: The Conservation Objectives and targets of the Qualifying Interests of the North Inishowen Coast SAC (NPWS 2014).

Qualifying Interest	Objectives	Target(s)[2]
Mudflats and sandflats not covered by seawater at low tide 1140	Maintain favourable conservation condition	988.31ha[4]; 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
(Fine to medium sand with *Eurydice pulchra* community complex)	Maintain favourable conservation condition	234.79ha[4]; conserve community type in natural condition
(Muddy sand to coarse sediment with *Pygospio elegans* community complex)	Maintain favourable conservation condition	542.99ha[4]; conserve community type in natural condition
(Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex)	Maintain favourable conservation condition	208.62ha[4]; conserve community type in natural condition
(*Zostera*-dominated community)	Maintain favourable conservation condition	1.91ha[4] and Shoots/m^2; Maintain natural extent and high quality of *Zostera* dominated communities
Perennial vegetation of stony banks 1220	Maintain favourable conservation condition	Area unknown[3]; 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[5]; 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	Restore favourable conservation condition	496.06ha[5]; 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.
Machairs (*priority habitat in Ireland) 21A0	Restore favourable conservation condition	17.96ha[5]; 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.

[2] Area values based on NPWS spatial data. https://www.npws.ie/maps-and-data/habitat-and-species-data (accessed 23 February 2021)

[3] From NPWS (2014a) Conservation Objectives Series. North Inishowen Coast SAC 002012.

Qualifying Interest	Objectives	Target(s)[2]
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[5]; 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 *Vertigo angustior* 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 *Lutra* 1355	Maintain favourable conservation condition	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. Habitat extents are: Terrestrial above high water 146.6ha and 61.3ha along river banks/ ponds, Marine 10.99.2ha Freshwater river 30.9km Freshwater lake 2.7ha

2.2. *Details of Aquaculture Activities in Site 002012*

Aquaculture activities within Site 002012 focus on the cultivation of the Pacific oyster, *C. gigas* in Trawbreaga Bay. Oyster production has been operational in Trawbreaga Bay since the late 1990's, however it was not until the early 2000's that licenses were first issued for the area. In 2001 there were 26 licences to farm oysters in the Trawbreaga Bay area. In Trawbreaga Bay there are currently a total of 80 licenced sites and applications for licences for a further 14 sites.

2.2.1. Husbandry

Current oyster cultivation within Site 002012 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 arrayed in double rows with wide gaps between the paired rows to allow for access. Trestles used are made from steel are typically 3 in length, 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 two and five 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 Trawbreaga Bay when G4 to G8 (6 – 10mm, respectively) oyster seed is brought to the service site

either in spring or late summer of each year. The mesh size in the mesh bags can vary (4mm, 6mm, 9mm and 14 mm) depending on oyster stock grade. For example, 6mm seed is put into 4mm mesh bags at a ratio of 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 for 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 and France Nissian

Oysters are thinned out and graded as they grow and will be taken to the handling / sorting facility twice per year for grading and re-packing then returned to the trestles. In the final stage they will be 'hardened[4]' 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 in instances that they are moved to other sites for on-growing, and even heavier if being sent to market. 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.

New (oyster) applicants, have indicated their source of seed will be from hatcheries currently used by existing farms within the Bay. All new applicants propose to use bag and trestles (intensive) as the method of cultivating their oysters. Currently DAFM only permit triploid oysters to be grown in the North Inishowen SAC.

2.2.2. Aquaculture Sites in Trawbreaga Bay

Aquaculture sites on the intertidal area are typically accessed during spring tides (at low tide) using tractors and trailers. Preparatory work is always conducted in onshore 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 Trawbreaga Bay there are currently a total of 80 licenced sites and applications for licences for a further 14 sites. Of the 80 licenced sites 19 are under appeal to the Aquaculture Licence Appeals Board. The location of licenced sites and application sites relative to Qualifying Interest 1140 are shown in **Figure 2.1**. The extent of spatial overlap with Qualifying Interest 1140 is presented in **Table 2.2** and **Table 2.3**.

[4] The process of hardening allows daily periods of exposure to air and generally takes place in the intertidal zone or in shallow water where tidal range is sufficient. Aerially exposed oysters have higher meat content and better keeping qualities once harvested.

It should be noted that the values presented in **Table 2.2** and **Table 2.3** represent the total overlap of the aquaculture sites with Qualifying Interest 1140. There are some sites or part of sites that do not overlap with Qualifying Interest 1140.

2.2.3. Maximum Production Tonnage of Oysters as Estimated for Licences

The current maximum annual production tonnage based on production estimates on licences (including appeals) is estimated to be 1837 T, and the proposed max annual production tonnage within the licence applications is estimated to be 216. The percentage increase in total tonnage licence applications are approved will be 11.75%.

2.2.4. Aquaculture Site Access and Routes

The existing and proposed aquaculture sites are accessed by tractor and trailers. Given the size and location of the existing licenced aquaculture sites on the intertidal zone, it is likely that these sites are accessed by tractors on a proportion of low tides, rather than on every low tide. It is unknown, however, how many tractors and trailers and access routes are currently used by producers.

It is proposed that existing access routes will be used to access the proposed sites and that there will be no increase in the area of seabed used for access to the trestles. This is true for access to the proposed sites along established access routes but access to the exact location of the proposed sites will in some instances require vehicles to use new areas of seabed as access routes. These new areas will be small relative to established access routes but they will result in an overall increase in access route area. Albeit a relatively small increase in access route area, there is some uncertainty around the magnitude of this increase. It should be noted that although the proposed sites will result in an increase in access route area, the intensity of the vehicle traffic along these new access routes will be far lower than along established primary access routes used for multiple sites

Existing access routes are shown in **Figure 2.2** relative to the Qualifying Interest 1140. The estimated width of these access route is 10m. The spatial extent of existing access routes overlapping the Qualifying Interest 1140 is presented in **Table 2.4**.

As is the case for aquaculture sites, it should be noted that some segments of the access routes do not overlap with Qualifying Interest 1140 or its' constituent communities.

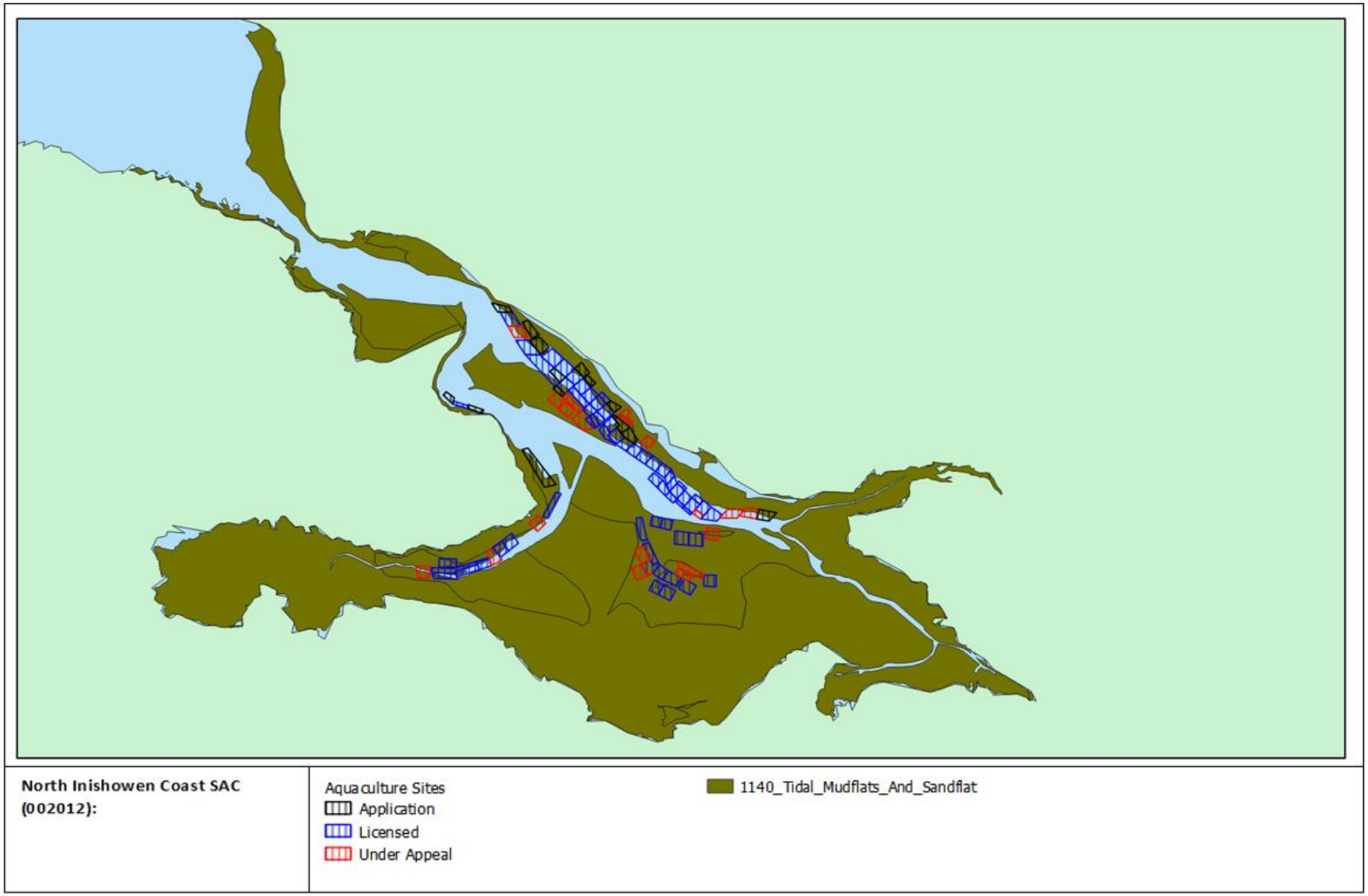

Figure 2.1: Aquaculture sites relative to Qualifying Interest 1140 in Site 002012.

Table 2.2: Spatial extent of licenced and under appeal aquaculture sites overlapping with Qualifying Interest 1140 in Site 002012.

		Licensed (61 sites)	Licensed - Under Appeal (19 sites)	Total
1140 - Mudflats and sandflats not covered by seawater at low tide (988.31ha)	**Area (ha)**	39.65ha	14.28ha	**63.14ha**
	% Qualifying Interest	4.01**%**	1.45**%**	**6.39%**

Table 2.3: Spatial extent of proposed aquaculture sites overlapping with Qualifying Interest 1140 in Site 002012.

