



Annex I

Report supporting Appropriate Assessment of Aquaculture and
Risk Assessment of Fisheries in Mullet/Blacksod Bay Complex
SAC (Site Code: 0470)

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1 Preface

In Ireland, the implementation of Article 6 of the Habitats Directive in relation to aquaculture projects and plans that occur within designated sites is achieved through sub-Article 6(3) of the Directive.

The Habitats Directive is transposed in Ireland in the European Communities (Birds and Natural Habitats) Regulations 2011. NPWS are the competent authority for the management of Natura 2000 sites in Ireland. Obviously, aquaculture operations existed in coastal areas prior to the designation of such areas under the Directives. Ireland is thereby assessing both existing and proposed aquaculture activities in such sites. This is an incremental process, as agreed with the EU Commission in 2009, and will eventually cover all aquaculture activities in all Natura 2000 sites.

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

2 Executive summary

2.1 The SAC

Mullet/Blacksod Bay Complex SAC (Site Code: 0470) is designated as a Special Area of Conservation (SAC) under the Habitats Directive. The marine area is designated for the habitats Tidal Mudflats and Sandflats (1140), Large Shallow Inlet and Bay (1160) and Reefs (1170). The bay supports a variety of sub-tidal and intertidal sedimentary and reef habitats including habitats that are sensitive to pressures, which might arise from fishing and aquaculture, such as Maërl (corraline algae), seagrass kelp reefs and biogenic *Serpula vermicularis* reefs. The area is also designated for and supports significant numbers of Otter. Conservation Objectives for these habitats and species were identified by NPWS (2014a) and relate to the requirement to maintain habitat distribution, structure and function, as defined by characterising (dominant) species in these habitats. For designated species the objective is to maintain various attributes of the populations including population size, cohort structure and the distribution of the species in the Bay. Guidance on the conservation objectives is provided by NPWS (2014b).

2.2 Activities in the SAC

Aquaculture includes the production of shellfish and finfish. The main species under cultivation is the native oyster, *Ostrea edulis*. In the 1990s and up into the 2000s Pacific oyster, *Crassostrea gigas* were grown within the intertidal zone. Trials were also carried out with the cultivation of clams (Venus and Manila Clam – Veneridae species) in tray frames and under clam mesh within the intertidal zone in Trawmore Bay, Blacksod Bay.

The profile of the aquaculture industry in the Mullet/Blacksod Bay, used in this assessment, was prepared by BIM and is derived from the list of licence applications received by DAFM and provided to the Marine Institute for assessment in May 2015.

A range of fishing activities occur in Blacksod Bay including scallop dredging, potting and hook and line fishing.

2.3 The Appropriate Assessment Process

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

The appropriate assessment process is divided into a number of stages consisting of a preliminary risk identification, and subsequent assessment (allied with mitigation measures if necessary) which may be identified in this report. The first stage of the process is an initial screening wherein activities which cannot have, because they do not spatially overlap with a given habitat or have a clear pathway for interaction, any impact on the conservation features and are therefore excluded from further consideration. The next phase is the Natura Impact Statement (NIS) where interactions (or risk of) are identified. Further to this, an assessment on the significance of the likely interactions between activities and conservation features is conducted. Mitigation measures (if necessary) will be introduced in situations where the risk of significant disturbance is identified. In situations where there is no obvious mitigation to reduce the risk of significant impact, it is advised that caution should be applied in licencing decisions. Overall the Appropriate Assessment is both the process and the assessment undertaken by the competent authority to effectively validate this Screening Report and/or NIS. It is important to note that the screening process is considered conservative, in that other activities which may overlap with habitats but which may have very benign effects are retained for full assessment. In the case of risk assessments consequence and likelihood of the consequence occurring are scored categorically as separate components of risk. Risk scores are used to indicate the requirement for mitigation.

2.4 Data Supports

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

2.5 Findings and Recommendations

Aquaculture and Habitats:

Of the 11 community types listed under the remaining habitat features (1140, 1160 and 1170), three (Mobile sand with *Bathyporeia guilliamsoniana* community, Sand with *Gastrosaccus spinifer* community complex and *Laminaria*-dominated community complex) were also excluded from further analysis as they had no overlap with aquaculture activities.

Based upon the scale of spatial overlap and the relatively high tolerance levels of the habitats and species therein, the general conclusions relating to the interaction between current and proposed aquaculture activities with habitats is that consideration can be given to licencing (existing and applications) in the Annex 1 habitats – 1140 (Mudflats and Sandflats not covered by seawater at low tide), 1160 (Large Shallow Inlets and Bays and 1170 (Reefs) with the exception of activities overlapping the following community types:

1. **Zostera-dominated community**- This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is 53.78%.
2. **Maerl-dominated community** - This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is significant at 83.54%.
3. ***Serpula vermicularis* dominated community** - The cumulative pressure of likely impacting activities on this habitat is 8.9%.

It is important to note that licenced areas impacted by aquaculture that might be redrawn to exclude any overlap with sensitive habitats should include a sufficient buffer zone to allow for mapping resolution and/or visual enforcement of exclusion.

Given the residence time of Blacksod Bay (i.e., 28 days) the risk of successful reproduction of *Crassostrea gigas* in the bay cannot be excluded, in particular if production is to increase and diploid oysters are to be used. As a mitigation measure, it is recommended that triploid *C. gigas* oysters be used in current and future oyster culture operations.

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

Aquaculture and Species:

It is acknowledged in this assessment that the favourable conservation status of the otter (*Lutra lutra*) has been achieved given current levels of aquaculture production within the SAC. On this basis, the current levels of licenced aquaculture (existing) are considered non-disturbing to otter conservation features.

The aquaculture activities proposed do not pose a threat to Otter in the Mullet/Blacksod Bay Complex SAC.

3 Introduction

This document assesses the potential ecological interactions of aquaculture activities within the Mullet/Blacksod Bay Complex SAC (site code 470) on the Conservation Objectives (COs) of the site. The information upon which this assessment is based is a list of applications and extant licences for aquaculture activities administered by the Department of Agriculture Food and Marine (DAFM) and forwarded to the Marine Institute as of May 2015; as well as aquaculture profiling information provided on behalf of the operators by Bord Iascaigh Mara. The spatial extent of aquaculture licences is derived from a database managed by the DAFM² and shared with the Marine Institute.

4 Conservation Objectives for Mullet/Blacksod Bay Complex (000470)

The appropriate assessment of aquaculture in relation to the Conservation Objectives for Mullet/Blacksod Bay Complex SAC is based on Version 1.0 of the objectives (NPWS 2014a - Version 1 December 2014) and supporting documentation (NPWS 2014b - Version 1 December 2014). The spatial data for conservation features was provided by NPWS³.

4.1 The SAC Extent

This SAC is a large coastal site located in northwest Co. Mayo and it comprises much of the Mullet Peninsula, the sheltered waters of Blacksod Bay and the low-lying sandy coastline from Belmullet to Kinrovar. The site displays an excellent range of coastal and marine habitats. Blacksod Bay is 16km in length and 8km wide at the mouth. It is a shallow bay, reaching a maximum depth of 19m with weak tidal streams. The bay has a good range of representative littoral and sublittoral sediment communities and infralittoral reefs.

Mullet/Blacksod Bay Complex SAC is designated for the marine Annex I qualifying interests of Tidal mudflats and sandflats (1140), Large shallow inlets and bays (1160) and Reefs (1170). The Annex I habitat Large shallow inlets and bays is a large physiographic feature that may wholly or partly incorporate other Annex I habitats including Tidal mudflats and sandflats and Reefs within its area. A number of coastal habitats can also be found in the SAC, including *Salicornia* Mud, Marram dunes, Fixed Dunes (priority habitat), Decalcified dune heath (priority habitat) and Machair. The SAC is also considered an important site for the Otter (*Lutra lutra*). The extent of the SAC and the marine qualifying interests can be seen in Figure 1 below.

4.2 Qualifying Interests (SAC)

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

² DAFM Aquaculture Database version Aquaculture: March 2015

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

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1160 Large shallow inlets and bays
- 1170 Reefs
- 1310 *Salicornia* and other annuals colonising mud and sand
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)
- 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
- 21A0 Machairs (* in Ireland)
- 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation
- 7230 Alkaline fens
- 1355 Otter *Lutra lutra*
- 1395 Petalwort *Petalophyllum ralfsii*

Constituent communities and community complexes recorded within the qualifying interest Annex 1 habitats (i.e. 1140 - Mudflats and sandflats not covered by seawater at low tide, 1160 - Large Shallow inlets and Bays, 1170 - Reefs) are listed in NPWS (2014b) and illustrated in Figure 2 and consist of:

- Mobile sand with *Bathyporeia guilliamsoniana* community
- Sand with *Angulus tenuis* and *Pygospio elegans* community complex
- Sand with *Gastrosaccus spinifer* community complex
- Fine sand with *Angulus fabula* community complex
- *Zostera*-dominated community
- Maërl-dominated community
- *Serpula vermicularis*-dominated community complex
- Intertidal reef community complex
- Sheltered subtidal reef community complex
- *Laminaria*-dominated community complex
- Shingle

The Mullet/Blacksod Bay Complex SAC is designated for Otter *Lutra lutra*. The species is listed in Annex IV(a) of the habitats directive and is afforded strict protection. It can be found all along the coastline of the SAC (NPWS, 2014a) (see Figure 3). It can forage c. 80m from the coastline (NPWS, 2014a) and travel distances of 500m between islands and across estuaries (De Jongh & O'Neill, 2010). According to Reid *et. al.*, (2013), although the presence of otters at surveyed coastal sites declined from 87.9% in 1980/81 to 64.7% in 2004/05 and to 56.7% in 2010/11 (92.5%, 70.5% and 63.3% respectively for all habitat types), the known distribution of otters remains widespread as there was a 51.7% increase in the known distribution of the species.