		Applications (14 sites)
Habitat 1140 - Mudflats and sandflats not covered by seawater at low tide (988.31ha)	**Area (ha)**	9.21ha
	% Qualifying Interest	0.93**%**

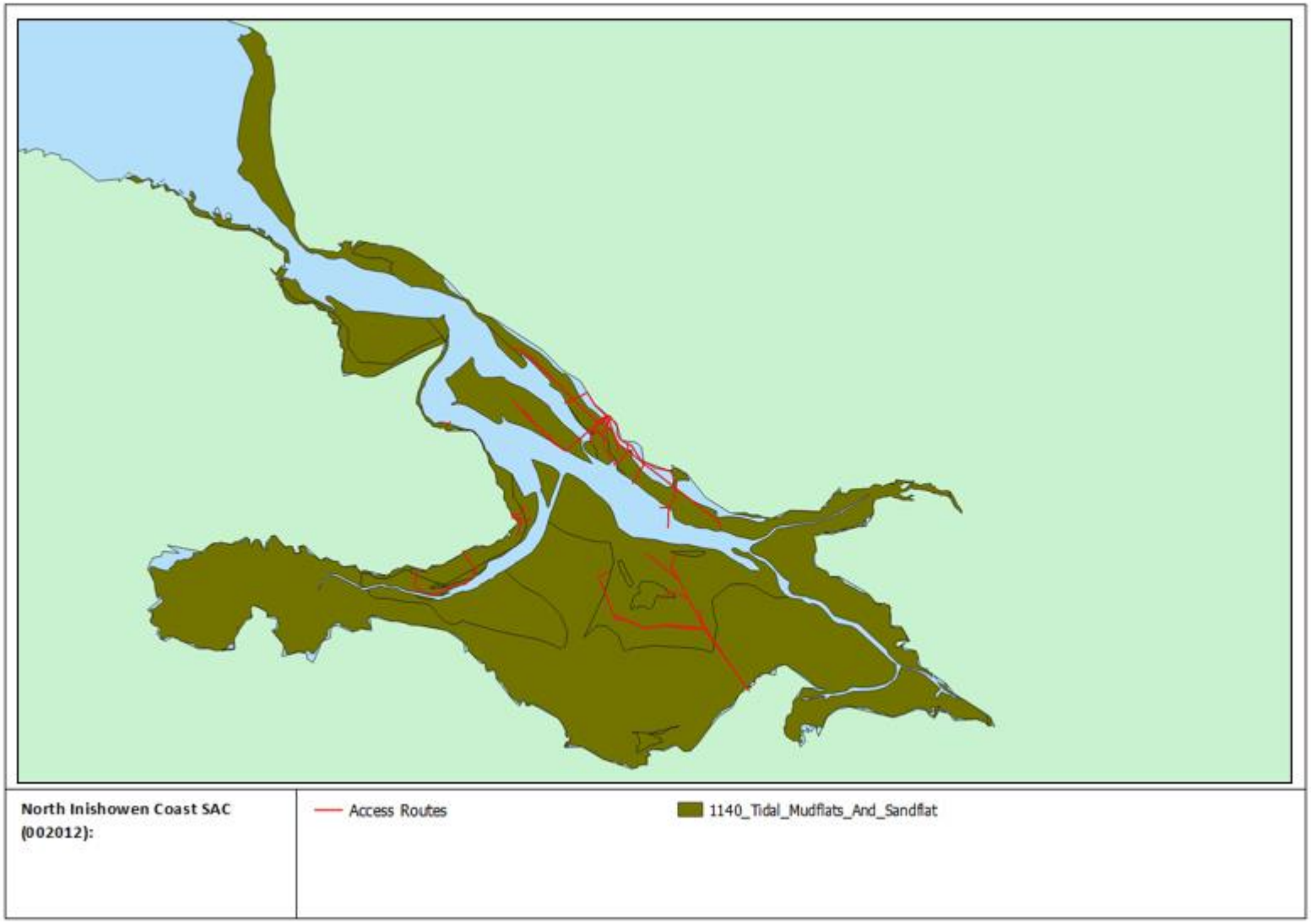

Figure 2.2: Access routes relative to Qualifying Interest 1140 in Site 002012.

Table 2.4: Spatial extent of access routes overlapping with Qualifying Interest 1140 in Site 002012.

		Access routes
Habitat 1140 - Mudflats and sandflats not covered by seawater at low tide (988.31ha)	**Area (ha)**	12.25ha
	% Qualifying Interest	1.24**%**

2.3. Screening of Potential *In Situ* and *Ex Situ* Interactions Between Aquaculture Activities and Qualifying Interests

2.3.1. Potential *In Situ* Interactions with the Qualifying Interests of Site 002012

This section presents a preliminary screening of the potential interaction between aquaculture activities and the Qualifying Interests in Site 002012. If an interaction is identified this indicates the potential for significant *in situ* effects of aquaculture activities on a Qualifying Interest[s]. **Table 2.5** contains the preliminary screening of potential interaction between aquaculture activities and Qualifying Interests in Site 002012.

In summary, aquaculture activities have the potential to interact with two Qualifying Interests only, Qualifying Interest 1140 and the Qualifying Interest 1335 (**Table 2.5**). Potential interactions with all other Qualifying Interests in Site 002012 were excluded based on distance from the aquaculture activities. The Qualifying Interests 1140 and 1355 were advanced to the next stages of the AA screening process (**Sections 2.4**).

Table 2.5: Qualifying Interests of the North Inishowen Coast SAC (NPWS 2014). Qualifying Interests brought forward to the Screening for AA are in bold.

Qualifying Interest	Preliminary screening
Mudflats and sandflats not covered by seawater at low tide 1140	**As shown in Section 2.2 above the aquaculture sites and access route overlap parts of the Qualifying Interest 1140 within the North Inishowen Coast SAC. Consequently, there is potential for aquaculture activities to interact with the Qualifying Interest .** **The Qualifying Interest 1140 is advanced to the next stage of the screening process.**
Perennial vegetation of stony banks 1220	The Qualifying Interest has been recorded at a total of 18 sub-sites, none of which are located in close proximity to the aquaculture sites (NPWS 2014a). Given location of the sub-sites, and the nature of aquaculture activities, potential interactions can be excluded– the Qualifying Interest is screened out from further assessment.
Vegetated sea cliffs of the Atlantic and Baltic coasts 1230	Sea cliffs are a feature of the SAC, with the best examples found in the west of the SAC (Dunree to Leenan Head and Dunaff Head) and in the area to the north-west of Glengad Head (NPWS 2014c). The closest sea cliffs to the aquaculture sites are located at the entrance of Trawbreaga Bay (NPWS 2014a). Given the distance of the sea cliffs from the aquaculture sites in inner Trawbreaga Bay potential interactions with aquaculture activities can be excluded – the Qualifying Interest is screened out from further assessment.

Qualifying Interest	Preliminary screening
Fixed coastal dunes with herbaceous vegetation (grey dunes) 2130	The closest area mapped for the Qualifying Interest 2130 is located at the entrance of Trawbreaga Bay (NPWS 2014a). Given the distance of the habitat from the aquaculture sites in inner Trawbreaga Bay potential interaction with aquaculture activities can be excluded – the Qualifying Interest is screened out from further assessment
Machairs (*priority habitat in Ireland) 21A0	The Qualifying Interest 21A0 are located on the north coast at the entrance to Trawbreaga Bay (NPWS 2014a). Given the distance of the habitats from the aquaculture sites in inner Trawbreaga Bay potential interaction with aquaculture activities can be excluded – the Qualifying Interest is screened out from further assessment.
European dry heaths 4030	This terrestrial habitat occurs in mosaic with other habitats such as wet heath/blanket bog and exposed rock and Vegetated sea cliffs of the Atlantic and Baltic coasts (1230). There is no potential for interaction between activities at the aquaculture sites and the Qualifying Interest – the Qualifying Interest is screened out from further assessment.
Narrow-mouthed Whorl Snail *Vertigo angustior* 1040	The closest area mapped for the Narrow-mouthed Whorl Snail is located at the entrance of Trawbreaga Bay. Given the distance of the area from the aquaculture sites in inner Trawbreaga Bay potential interaction with aquaculture activities can be excluded – the Qualifying Interest is screened out from further assessment.
Otter *Lutra* 1335	**Trawbreaga Bay supports extensive area of otter commuting habitat. There is potential that the species may occur within the aquaculture sites. Consequently, there is potential for aquaculture activities to interact with the Qualifying Interest.** **The Qualifying Interest Otter *Lutra* (1335) is advanced to the next stage of the screening process.**

2.3.2. Potential *Ex-Situ* Interactions with the Qualifying Interests of Adjacent SACs

This section presents a preliminary screening of the potential interaction between aquaculture activities at Trawbreaga and the Conservation Objectives of the Qualifying Interests of adjacent SACs (*i.e.* potential for *ex situ* effects).

SACs sites occurring within 15 km of the aquaculture sites at Trawbreaga were considered. The 15 km buffer zone was chosen to ensure that all potentially affected SACs were considered in the process. Two SACs are located within 15km of the existing and proposed aquaculture sites at Trawbreaga Bay (**Figure 2.3**). The SAC sites are:

- Magheradrumman Bog SAC (**Site 000168**)
- Inishtrahull SAC (**Site 000154**)

The Qualifying Interests of the Site 000168 and Site 000154 sites are identified in **Table 2.6** where a preliminary screening is carried out on the likely interaction with aquaculture activities.

In summary, as there is no potential for any interaction between the Qualifying Interests of Site 000168 and Site 000154 and the aquaculture activities, potential effects on the Qualifying Interests of Site 000168 and Site 000154 sites can be excluded. The Qualifying Interests can be screened out of this assessment.

Table 2.6: Qualifying Interests of SAC sites within 15km of the existing and proposed aquaculture sites at Site 002012 - initial screening assessment on likely interactions.

Natura site	Qualifying Interest	Preliminary screening
Magheradrumman Bog SAC	Northern Atlantic wet heaths with *Erica tetralix* (4010)	No spatial overlap or likely interactions of the Qualifying Interest with aquaculture activities within North Inishowen Coast SAC – Qualifying Interest screened out from further assessment.
	Blanket bogs (* if active bog) (7130)	No spatial overlap or likely interactions of the Qualifying Interest with aquaculture activities within North Inishowen Coast SAC – Qualifying Interest screened out from further assessment.
Inishtrahull SAC	Vegetated sea cliffs of the Atlantic and Baltic coasts (1230)	No spatial overlap or likely interactions of the Qualifying Interest with aquaculture activities within North Inishowen Coast SAC – Qualifying Interest screened out from further assessment.