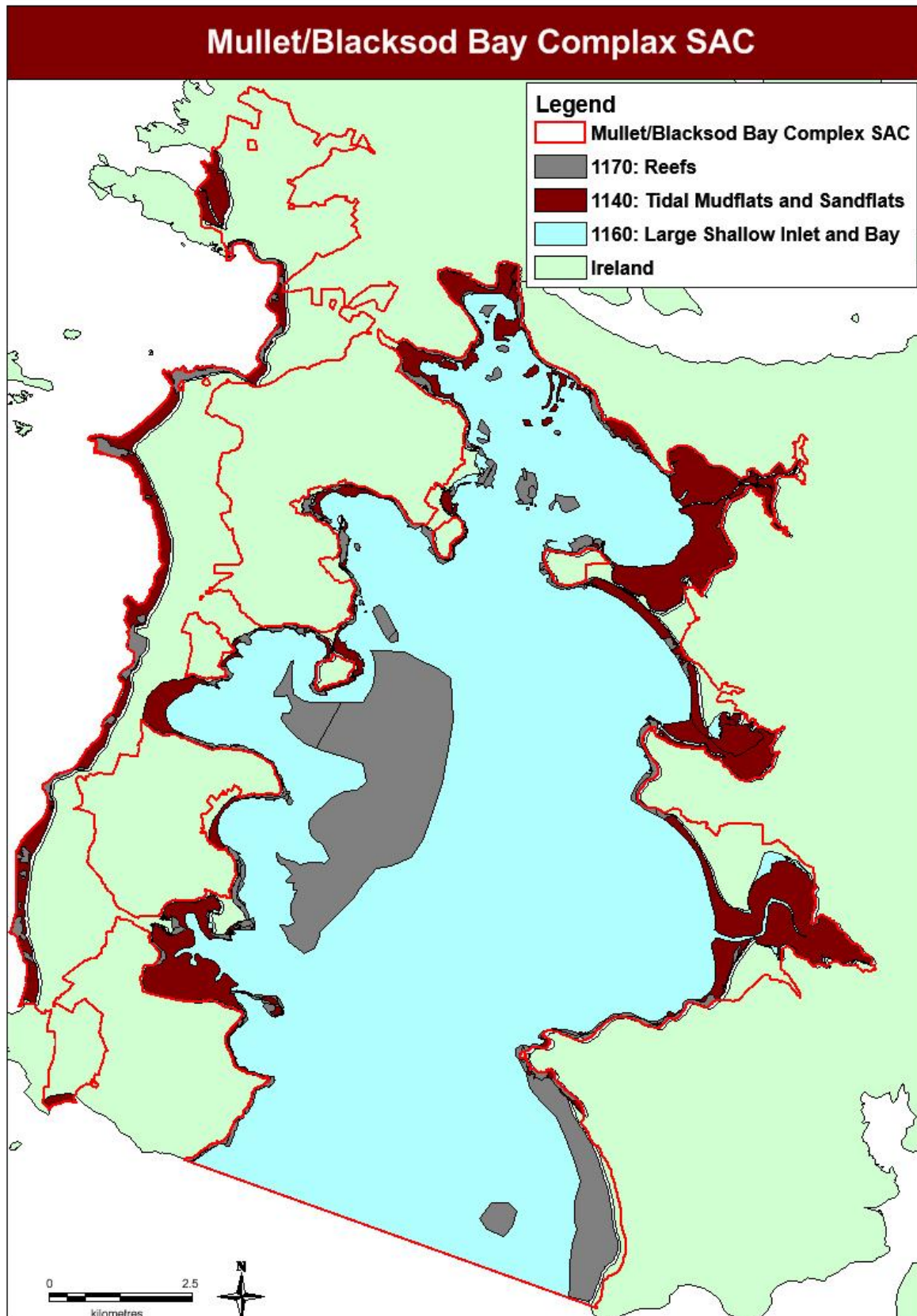


Figure 1: The extent of the Mullet/Blacksod Bay Complex SAC (Site Code 000470) and qualifying interest 1140 Tidal Mudflats and Sandflats, 1160 Large Shallow Inlet and Bay and 1170 Reef