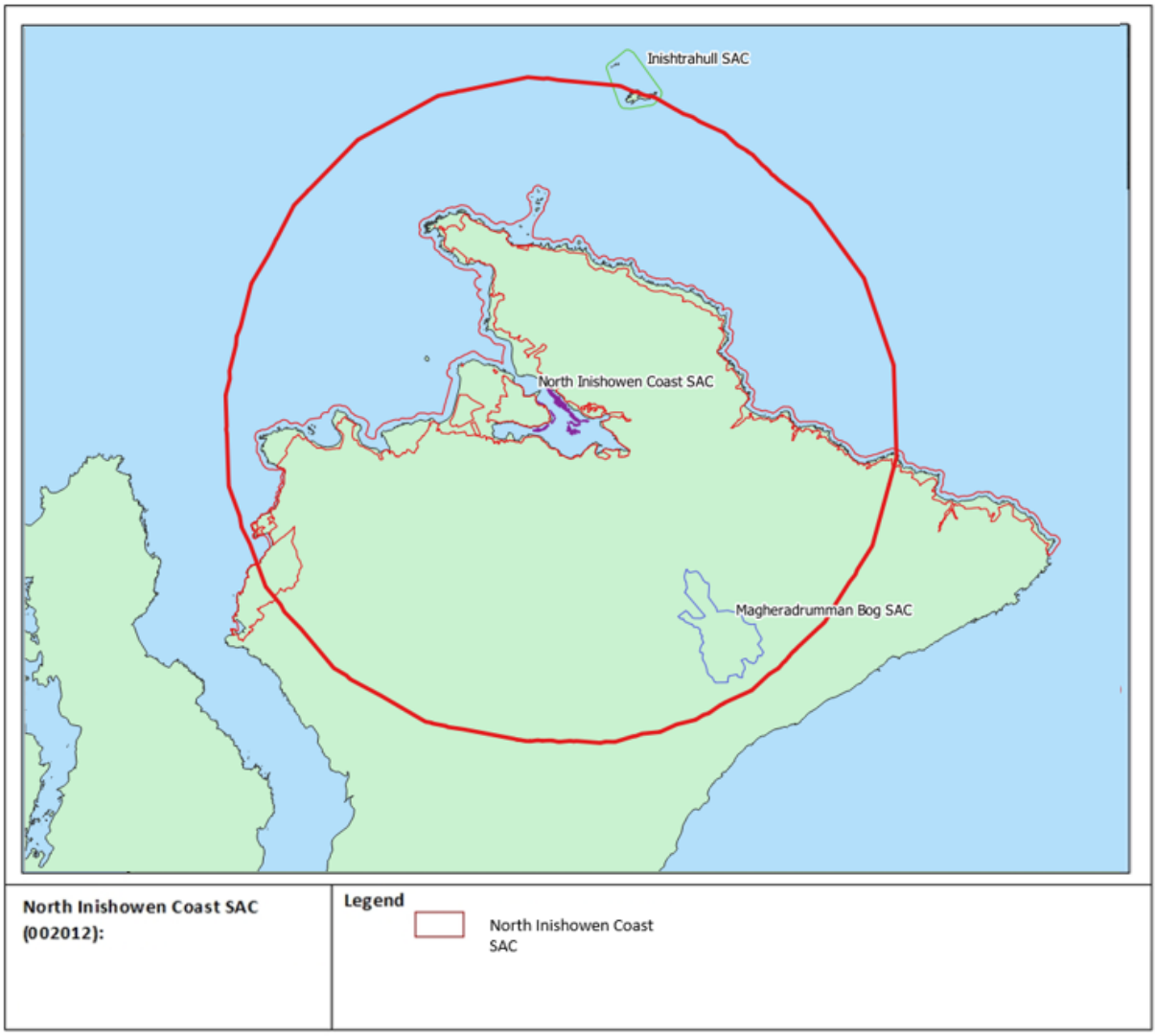

Figure 2.3: SACs within 15km of the existing and proposed aquaculture sites at the north Inishowen Coast SAC (Site code: 002012)

2.4. Screening of the Potential Effects of Aquaculture Activities on Identified Qualifying Interests

Potential effects of intertidal aquaculture with regard to benthic habitats (such as those in Qualifying Interest 1140) are described in **Section 2.4.1** while potential effects to Otter (Qualifying Interest 1335) are described in **Section 2.4.2.**

Screening assessments of whether or not the potential interactions could result in significant effects on Qualifying Interest 1140 and Qualifying Interest 1335 are provided in **Section 2.4.3** and **Section 2.4.4** respectively.

2.4.1. Potential Effects on Benthic Habitats - Qualifying Interest 1140

Filter feeding organisms, for the most part, feed at the lowest trophic level, usually relying primarily on ingestion of phytoplankton. Culture of filter feeding bivalve is a extractive process 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. The degree of deposition and accumulation of biologically derived material on the seafloor is a function of factors discussed below.

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. Whether material accumulates beneath oyster trestles is dictated by a number of factors, including: -

1. **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.
2. **Turbidity of water** – oysters have very plastic response to increasing suspended matter in the water column with a consequent increase in faecal or pseudo-faecal production. 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 an increase build-up of material beneath structures.
3. **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.

4. **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/mussel 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.

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

Oyster culture poses a risk in terms of the introduction of the non-native species Pacific oyster (*C. gigas*). Wild recruitment of *C. gigas* has been documented in a number of bays on the west and north coasts of Ireland and the species appear to have become naturalised in these areas (i.e. establishment of a breeding population) (Kochmann et al., 2012, 2013; Zwerschke et al., 2017). Naturalised population 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 and the establishment of 'wild' breeding populations.

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 the production site. 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' at Trawbreaga, 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/).

Non-native (alien) species may be introduced to environments accidentally or deliberately. Aquaculture activities, as well as shipping (commercial and recreational), are the main vectors for the introduction of alien species. Aquaculture is responsible for the introduction of alien species intended for culture and as a result of unintended transmissions arising from imports or movements of aquaculture stock.

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. **Table 2.7** summarises the potential effects of aquaculture activities on benthic habitats.

2.4.2. Potential Effects on Otter - Qualifying Interest 1335

There is little literature regarding otter and its potential interactions with aquaculture. According to the NPWS (2009) habitat destruction and degradation, water pollution and accidental death/ persecution are considered the major threats to this species.

The most recent otter survey in Ireland was carried out in 2010/11 (Reid *et al*., 2013) found that otter densities had declined from 70.5% in 2004/05 to 63.3%, following an initial reduction from 90% in 1980. However, the known distribution of otters remains widespread as there was a 51.7% increase in the known distribution of the species. According to Reid *et al*. (2013) the known range of otter increased by 31% from 1993-2006 to 2007-2011 while the population estimate of 7,800 [95%CI 7,200 – 10,200] breeding females during 2010/11 was not significantly different from that established as a baseline. Modelling of species-habitat associations suggested that available habitat was not limiting and no putative pressures recorded at survey sites negatively impacted species occurrence. Thus, under the statutory parameters for assessing a species' conservation status, *i.e.* range, population, habitat and future prospects, the otter was judged to be in Favourable or 'Good' status.

In the threat response plan NPWS (2009) state 'Little evidence has come to light in recent studies to suggest that disturbance by recreation is a significant pressure'. Recreation in the NPWS report is defined as angling, boating and aquaculture.

There is potential for aquaculture activities to affect otter through exclusion and/or displacement of the species from habitat area, disturbance due to human, boat and vehicular traffic, entanglement with aquaculture structures and equipment (**Table 2.8**).

Table 2.7: Potential effects of aquaculture activities on benthic habitats - Qualifying Interest 1140

Activity	Pressure Category	Pressure	Potential Effects	Equipment/ Gear	Duration (days)	Time of Year	Factors constraining the Activity
Aquaculture Activities	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	Spatial extent and location of structures used for culture
		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				
		Seston filtration	Alteration of phytoplankton and zooplankton communities and potential impact on carrying capacity eg. Affecting growth rates and structure of wild populations through competition for food.				
	Biological	Non-native (alien) species introduction	Potential for non-native species (*C. gigas*) 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				

Table 2.8: Potential Effects of Aquaculture Activities on otter - Qualifying Interest (1335)

Culture Method	Pressure Category	Pressure	Potential Effects	Equipment	Duration (days)	Time of Year	Factors constraining the activity
Aquaculture Activities	Physical	Habitat Exclusion	Structures may result in a barrier to movement of otters.	Bags and trestles	365	All Year	Spatial extent and location of structures used for culture
		Disturbance	Ancillary activities at sites increase the risk of disturbance to otter.	Site services, human, boat and vehicular traffic	365	All Year	Seasonal levels of activity relating to husbandry including harvesting
		Entanglement	Entanglement of otters from ropes or material used on structures or during operation of farms	Trestles, bags, and/or ropes used in day to day	365	All Year	Farm management practices
		Ingestion	Ingestion of waste material used on farm	Ties used to secure bags and secure bags to trestle	365	All Year	Farm management practices

2.4.3. Screening of Effects on Qualifying Interest 1140

For habitats, the screening assessment of aquaculture activities is based primarily on spatial overlap with Qualifying Interests *i.e.* if the proposed activities overlap with the habitat then significant effects on the habitat cannot be excluded (not screened out) except where there is absolute and clear rationale for doing so. Where there is spatial overlap, full assessment is warranted and the habitat is brought forward a more detailed assessment of potential effects in **Section 3**. Likewise, if there is no spatial overlap and no likely interactions, then the possibility of significant impact is excluded and further assessment of possible effects is deemed not to be necessary.

Qualifying Interest 1140 which covers an area of 988.31ha within Trawbreaga Bay in Site 002012 hosts four benthic community types:

1. Fine to medium sand with *Eurydice pulchra* community complex (234.79ha)
2. Muddy sand to coarse sediment with *Pygospio elegans* community complex (542.99ha)
3. Sand with *Angulus tenuis* and *Scoloplos* (*Scoloplos*) *armiger* community complex (208.99ha)
4. *Zostera*-dominated community (1.91ha)

The overlap of aquaculture sites and access routes with community complexes and community types within Site 002012 are shown in **Figure 2.7** and **Figure 2.8** while the spatial extent of overlap is presented in **Table 2.10** and **Table 2.11**.

Aquaculture sites and access routes do not overlap the community type **1.** Fine to medium sand with *Eurydice pulchra* community complex or **4.** *Zostera*-dominated community; consequently, potential effects on these community types can be screened out.

In contrast, aquaculture sites and access routes overlap the community types **2.** Muddy sand to coarse sediment with *Pygospio elegans* community complex and **3.** Sand with *Angulus tenuis* and *Scoloplos* (*Scoloplos*) *armiger* community complex; consequently, potential significant effects cannot be screened out. The potential effects to these community type are further assessed in **Section 3** below.

2.4.4. Screening of Effects on Qualifying Interest 1335

For otter, the screening assessment against the aquaculture activities considers the behaviour of the species and the potential for the species to interact with the aquaculture activities. Where interaction with aquaculture activities unlikely to occur, then the possibility of an effect is excluded and further assessment of possible effects is deemed unnecessary.

Otters forage and feed within 80m to 100m of the coastline (Kruuk & Moorhouse, 1991; De Jongh & O'Neill, 2010) and can travel distances up to 500m across estuaries or between islands (De Jongh & O'Neill, 2010). The diving depth of otters typically ranges from 10-12m with the majority of dives

being <3m and lasting <20 seconds (Kruuk *et al.,* 1985). Kruuk & Moorhouse (1991) reported that small benthic fish, eels and crustaceans are common prey items for otters, and they appear to have a strong preference for hunting in areas with dense seaweed cover in shallow, rocky environments. Inner Trawbreaga Bay is noted as being well used by otters, with vegetation providing lying up spots and holts. The distribution of mapped otter commuting habitat within Trawbreaga Bay relative to aquaculture sites and access routes is shown in **Figure 2.9**.