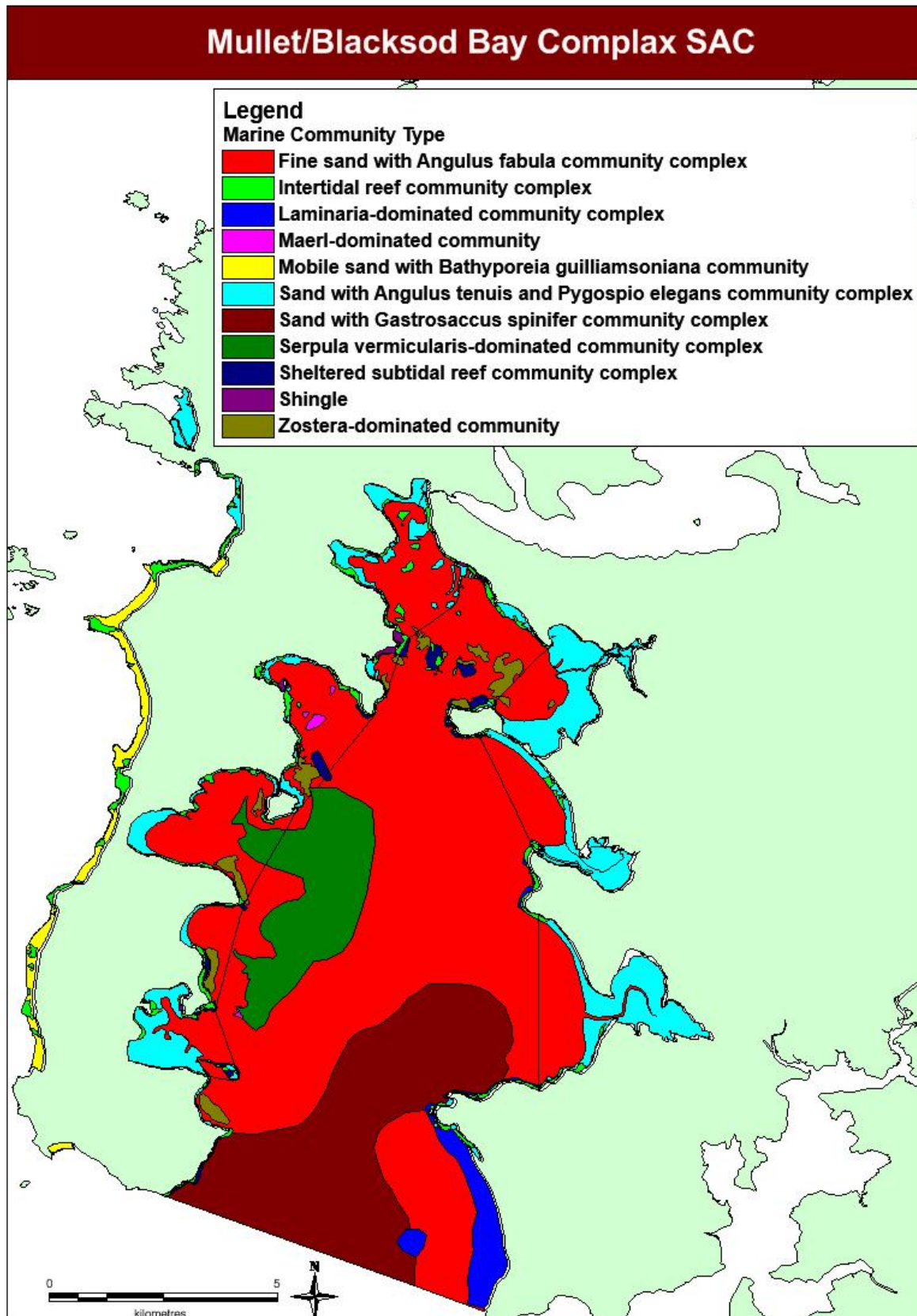


Figure 2: Principal benthic communities recorded within the qualifying interests Tidal mudflats and sandflats, Large shallow inlets and bays and Reefs within the Mullet/Blacksod Bay Complex SAC (Site Code 000470) (NPWS 2014a).

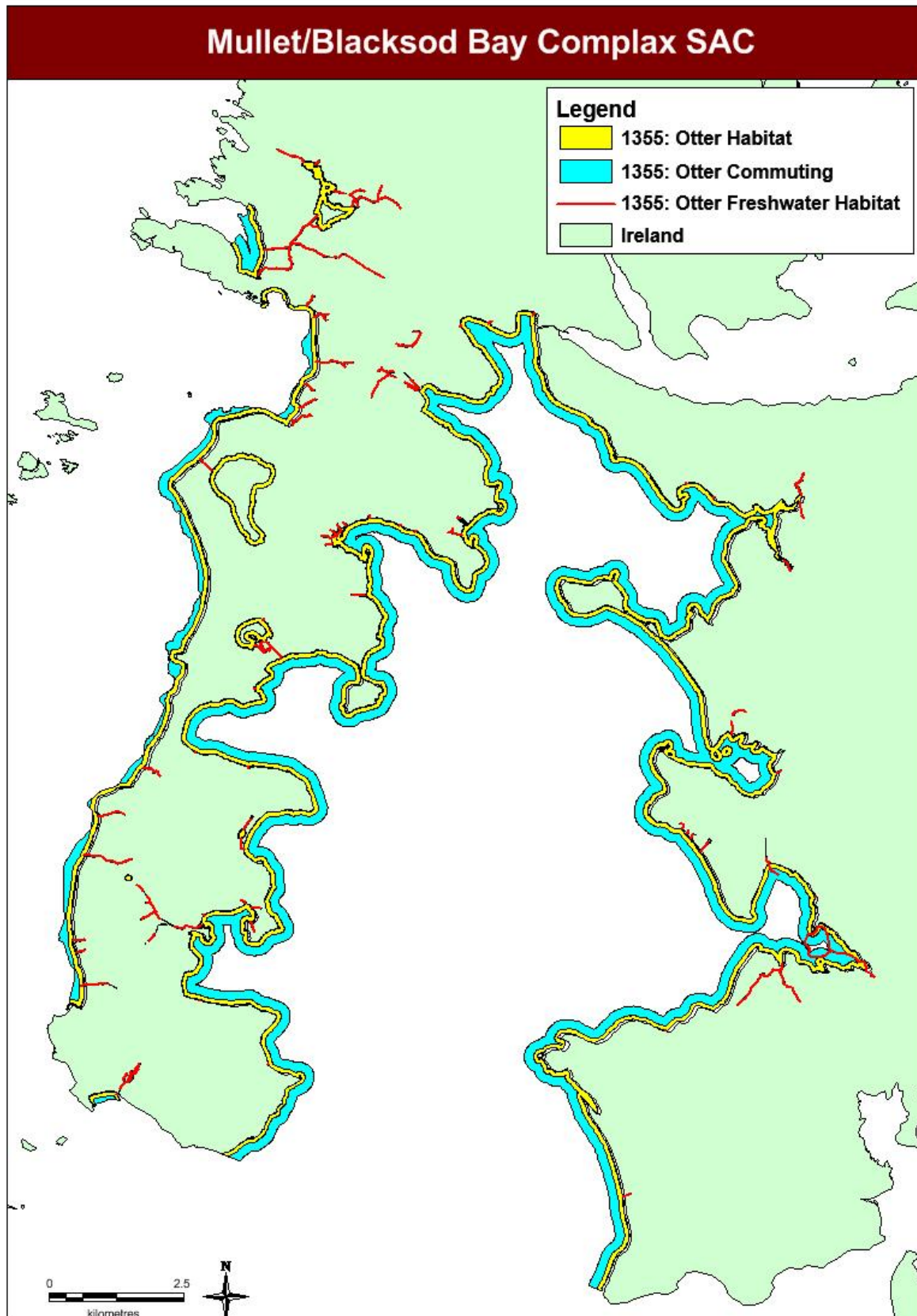


Figure 3: Otter (*Lutra lutra*) habitat in Mullet/Blacksod Bay Complex SAC (Site Code 000470).

4.3 Conservation Objectives for Mullet/Blacksod Bay Complex SAC

The conservation objectives for the qualifying interests (SAC) were identified in NPWS (2014a). The natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution. Habitat availability should be maintained for designated species and human disturbance should not adversely affect such species. The features, objectives and targets of each of the qualifying interests within the SAC are listed in Table 1 below.

Table 1: Conservation objectives and targets for marine habitats and species in Mullet/Blacksod Bay Complex SAC (Site Code 000470) (NPWS 2014a, 2014b). Annex I and II features listed in bold.

Feature (Community Type)	Objective	Target(s)
Mudflats and sandflats not covered by seawater at low tide	Maintain favourable conservation condition	1,428ha; permanent habitat is stable or increasing subject to natural processes and maintain the communities in a natural condition
(Mobile sand with <i>Bathyporeia guilliamsoniana</i> community)	Maintain favourable conservation condition	197ha; Maintained in a natural condition
(Sand with <i>Angulus tenuis</i> and <i>Pygospio elegans</i> community complex)	Maintain favourable conservation condition	1,231ha; Maintained in a natural condition
Large shallow inlets and bays	Maintain favourable conservation condition	11,169ha; 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.
(Sand with <i>Angulus tenuis</i> and <i>Pygospio elegans</i> community complex)	Maintain favourable conservation condition	1,182ha; Maintained in a natural condition
(Sand with <i>Gastrosaccus spinifer</i> community complex)	Maintain favourable conservation condition	1,994ha; Maintained in a natural condition
(Fine sand with <i>Angulus fabula</i> community complex)	Maintain favourable conservation condition	6,289ha; Maintained in a natural condition
(<i>Zostera</i> dominated communities)	Maintain favourable conservation condition	170ha; Maintain natural extent and high quality of <i>Zostera</i> dominated communities
(Maërl-dominated community)	Maintain favourable conservation condition	14ha; Maintain natural extent and high quality of Maërl dominated communities
(<i>Serpula vermicularis</i> -dominated community complex)	Maintain favourable conservation condition	855ha; Maintain natural extent and high quality of <i>Serpula</i> dominated communities
(Intertidal reef community complex)	Maintain favourable conservation condition	254ha; Maintained in a natural condition
(Sheltered subtidal reef community complex)	Maintain favourable conservation condition	81ha; Maintained in a natural condition
(<i>Laminaria</i> -dominated community complex)	Maintain favourable conservation condition	251ha; Maintained in a natural condition
(Shingle)	Maintain favourable conservation condition	38ha; Maintained in a natural condition

Feature (Community Type)	Objective	Target(s)
Reefs	Maintain favourable conservation condition	1,531ha; The distribution and permanent area is stable or increasing, subject to natural processes.
(<i>Serpula vermicularis</i> -dominated community complex)	Maintain favourable conservation condition	855ha; Maintain natural extent and high quality of <i>Serpula</i> dominated communities
(Intertidal reef community complex)	Maintain favourable conservation condition	338ha; Maintained in a natural condition
(Sheltered subtidal reef community complex)	Maintain favourable conservation condition	81ha; Maintained in a natural condition
(<i>Laminaria</i> -dominated community complex)	Maintain favourable conservation condition	256ha; Maintained in a natural condition
Salicornia and other annuals colonising mud and sand	Maintain favourable conservation condition	0.02ha; 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
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)	Restore favourable conservation condition	18.95ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of restoring function and diversity of favourable species and managing levels of negative species
Fixed coastal dunes with herbaceous vegetation (grey dunes)	Restore favourable conservation condition	937.07ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of restoring function and diversity of favourable species and managing levels of negative species
Atlantic decalcified fixed dunes (<i>Calluno-Ulicetea</i>)	Maintain favourable conservation condition	10.29ha; 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 (* in Ireland)	Restore favourable conservation condition	595.64ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of restoring function and diversity of favourable species and managing levels of negative species
Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> – type vegetation	Maintain favourable conservation condition	Occurs in Cross Lough 108ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species.
Alkaline fens	Maintain favourable conservation condition	Extent unknown; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species