As the aquaculture site and access route activities overlap spatially with otter territory, these activities may have negative effects on the abundance and distribution of populations of the species as otter may migrate in and out of the area.

The risk of negative interactions between aquaculture operations and aquatic mammal species is a function of:

- 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?
- The schedule of operations on the site – is the frequency such that they can cause disturbance to the animals?

Negative effects from intertidal oyster cultivation can be excluded on the basis that the proposed activities will not lead to any modification of the following attributes for otter:

- Extent of habitat (terrestrial, marine and/or freshwater habitat) primarily because The oyster culture structures are raised from the seabed (0.5m -1m) and are oriented in rows, thus allowing free movement through and within the aquaculture sites.
- The activity involves net input rather than extraction of fish biomass as fish are attracted to the trestles and provide foraging opportunities for otters, as such, 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. Shellfish production activities are unlikely to pose any risk to otter populations through entrapment or direct physical injury.
- Disturbance associated with vessel and foot traffic at oyster cultivation sites could potentially affect the distribution of otters at the site. However, the level of disturbance is likely to be very low given that the likely encounter rates will be low and dictated primarily by tidal state and in daylight hours.
- Oyster culture operations are likely to be carried out in daylight hours. The interaction with the otter is likely to be minimal given that otter are mainly active in the early morning and/ or late evening. Given this behaviour, it is unlikely that the species will be active at the

aquaculture site and access routes during operations and encounter rates will be low; consequently, significant disturbance effects will not occur.

Potential effects of aquaculture activities to otter can be screened out.

2.5. In-combination Effects

2.5.1. Fisheries

2.5.1.1. Overview

Putative fisheries activities occurring in the SAC include dredge fishing for cockles and pot fishing for crustaceans (lobster and crab). An overview of fishing activities occurring in the Site 002012 is presented in **Section 2.5.1.2** below while an assessment of potential effects is presented in **Section 2.5.1.3**.

What follows is a summary of a description prepared by the Marine Institute (Marine Institute, 2015) of fisheries occurring within SAC and SPAs sites on the west and south coast.

Lobster fishing occurs on all coasts from Erris into Donegal Bay to Inver Bay and on the Donegal coastline north to Malin. Over 200 vessels are actively involved in the fishery off Donegal the majority of which are <10m in length. Approximately 57 vessels fish between Erris Head and Sligo. The latter vessels use on average 350 pots each and fish for over 100 days per year between Mar and Nov. This fishery occurs throughout the year, but activity increases during spring and peaks in summer. There is an intensive v-notching programme in the area with up to 3.7 tonnes of lobster v-notched and released per annum in recent years (Marine Institute, 2015).

Cockle beds may exist in intertidal mud and sand flats in Loughrous Beg, Gweebarra and Trawenagh in south west Donegal. Harvesting of cockles in Drumcliff Bay is by hand gathering and not by dredging. Razor clam stocks may occur in Rutland Channel and Gweedore Bay. These stocks do not have a microbiological classification and are not fished (Marine Institute, 2015).

The brown crab fishery extends from the coast offshore to the 200m depth contour both off the north Mayo coast and the north west Donegal coast. There are approximately 50 vessels and 50000 pots in the Donegal fishery. The offshore crab fleet in Donegal is an over 18m vivier fleet while the offshore fleet working out of Mayo is mainly 18m) have also declined as this fleet now spends a proportion of the year fishing in the southern north Sea. Effort hours (VMS) by this fleet in the area declined from 5714hrs in 2006 to 2238hrs in 2014 (Marine Institute, 2015).

A trap fishery for whelk has developed off the Inishowen peninsula in recent years. Up to 10 vessels may participate in this seasonal fishery in spring and summer depending on the relative market strength for whelk, lobster and crab (Marine Institute, 2015).

2.5.1.2. Effects of Fisheries on Qualifying Interest 1140

Cockle Dredging

Based general accounts of fishing in the area a putative cockle dredge fishing area at Trawbreaga was identified (see **Figure 2.4**).

Figure 2.5 and **Figure 2.6** respectively show the putative dredge fishery area relative to the Qualifying Interest 1140 and constituent marine community types.

The putative dredging areas overlaps 15.66% of Qualifying Interest 1140 (see **Table 2.9**) and with 14.43% and 35.15% respectively of Muddy sand to coarse sediment with *Pygospio elegans* community complex, and Sand with *Angulus tenuis* and *Scoloplos* (*Scoloplos*) *armiger* community complex) (see **Table 2.9**).

Soft sediment communities, particularly suspension feeders and crustaceans, are sensitive to fishing pressure from dredging. 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).

Table 2.9: Spatial extent of cockle dredge fisheries activities overlapping with Qualifying Interest 1140 and with constituent communities.

Qualifying Interest	**Overlap**	
	Area (ha)	**% Qualifying Interest**
Mudflats and sandflats not covered by seawater at low tide (988.31ha)	151.78	15.66
Community Type	**Overlap**	
	Area Ha	**% Community type**
Muddy sand to coarse sediment with *Pygospio elegans* community complex (542.99ha)	78.33	14.43
Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex [208.53ha]	73.14	35.15