Feature (Community Type)	Objective	Target(s)
Otter <i>Lutra lutra</i>	Maintain favourable conservation conditions	No significant decline in distribution – current range estimated at 93.6% positive survey sites. 929.6ha; No significant decline in extent of marine habitat; Couching sites and holts - no significant decline and minimise disturbance: Fish biomass - No significant decline in marine fish species in otter diet. Barriers to connectivity - No significant increase.
Petalwort <i>Petalophyllum ralfsii</i>	Maintain favourable conservation conditions	No decline in distribution of two sub-populations in machair habitat. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of the species

4.4 Screening of Adjacent SACs or for *ex-situ* effects

In addition to the Mullet/Blacksod Bay Complex SAC there are a number of other SAC sites proximate to the proposed activities (Figure 4). The characteristic features of these sites are identified in Table 2 where a preliminary screening is carried out on the likely interaction with aquaculture activities based primarily upon the likelihood of spatial overlap. As it was deemed that there are no *ex situ* effects and no effects on features in adjacent SACs all qualifying features of adjacent Natura 2000 sites were screened out.

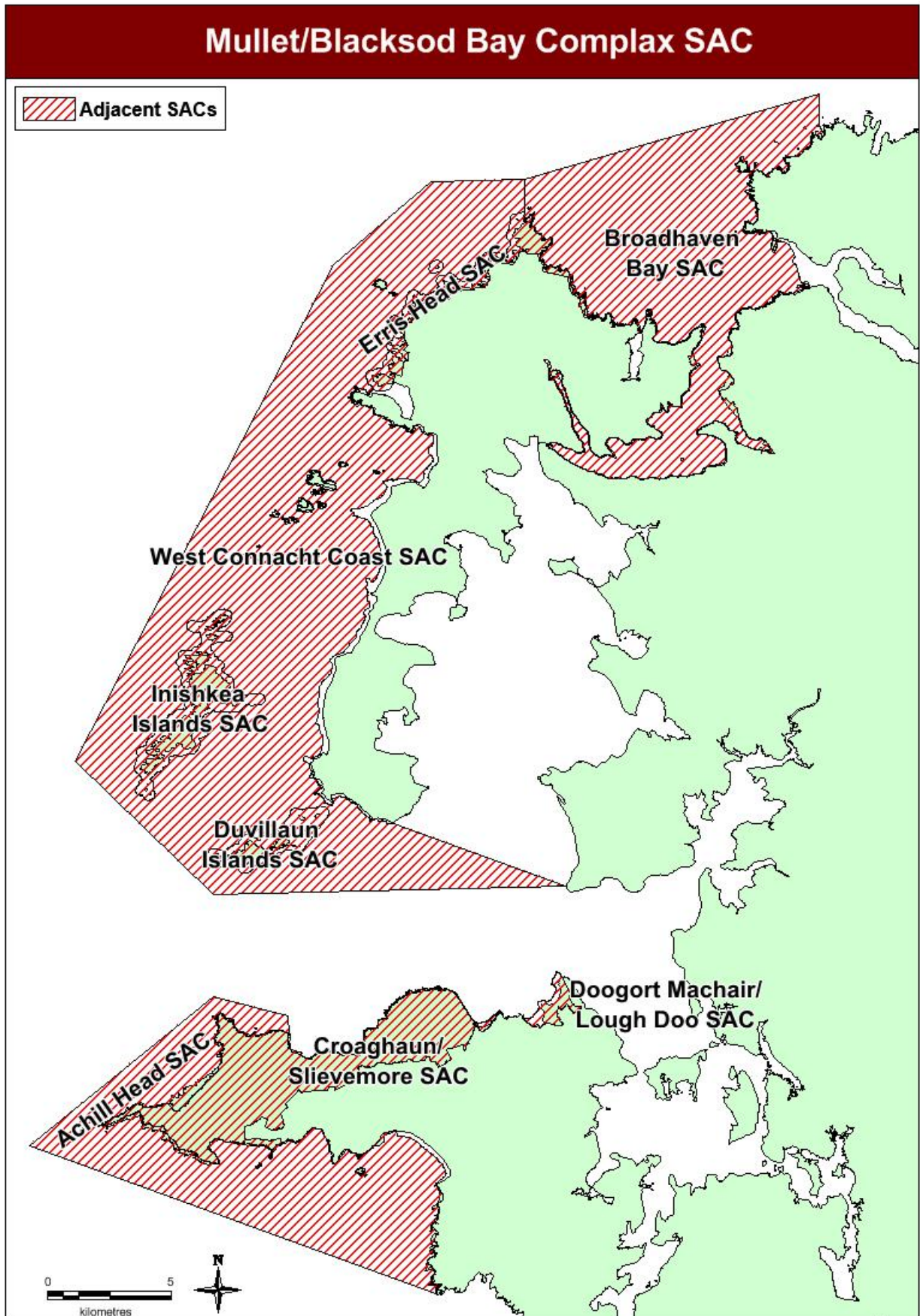


Figure 4: Natura 2000 sites adjacent to the Mullet/Blacksod Bay Complex SAC.