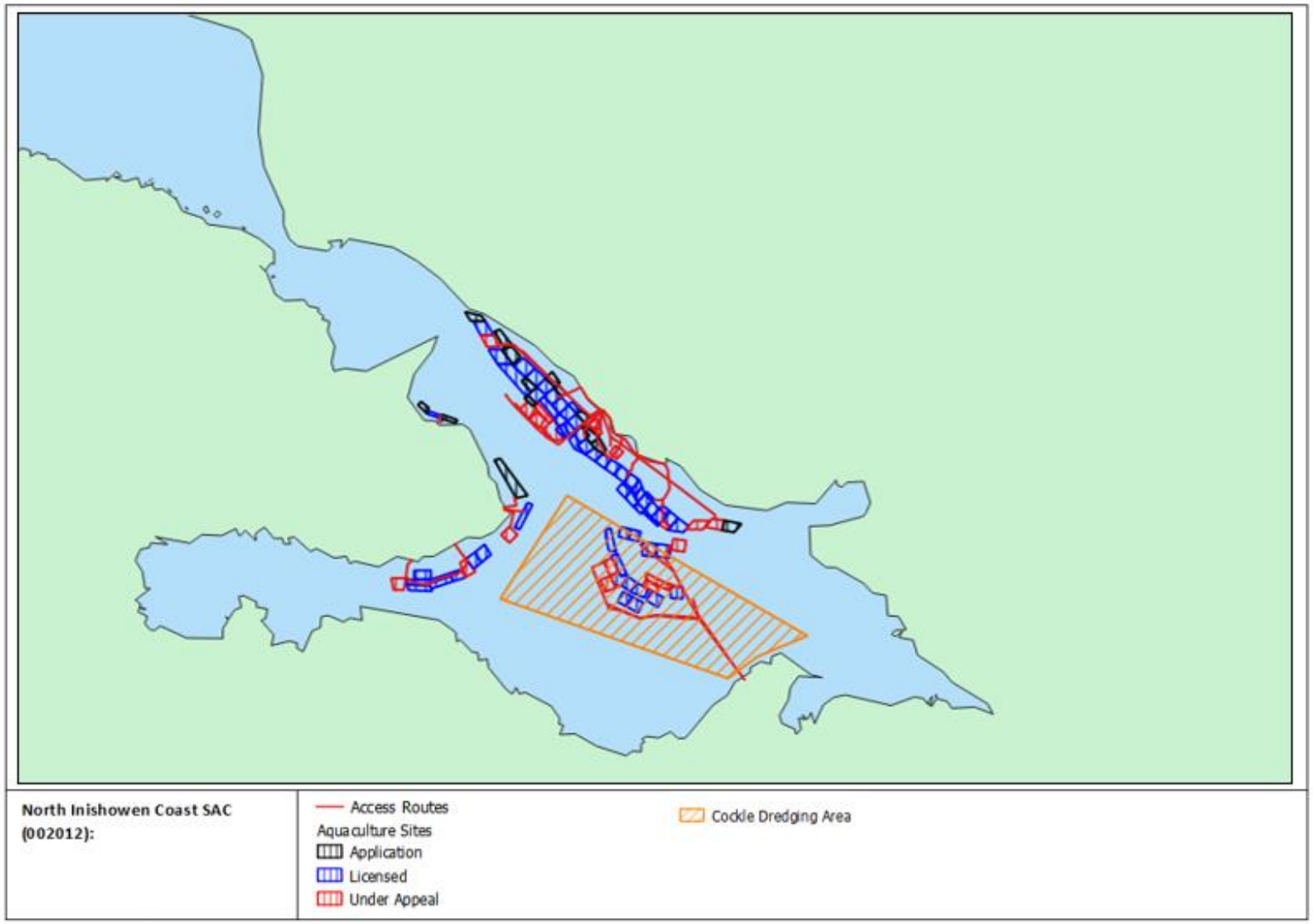

Figure 2.4: Aquaculture activity and putative dredge fishing at Trawbreaga

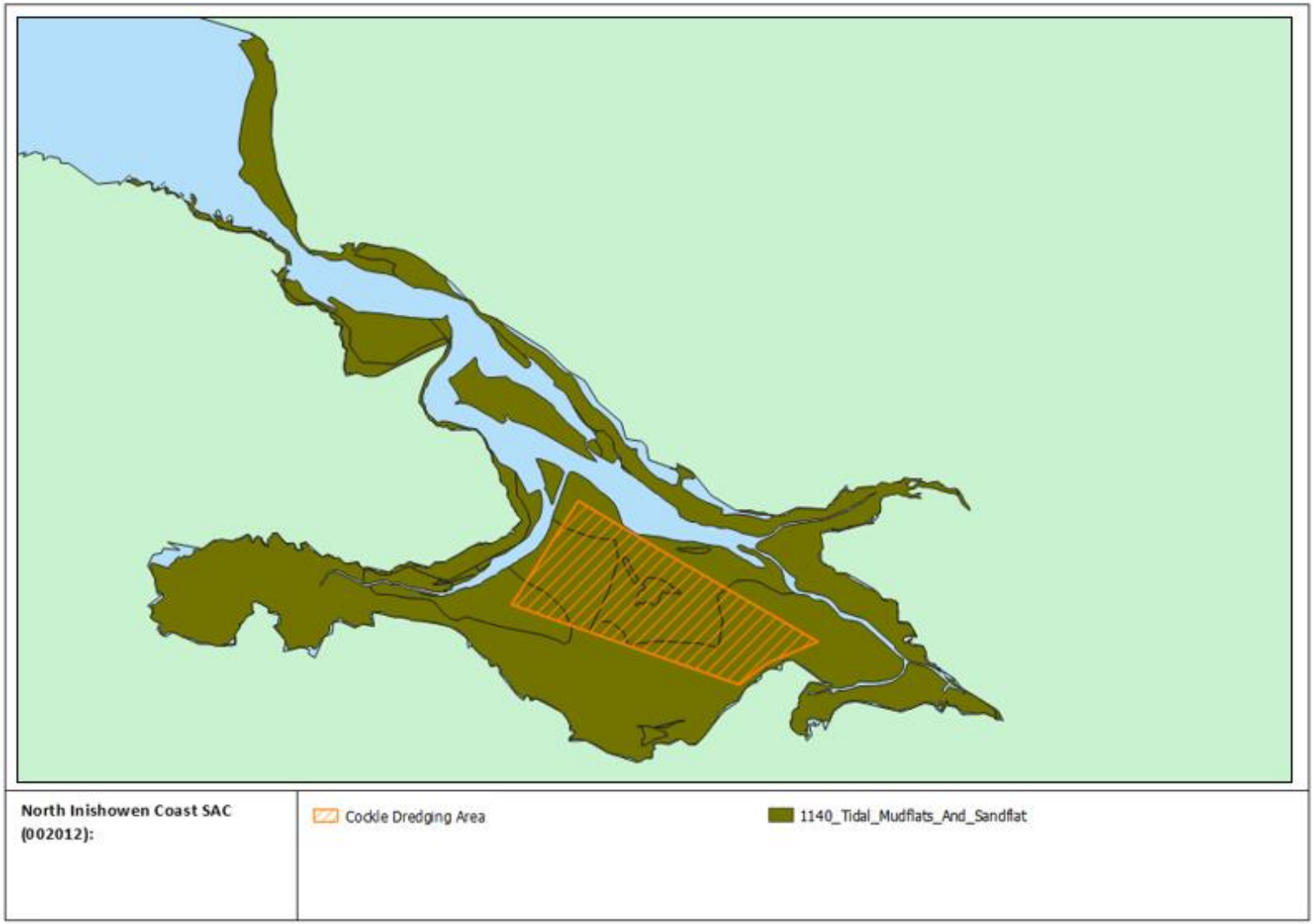

Figure 2.5: Putative dredge fishing area relative to Qualifying Interest 1140

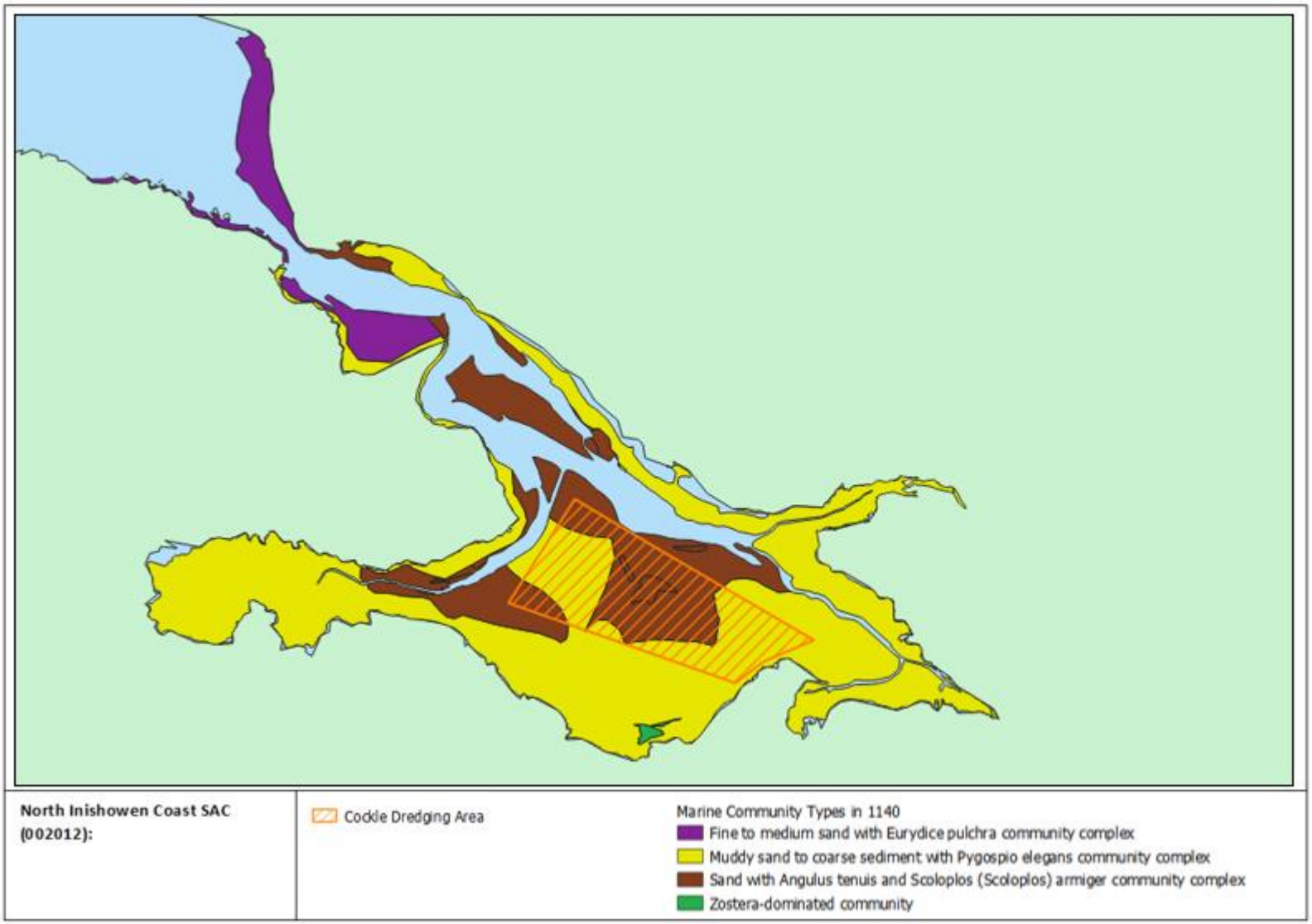

Figure 2.6: Putative cockle dredge fishing area relative to community types comprising Qualifying Interest 1140

Pot Fishing

Pot fishery at Trawbreaga overlaps with 0.26% of Qualifying Interest 1140 and with 1.10% of the constituent marine community type Fine to medium sand with *Eurydice pulchra* community complex.

Pot fisheries may cause localized abrasion and disturbance which may be significant for habitats that are highly sensitive to such pressures (*e.g.* maërl and seagrass meadows). In many instances, pots are retrieved via tractor or other vehicles as opposed to exclusively by boat. However, given the spatial scale of and low intensity of this fishery practice the risk posed by the crustacean pot fishery to muddy sand and sandy mud habitats is deemed to be low and insignificant (ABPMer 2013e).

2.5.1.3. Effects of Fisheries on Qualifying Interest 1140

Cockle Dredging

The level of coverage presented in **Table 2.9** is unlikely to be a true reflection of dredge fishing in the area for the following reasons:

- Dredge fishing activities are typically confined to deeper water and is unlikely to occur in shallow subtidal and intertidal areas;
- The presence of oyster trestles in existing licenced areas will preclude the operation of a dredge in the area identified;
- The intertidal nature of part of the putative cockle dredge fishing area would be impractical for dredging activity relative to adjacent subtidal habitats;
- The area identified for putative dredging is not suitable for dredging given the high abundance of boulders and rocks found in the (sedimentary) intertidal areas of the SAC.
- There are no known applications for a fishery or a proposed fishery plan for the area.

Given the above reasons, significant effects of dredge fishing on designated Qualifying Interest 1140 and its' constituent community types can be excluded from further assessment.

Future fisheries activities will be subject to full risk assessment should an application be presented.

Pot Fishing

In comparison to bottom fishing using dredges, which are specifically designed to disturb the upper few centimetres of sediments, benthic habitats are relatively resilient to physical disturbance associated with the deployment and retrieval of pots and creels. In addition, the actual footprint of static gear such as creels and pots will be much lower than the percentage of the area over which the fishery might occur. Given the low level of spatial overlap, and the relative resilience of the habitat and community types to disturbances from pot fisheries, significant effects can be excluded.

2.5.1.4. Screening of In-combination Effects

Qualifying Interest 1140

Given that interactions between Qualifying Interest 1140 and fishing activities are unlikely to occur, in-combination effects of fishery aquaculture activities are screened out.

2.5.2. Intertidal Seaweed Harvesting

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 effects on intertidal habitats may also occur as a consequence of travel across the shore to harvest sites. Removal of seaweed cover may alter local hydrodynamic conditions and change wave exposure regimes which, in turn, can modify sedimentation rates.

There are anecdotal accounts of seaweed harvesting occurring along reefs and also from boulders and cobbles scattered on top of intertidal sediments in areas near Community 2. There are currently foreshore applications for seaweed harvesting decisions pending, the full consideration of this un-licenced activity in combination with existing (and proposed) aquaculture activities is not possible at this stage.

It is understood that any seaweed harvesting that occurs is infrequent and dependant on market prices and weather. These two factors serve to make this an infrequent source of disturbance and given that harvesting occurs on hard substrates then neither Community 1 or Community 2 can be affected as these communities are sedimentary and not characterised by the presence of boulders or cobbles.

2.5.2.1. Screening of In-combination Effects

Given that no direct interaction between either Community 1 or 2 with seaweed harvesting any adverse in-combination effects can be screened out.

2.5.3. 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.

2.5.3.1. Screening of In-combination Effects Screening

The Environmental Protection Agency has classified water quality in Trawbreaga Bay as unpolluted. Furthermore, 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 can be screened out.

2.6. Screening Outcome

The screening assessment investigates the potential for the existing and proposed aquaculture activities to have significant *in situ* and/ or *ex situ* effects on SACs sites within the Natura 2000 network.

The screening exercise has determined, in light of best available scientific data, that there is potential for significant *in situ* effects on Qualifying Interest 1140 of Site 002012. The Qualifying Interest and site are screened in for further detailed consideration of the potential for effects in **Section 3**. The likelihood of significant *in situ* and *ex situ* effects on all other Qualifying Interests of SAC sites have been excluded (screened out).