Table 2: Natura Sites adjacent to Mullet/Blacksod Bay Complex SAC and qualifying features with initial screening assessment on likely interactions with aquaculture activities.

NATURA SITE	QUALIFYING FEATURES [HABITAT CODE]	AQUACULTURE SCREENING
Broadhaven Bay SAC (000472)	Mudflats and sandflats not covered by seawater at low tide (1140)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Large shallow inlets and bays (1160)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Reefs (1170)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) (1330)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Submerged or partially submerged sea caves (8330)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
Duvillaun Islands SAC (000495)	Grey seal (<i>Halichoerus grypus</i>) (1364)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
Inishkea Islands SAC (000507)	Machairs (* in Ireland) (21A0)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Grey seal (<i>Halichoerus grypus</i>) (1364)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Petalwort (<i>Petalophyllum ralfsii</i>) (1395)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
Doogort Machair/Lough Doo SAC (001497)	Machairs (* in Ireland) (21A0)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Petalwort (<i>Petalophyllum ralfsii</i>) (1395)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis

NATURA SITE	QUALIFYING FEATURES [HABITAT CODE]	AQUACULTURE SCREENING
Erris Head SAC (001501)	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Alpine and Boreal heaths [4060]	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
Croaghau/Slievemore SAC (001955)	Alpine and Boreal heaths [4060]	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
Achill Head (002268)	Mudflats and sandflats not covered by seawater at low tide (1140)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Large shallow inlets and bays (1160)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
	Reefs (1170)	No spatial overlap or likely interaction with aquaculture activities within Mullet/Blacksod Bay Complex SAC – excluded from further analysis
West Connaught Coast SAC (002998)	Common bottlenose dolphin (<i>Tursiops truncatus</i>) [1349]	Structures do not pose a risk to dolphin either because of dolphin's ability to avoid in subtidal areas and shallow nature of intertidal sites – excluded from further analysis

5 Details of the proposed Aquaculture projects

Aquaculture activities in the Mullet/Blacksod Bay Complex SAC is at present - 2015- minimal. The main species under cultivation is the native oyster, *Ostrea edulis*. In the 1990s and up into the 2000s Pacific oyster, *Crassostrea gigas* were grown within the intertidal zone. Trials were also carried out with the cultivation of clams (Venus and Manila Clam – Veneridae species) in tray frames and under clam mesh within the intertidal zone in Trawmore Bay, Blacksod Bay.

Currently within the Mullet/Blacksod Bay Complex SAC there are:

- Licence renewal for extensive cultivation of native oysters at two sites,
- Licence renewal for intertidal intensive cultivation for oysters, mussels and winkles at Doolough,
- Two new licence application for intertidal intensive cultivation of pacific oysters and clams at Trawmore Bay,
- Two new licence applications for semi-submerged longline cultivation of seaweed.

Figure 5 below shows the location and designation of these (existing and proposed) licences.

Descriptions of spatial extents of existing and proposed activities within the qualifying interests of the Mullet/Blacksod Bay Complex SAC were calculated using coordinates of activity areas in a GIS. The spatial extent of the various aquaculture activities (current and proposed) overlapping the QI habitat features is presented in Table 3 (data provided by DAFM).

Mullet/Blacksod Bay Complex SAC Aquaculture Sites, Access Routes and Boat Access Points