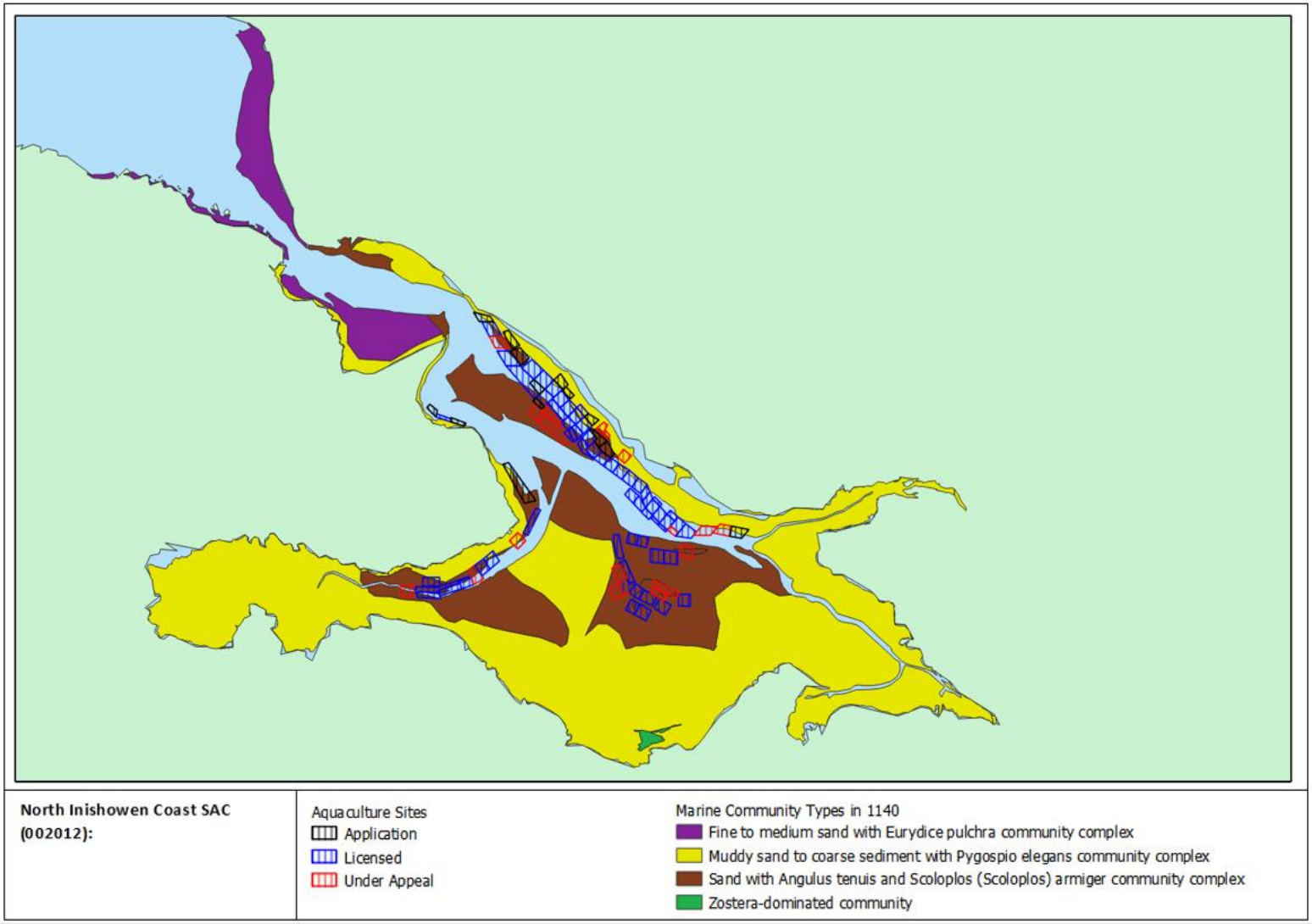

Figure 2.7: Aquaculture sites relative to benthic communities in Qualifying Interest 1140, Trawbreaga Bay.

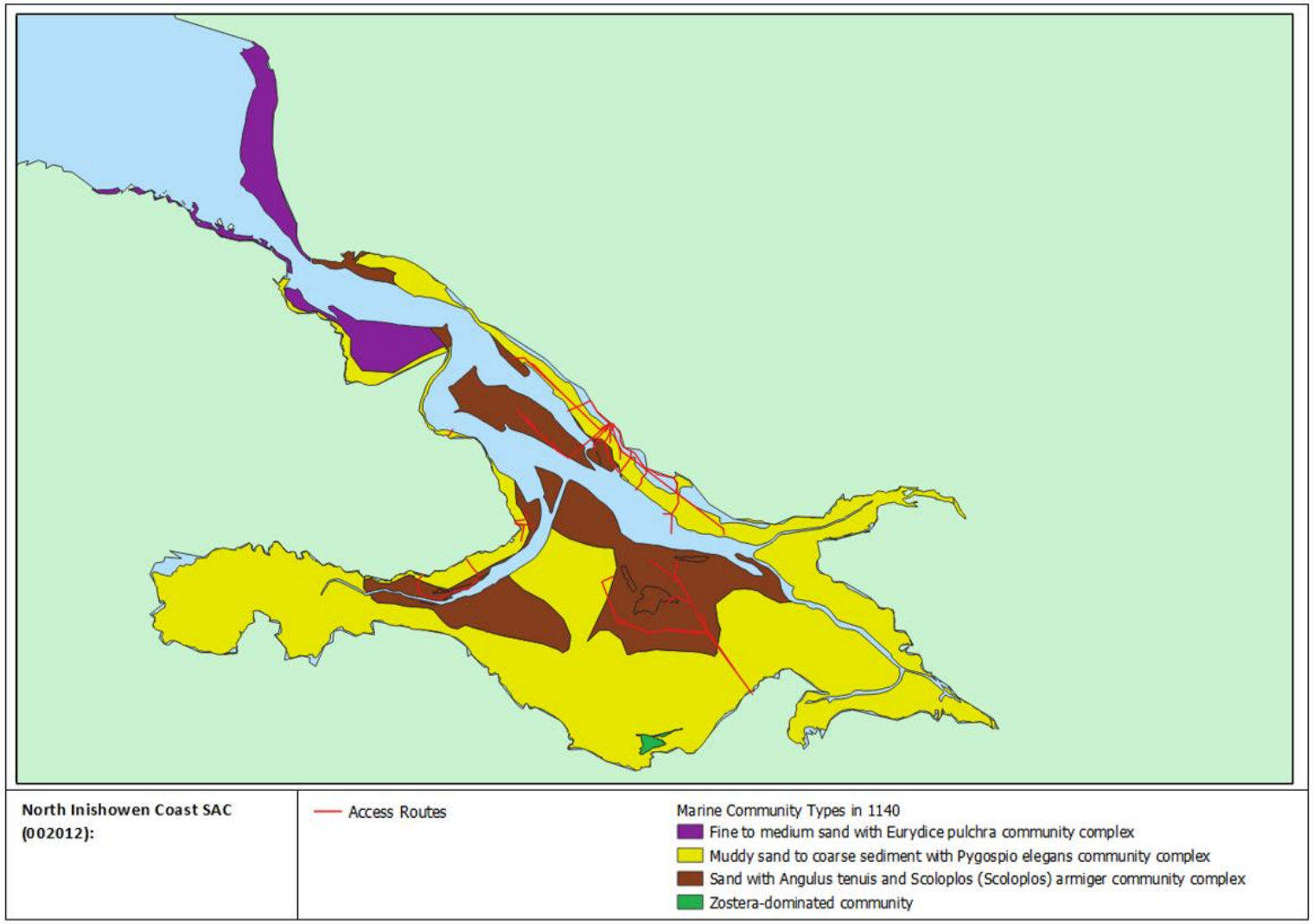

Figure 2.8: Access routes relative to benthic communities in Qualifying Interest 1140, Trawbreaga Bay .

Table 2.10: Spatial Extent of Aquaculture sites overlapping communities within Qualifying Interest 1140 in Site 002012.

		Licensed (61 sites)	Licensed - Under Appeal (19 sites)	Total Licenced (80 sites)	Applications (14 sites)	Combined Licenced and Applications (94 sites)
Fine to medium sand with *Eurydice pulchra* community complex (234.79ha)	**Area (ha)**	-	-	**-**	-	-
	% of community complex	-	-	**-**	-	-
Muddy sand to coarse sediment with *Pygospio elegans* community complex (542.99ha)	**Area (ha)**	15.21ha	5.56ha	**20.77ha**	8.90ha	**29.67ha**
	% community complex	2.80**%**	1.02**%**	**3.82%**	1.64**%**	**5.46%**
Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex (208.99ha)	**Area (ha)**	33.07	11.91	**44.98ha**	5.84	**50.82ha**
	% community complex	15.82%	5.70%	**21.52%**	2.79%	**24.31%**
***Zostera*-dominated community (1.91ha)**	**Area (ha)**	-	-		-	-
	% community	-	-		-	-

Table 2.11: Spatial extent of access routes overlapping communities within Qualifying Interest 1140 in Site 002012.

		Access routes
Fine to medium sand with *Eurydice pulchra* community complex (234.79ha)	**Area (ha)**	-
	% community complex	-
Muddy sand to coarse sediment with *Pygospio elegans* community complex (542.99ha)	**Area (ha)**	11.13ha
	% community complex	2.05%
Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex (208.99ha)	**Area (ha)**	7.66ha
	% community complex	3.66%
***Zostera*-dominated community (1.91ha)**	**Area (ha)**	-
	% community	-

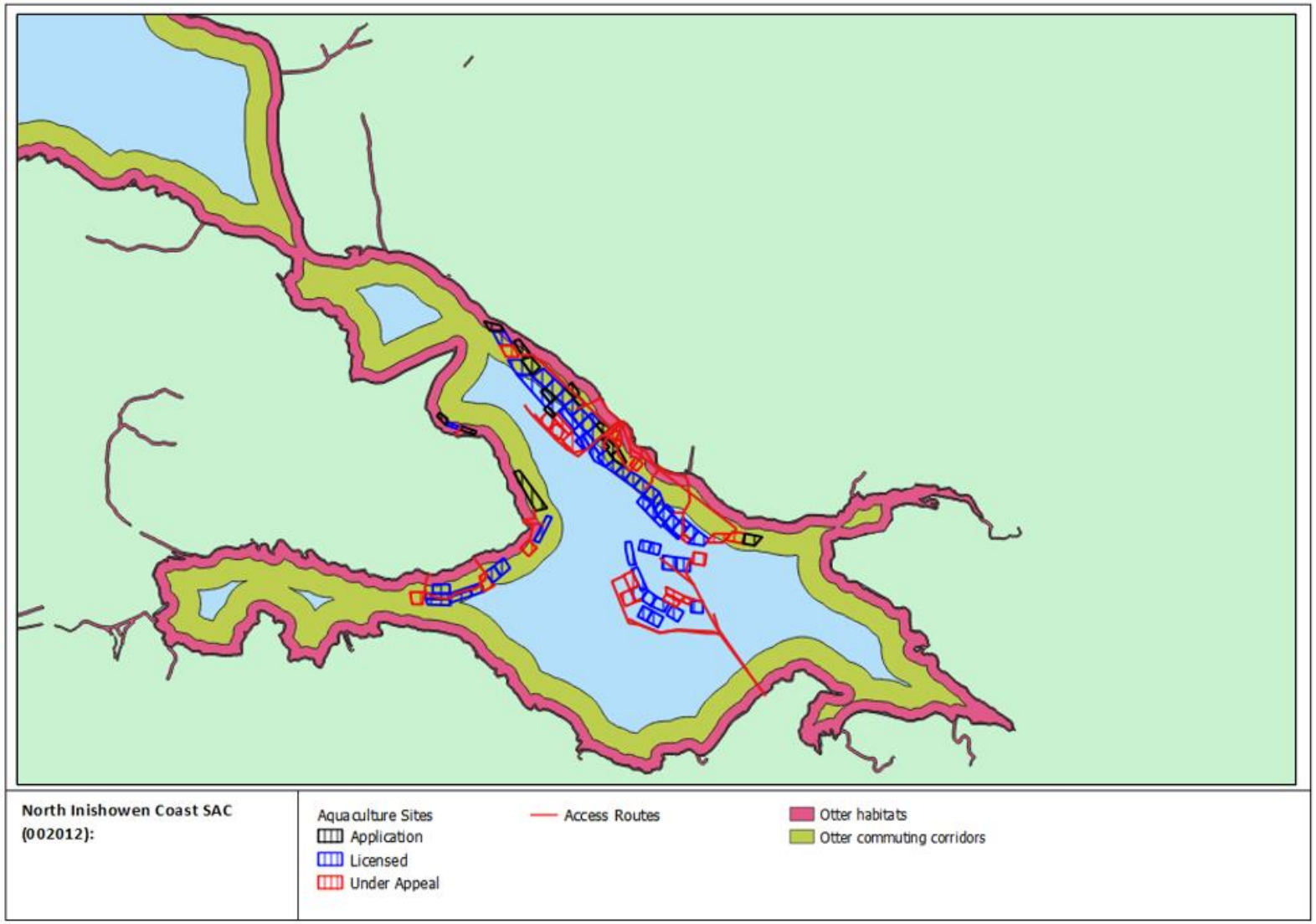

Figure 2.9: Aquaculture sites and access routes relative to mapped otter habitats and commuting corridors.

3. Appropriate Assessment Natura Impact Statement

3.1. Overview

The screening presented in **Section 2** screened out *in situ* and *ex situ* and in-combination effects on Qualifying Interests of SACs with the exception of the potential for *in situ* effects on the Qualifying Interest 1335 and Qualifying Interest 1140 in Site 002012.

Aquaculture sites and access routes overlap two community types within the Qualifying Interest 1140 of Site 002012. The community types are Muddy sand to coarse sediment with Pygospio elegans community and the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community.

Due to the overlap, potential significant effects to the Qualifying Interest 1140 could not be screened out. This section provides a determination of the significance of the possible effects of aquaculture activities on these community types. The significance of effects is determined on the basis of Conservation Objective guidance for constituent community complexes of 1140 provided in NPWS 2014a and NPWS 2014b.

3.2. Direct Effects of Aquaculture on Habitats

3.2.1. Overview

For Site 002012, NPWS (2014a) and NPWS (2014b) provide guidance on the interpretation of the Conservation Objectives which are, in effect, management targets for the Qualifying Interests of the SAC. The 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 Qualifying Interest 1140, NPWS (2014a) and NPWS (2014b) include Conservation Objectives and targets for the constituent community types of the Qualifying Interest.

For the practical purpose of management of sedimentary habitats, a 15% threshold of overlap between a disturbing activity and the community type is given in the NPWS guidance (NPWS 2014b). 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.

3.2.2. Determining Significance

The significance of effects is determined on the basis of guidance for constituent habitats (NPWS 2014a, NPWS, 2014b) in particular the disturbance thresholds set for community types.

A schematic outlining the determination of significant effects on habitats and marine community types is presented in **Figure 3.1.**

For habitats and community types significance of impact is determined in relation to, first and foremost, spatial overlap. Subsequent disturbance and the persistence of disturbance are considered as follows:

- The degree to which the activity will disturb the Qualifying Interest;
    - In this instance a disturbance results in a change in the characterising species, as listed in the Conservation Objective guidance (NPWS 2014a and NPWS 2014b) 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 3.2.3** below).
- 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.
- 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.

NPWS 2014b outlines that effects are 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.

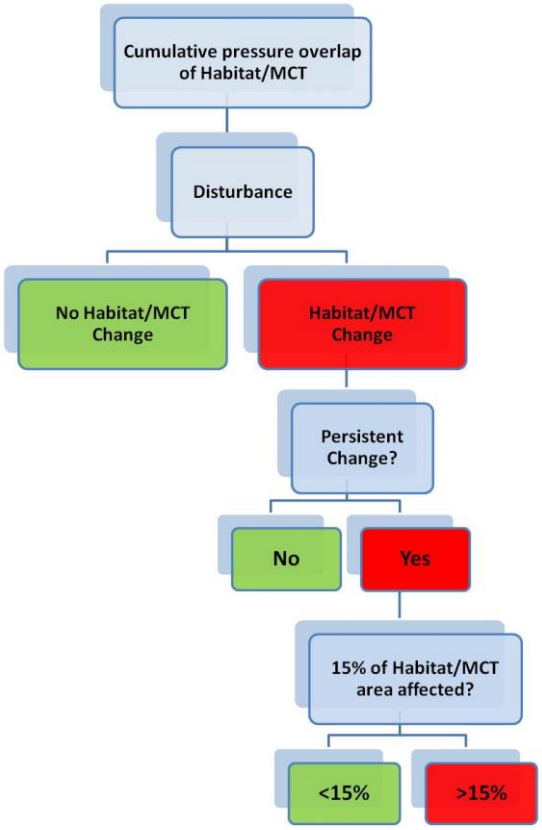

Figure 3.1: Schematic outlining the determination of significant effects on habitats and marine community types (MCT) (following NPWS 2014b).

3.2.3. Sensitivity and Assessment Rationale

This assessment used a number of sources of information in assessing the sensitivity of the characterising species of the community types recorded within the benthic habitats of Site 002012 that are overlapped by aquaculture sites and access routes.

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. 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 disturbed if more than 15% of the community is thus exposed (NPWS 2014b).
- 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 Site 002012 to pressures similar to those caused by aquaculture (*e.g.* smothering, organic enrichment and physical disturbance) are identified in **Table 3.1**. 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 3.2**. 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).

Table 3.1: Matrix showing the characterising sensitivity scores x pressure categories for intertidal communities (or surrogates) in the Site 002012 (ABPMer 2013a-h) (Table 3.3 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 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
Muddy sand to coarse sediment with *Pygospio elegans* 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 *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* 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 3.2: Matrix showing the characterising species sensitivity scores x pressure categories for taxa (or surrogates) in Site 002012 (ABPMer 2013a-h) (Table 3.3 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
Angulus tenuis	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 (*)
Arenicola marina	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 (*)
Capitella 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 (*)
Cerastoderma edule	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 (*)
Corophium volutator	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 (*)
Hediste diversicolor	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 (*)
Lanice conchilega	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 (*)

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
Nemtoda	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 (*)
Pygospio elegans	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 (*)
Scoloplos (Scoloplos) armiger	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 (*)
Scolelepis (Scoloplos) squamata	NS (*)	NS ***	NS (*)	NS (*)	NS (*)	L-M (*)	L-M ***	L-M ***	NS (*)	NS (*)	NS (*)			NS (*)	NS ***	NS (*)	L (*)	L (*)		NS (*)	NS (*)	Nev	Nev		NS (*)
Scrobicularia plana	NS (*)	NS (**)	M-H (*)	NS (**)	L (**)	M-H (*)	NS-L (*)	M-H (*)	M-H (*)	NS (*)	NS (*)	L (*)	NS (*)	M (*)	M (*)	NS (*)	NS (*)	NS (*)	M (*)	NS (*)	NS (*)	NS (*)	NA	L (*)	NS (*)
Spio sp.	L (*)	L ***	L (***)	L (*)	L (*)	L-M (*)	NS (*)	M (*)	L-M (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS ***	NS (*)	NEv	NEv	VH (*)	NS (*)	NS (*)	NS (*)	NEv	NS ***	NS (*)
Tubificoides sp.	NS (*)	NS (*)	L (**)	L (*)	L (*)	M (*)	NS (*)	L (*)	NS (*)	NS (*)	NS ***	NS (*)	NS (*)	NS ***	NS ***	NS (*)	NS ***	NS ***	NS (*)	NS (*)	NS (*)	NS (**)	Nev	Nev	NS (**)

Table 3.3: Codes of sensitivity and confidence applying to species and pressure interactions presented in Table 3.1 and Table 3.2.

Pressure interaction codes	
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

3.2.4. Assessment of the Effects

Aquaculture pressures on a given habitat are related to vulnerability to the pressures induced by culture activities. Consequently, the following are important factors to be considered when assessing risk of disturbance to habitats and species:

- type of activity;
- location and orientation of structures associated with the culture organism;
- density of cultured organisms; and
- duration of the culture activity.

NPWS (2014a) and NPWS (2014b) identify the species characteristic of benthic communities that are defined in the Conservation Objectives.

The species defined are typical of fine sedimentary habitats as well as where relevant, 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.

As described in the Conservation Objectives document for the sites (NPWS 2014b), Favourable Conservation Status is defined by targets set for attributes of the Annex I habitat.

The attributes are:

1. Habitat Area and
2. Community distribution

Assessment of the potential effects on Qualifying Interest 1140 with respect to attribute **1.** and attribute **2.** are presented in **Section 3.2.4.1** and **Section 3.2.4.2.**

3.2.4.1. Habitat Area

For attribute 1, the target for Qualifying Interest 1140 is to ensure that the permanent habitat area is stable or increasing, subject to natural processes. As outlined in NPWS (2014b), this target refers to activities or operations that propose to permanently remove habitat from a site, thereby reducing the permanent amount of habitat area. It does not refer to long or short term disturbance of the biology of a site.

The potential effects of aquaculture activities on benthic habitats are described in **Section 2.4.1**. In summary, aquaculture activities may alter the characteristics of sediments in the vicinity of the trestle due to the release and subsequent deposition of oyster faeces and pseudo-faeces, while the physical presence of the trestle structures may alter the current regime in the immediate surrounding of the sites resulting in increased deposition of fines or scouring changing the local sediment characteristics. Vehicle movements at the trestle sites and along access routes may result in sediment compaction resulting in sediment changes.

The effects described above have potential to result in long or short term disturbance to discrete areas within or immediately adjacent to the aquaculture sites and access routes and, will not act to permanently reduce habitat area.

3.2.4.2. Community Distribution

Attribute 2 relates to the distribution of communities identified within the Annex I habitats. The constituent communities of the Qualifying Interest 1140 overlapped by the aquaculture sites and access route are Muddy sand to coarse sediment with *Pygospio elegans* community complex and, Sand with *Angulus tenuis* and *Scoloplos* (*Scoloplos*) *armiger* community complex. As outlined in NPWS (2014b), this target requires that community types are conserved in a natural condition, and that significant continuous or ongoing disturbance of communities should not exceed an approximate area of 15% of the interpolated area of each community type. The spatial overlap of aquaculture sites and access route with the constituent community types is presented in **Table 3.4** and **Table 3.5**.

Aquaculture sites

The possible effects of the aquaculture sites on Muddy sand to coarse sediment with Pygospio elegans community complex and, Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex were considered because aquaculture activities directly overlap with these community types**.** The Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex has been shown to be resilient to any potential depositional or organic enrichment effects under oyster trestles in previous studies of this community type in other bays around Ireland (Forde *et al*., 2015 and O'Carroll *et al*., 2016). There is significant overlap between the Sand with Angulus tenuis and Scoloplos

(Scoloplos) armiger community complex and aquaculture sites with current levels being 21.52%, and proposed levels = 24.31% which is greater than the 15% threshold set by NPWS (NPWS 2014b). However, the 15% threshold set by NPWS is a disturbance threshold and given the evidence on the resilience of this community to depositional and organic enrichment effects the existing and proposed overlap of trestles will not result in significant adverse effects or disturbance.

The level of overlap between oyster trestle sites and the Muddy sand to coarse sediment with Pygospio elegans community complex are low (current levels = 3.82% and proposed levels = 5.46%), but there is no existing data on the sensitivity of this community type to depositional and organic enrichment effects. Given that the Muddy sand to coarse sediment with Pygospio elegans community complex has not been studied in terms of its resilience it cannot be determined if this community is resilient to depositional and organic enrichment effects. It is possible that this community complex is sensitive and where overlap between this community and aquaculture sites occurs that significant adverse effects will arise. Given this lack of information the risk of depositional and organic enrichment effects arising from the overlap between aquaculture sites and the Muddy sand to coarse sediment with Pygospio elegans community complex the risk of adverse effects cannot be discounted.

There is also potential that current and proposed levels of activity within the bay exceed the natural ecological carrying capacity of the bay with regard to the availability of phytoplankton within the water column to filter feeding species (including the cultured oysters). As well as directly adversely impacting filter feeding organisms comprising the biological communities of the bay, there is potential that exceeding the carrying capacity of the bay and depleting available levels of phytoplankton, would increase the time required for culture oysters to attain harvestable size.

Access Routes

With respect to access routes, it is reported in Forde *et al*. (2015), O'Carroll *et al*. (2016) and De-Grave *et al*. (1998), that activities at access routes in intertidal areas, presumably by virtue of persistent compaction of the sedimentary habitats by heavy vehicles, are considered disturbing to habitats.

For the previous AA reports prepared by the Marine Institute to support DAFM aquaculture licencing decisions, the Marine Institute has concluded that the activity at access routes is non-disturbing to intertidal habitats where the spatial overlap is less than the disturbance thresholds identified by NPWS in Conservation Objectives (*i.e.* where overlap is below 15%).

In the case of Trawbreaga the access routes overlap 2.05% and 3.66% respectively of the. The level of overlap of access routes is below the disturbance threshold.

The level of overlap of access routes with the Muddy sand to coarse sediment with *Pygospio elegans* community complex and the Sand with *Angulus tenuis* and *Scoloplos* (*Scoloplos*) *armiger* community complex is 2.05% and 3.66% respectively and within these areas both communities are likely to be significantly affected. It is proposed that the same access routes will be used to access the proposed sites and that there will be no increase in the area of seabed used for access to the trestles. This is true for access to the proposed sites along established access routes but access to the exact location of the proposed sites will in some instances require vehicles to use new areas of seabed as access routes. These new areas will be small relative to established access routes but they will result in an overall increase in access route area. Albeit a relatively small increase in access route area, there is some uncertainty around the magnitude of this increase. It should be noted that although the proposed sites will result in an increase in access route area, the intensity of the vehicle traffic along these new access routes will be far lower than along established primary access routes used for multiple sites and therefore any compaction effects will also be less intense. The level of uncertainty around the magnitude of the increase in access route area and associated effects is not such that would warrant the precautionary approach to be followed in this instance but it should be noted for future reference that compaction effects beyond the area of the established access routes in Trawbreaga Bay will increase with each new licence granted. Overall, the risk of significant effects on both community complexes of access routes to the proposed sites cannot be discounted.

3.2.4.3. Ecological Carrying Capacity of Trawbreaga

Due to the large maximum production tonnage licenced for Trawbreaga Bay and the enclosed nature of the Bay, ecological carrying capacity is now an important consideration for the licensing of aquaculture in Site 002012. Ecological carrying capacity issues arise when wild populations such as benthic filter feeders are out competed for resources such as phytoplankton to a degree that results in measurable adverse effects on ecosystem processes at the Bay scale (Nunes et al., 2011). Extensive aquaculture practices such as oyster trestle cultivation results in a net extraction of carbon and phytoplankton from the ecosystem and if at a high enough density, can exert top-down control on phytoplankton dynamics at the bay-scale (Gibbs, 2005). Every unit mass of phytoplankton removed from the system is forgone to wild zooplankton, benthic filter feeders, and demersal fish species that prey on benthic filter feeders which can have significant effects on energy transfer through the food web and nutrient recycling in the ecosystem (Gibbs, 2005). Further investigations into the ecological carrying capacity of Trawbreaga Bay and other bays containing aquaculture, is required before a determination on the likelihood of ecological carrying capacity being exceeded can be made.

3.2.5. Conclusion on Effects on Communities of Qualifying Interest 1140

3.2.5.1. Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex

The risk of significant adverse depositional and organic enrichment effects of aquaculture sites on the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex **can be discounted**, because this community complex has been shown to be resilient to depositional and organic enrichment effects.

The risk of significant adverse sediment compaction effects along access routes on the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex **cannot be discounted**. However, the current levels of effect are below the 15% disturbance threshold for this community complex.

3.2.5.2. Muddy sand to coarse sediment with Pygospio elegans community complex

The risk of significant adverse depositional and organic enrichment effects of aquaculture sites on the Muddy sand to coarse sediment with Pygospio elegans community complex **cannot be discounted** because this community complex has never been studied in relation to the effects of oyster trestle cultivation.

The risk of significant adverse sediment compaction effects along access routes on the Muddy sand to coarse sediment with Pygospio elegans community complex **cannot be discounted**. However, the current levels of effect are below the 15% disturbance threshold for this community complex.

Given the lack of data on the sensitivity of this community complex to oyster trestle cultivation activities monitoring should be carried so that an understanding of the effects on this community complex is established before the 15% threshold is exceeded by potential future sites.

Table 3.4: Spatial extent of aquaculture site overlapping constituent communities and community complexes within the Qualifying Interest 1140.

		Licensed (61 sites)	Licensed - Under Appeal (19 sites)	Total Licenced (80 sites)	Applications (14 sites)	Combined Licenced and Applications (94 sites)
Muddy sand to coarse sediment with *Pygospio elegans* community complex (542.99ha)	**Area (ha)**	15.21ha	5.56ha	**20.77ha**	8.90ha	**29.67ha**
	% community complex	2.80%	1.02%	**3.83%**	1.64%	**5.46%**
Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex (208.99ha)	**Area (ha)**	33.07	11.91	**44.98ha**	5.84	**50.82ha**
	% community complex	15.82%	5.70%	**21.52%**	2.79%	**24.32%**

Table 3.5: Spatial extent of access routes overlapping constituent communities and community complexes within the Qualifying Interest 1140.

		Access routes
Muddy sand to coarse sediment with *Pygospio elegans* community complex (542.99ha)	**Area (ha)**	11.14ha
	% community complex	2.05%
Sand with *Angulus tenuis* and *Scoloplos (Scoloplos) armiger* community complex (208.99ha)	**Area (ha)**	7.66ha
	% community complex	3.66%

3.3. Effect of Non-Native Species on Habitats

3.3.1. Overview

Aquaculture activity has the potential to act as a vector for the introduction of non-native species to Site 002012. It should be noted, however, that the cultivation of oysters grown in other bays in Ireland and 'finished' at the Trawbreaga sites do not present a significant risk of introduction of non-native species.

In contrast, on-growing in bay of half-grown stock which have been grown for extended periods in places outside of Ireland present a higher risk.

3.3.2. Determining Significance

As outlined in **Table 3.1** intertidal and subtidal sand are sensitive to the introduction of non-native species. Aquaculture has been identified as a vector for the introduction and/ or spread of a number of non-native species in Irish waters that have the potential to impact Qualifying Interest habitats and species of designated SACs.

Non-native species accidentally introduced/ spread to bays via aquaculture activities present a risk to the Qualifying Interest 1140. Specifically, there is potential that invasive species may alter community structure thus impacting the attributes defined for habitats defined in the Conservation Objectives. At high densities, impact from alien species may result from competition to resident benthic species for food and space (JNCC 2002). In addition, sediment characteristics may be altered through the removal of large volumes of suspended organic material from the water column, and depositing filtered material on the bottom as pseudofaeces (Thieltges *et al*., 2003).

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 Site 002012 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 Site 002012 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 (**Site 002287**) 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 recommended that triploid oysters only are grown in in Site 002012 in order to minimise any risk to Site 002287.

With strict adherence to relevant legislation and best practice guidelines, there will be no likely significant adverse effects of invasives on Site 002012.

3.3.3. Conclusion Summary

The site is at low risk from the introduction of non-native species on and among culture stock. To manage the risk of introduction of alien species to the Qualifying Interest 1140 and associated constituent community types, all stock movement in the bay follow should strictly adhere to relevant legislation and follow best practice guidelines. In addition, operators should undertake monitoring for alien species.

4. Concluding Statement and Recommendations

The screening resulted in six Qualifying Interests being excluded from further consideration, five Annex I habitats and one Annex II species, by virtue of the fact no significant effects were expected to occur.

The habitats excluded screened out 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

Two of the four community complexes within the habitat 1140 Mudflats and sandflats not covered by seawater at low tide were screened out:

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

The species screened out were:

- 1014 Narrow-mouthed Whorl Snail *Vertigo angustior*
- 1335 Otter *Lutra lutra*

A full assessment was carried out on the likely interactions between existing and proposed aquaculture activities with the remaining two community complexes within Qualifying Interest 1140 (*Mudflats and sandflats not covered by seawater at low tide*):

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

The risk of significant adverse depositional and organic enrichment effects of aquaculture sites on the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex **can be discounted**, because this community complex has been shown to be resilient to depositional and organic enrichment effects.

The risk of significant adverse sediment compaction effects along access routes on the Sand with Angulus tenuis and Scoloplos (Scoloplos) armiger community complex **cannot be discounted**. However, the current levels of effect are below the 15% disturbance threshold for this community complex.

The risk of significant adverse depositional and organic enrichment effects of aquaculture sites on the Muddy sand to coarse sediment with Pygospio elegans community complex **cannot be discounted**, because this community complex has never been studied in relation to the effects of oyster trestle cultivation.

The risk of significant adverse sediment compaction effects along access routes on the Muddy sand to coarse sediment with Pygospio elegans community complex **cannot be discounted**. However, the current levels of effect are below the 15% disturbance threshold for this community complex.

Recommendations

It is recommended that targeted monitoring exercises are carried out so that the effects of oyster trestle cultivation on the constituent communities of the conservation feature mudflats and sandflats not covered by high tide are carried out because:

1. No benthic monitoring exercise has been carried out in Trawbreaga previously and monitoring is required for the purpose of continuing to make evidence informed decisions in relation to oyster trestle cultivation licensing;
2. The Muddy sand to coarse sediment with *Pygospio elegans* community has not been previously studied and should be before the 15% overlap threshold is reached or exceeded by oyster trestle cultivation activities in Trawbreaga Bay.

It is also recommended that ecological carrying capacity of Trawbreaga Bay is investigated so that future licensing decisions can take this aspect of the ecological interactions of oyster trestle cultivation into account.

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