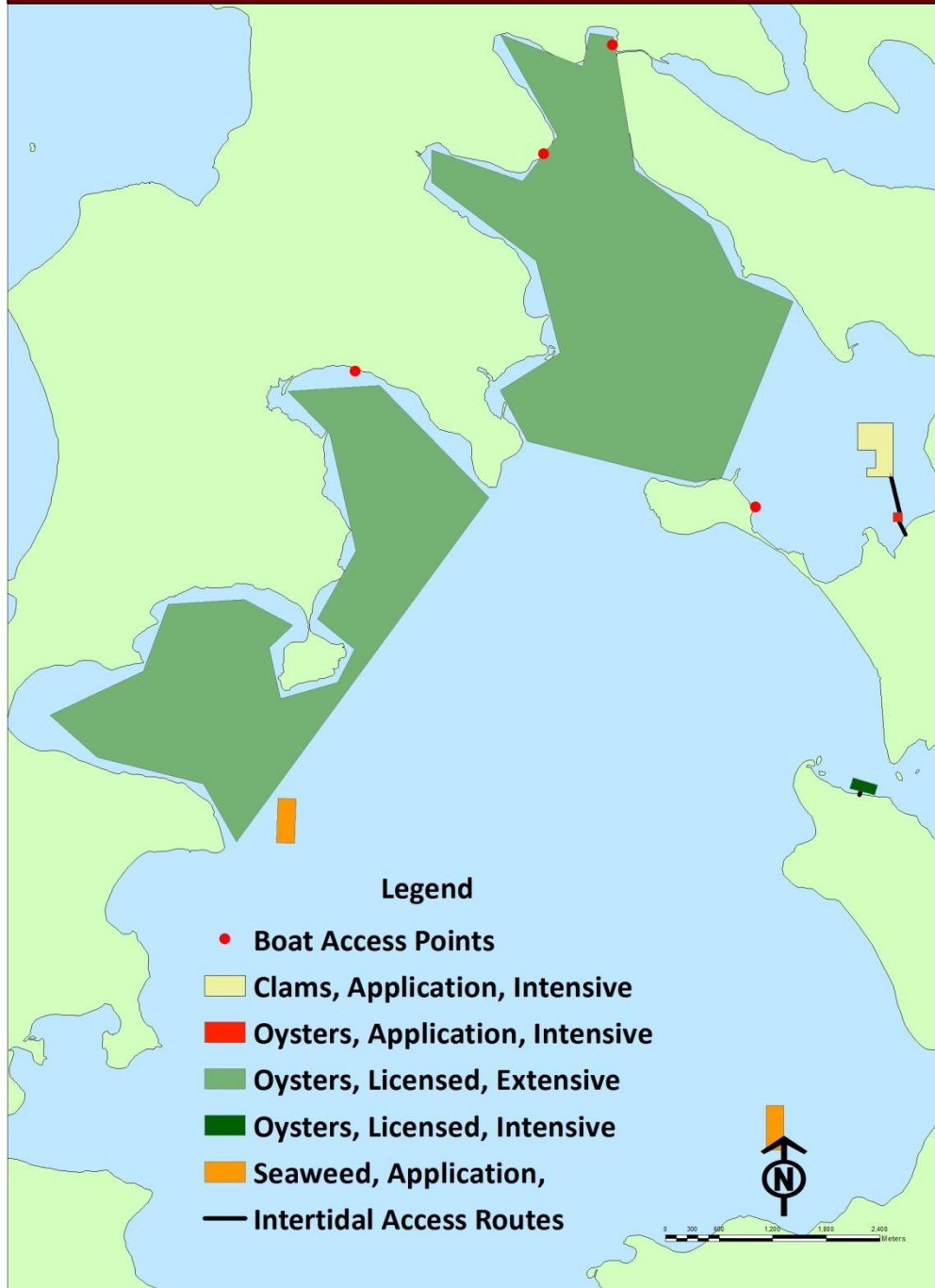


Figure 5. Aquaculture sites (Licenced and Applications) in Mullet/Blacksod Bay Complex SAC (Site Code 002158).

5.1 Native Oysters

The North Mayo Oyster Development Co-operative manages the naturally occurring beds of native oysters (*Ostrea edulis*) of Inner Blacksod Bay. The original oyster beds were seeded and managed in the 19th Century by local landlords - Binham and Carter. The beds pretty much lay unmanaged and dormant for most of the 20th Century until local fishermen and fishermen from other parts of Mayo, Galway and Donegal started fishing the beds in the late 1970s. The Co-op was formed in 1983 principally to manage the oyster fishery as it was in danger of being over-exploited. Membership today is c. 148 members. The Co-operative was successful in being granted an aquaculture licence for native oysters for two areas in 1993.

The native oyster can change sex several times a year and is unlike other bivalve shellfish in that fertilisation takes place internally with the egg being retained in the gill cavity and the sperm being released free into the sea, before being drawn by the current into the waiting female oyster. After fertilisation and brooding the eggs enter a planktonic stage in the sea for 8 to 14 days before finding a suitable hard surface where it settles. Weathered mussel shell, known as cultch is often used as a suitable settlement material in oyster fisheries. The flat oyster needs a sea temperature of between 14 and 22°C for successful spawning and settlement to occur.

The oyster fishery has always depended on the natural settlement for recruitment of young stock. Numerous stock surveys were carried out over the years. In the 1980s mussel shell 'cultch' was purchased by the Co-op and spread over the oyster beds to assist with recruitment. In addition bags of mussel shell were suspended from buoys – floats in areas of good oyster spatfall. Once settlement occurred the shell was then spread on the seabed. Other management tools used by the Co-op over the past 22 years include hand harvesting bloodstock from very shallow parts of the bay and relaying them in deeper areas. Beds were closed for a number of years to allow stock recovery. The number of days are restricted to a short season normally in the spring time February to March. It is normally now no more than 8 fishing days in the season. Only registered fishing vessels and members of the Co-op are allowed to fish. Each vessel has to obtain a dredging licence from Inland Fisheries Ireland (IFI). The recent maximum number of dredge licences issued by the IFI was 18, although in past few years it has been usually around 12 vessels that fish in the season, if Co-op permit fishing to go ahead.

The fishing of the native oyster involves the use of a four-foot dredge, which is fished from the side or back of a boat, as seen in Figure 6 below picture from Blacksod Bay.



Figure 6. Oyster fishing in Blacksod Bay

The North Mayo Oyster Development Co-operative manages the native oyster beds in Blacksod Bay under their aquaculture licence by limiting the number of fishing days allowable, by limiting hours in day and limiting areas to be fished each season. The positive identification of *Bonamia ostreae* in 1993 does not seem to have a very drastic effect on the native oyster stock in the past 12 years as the prevalence has been low.

5.2 Pacific Oysters

Pacific oysters (*Crassostrea gigas*) have been grown in Blacksod Bay since the 1990s, although in recent years the number of farms has reduced due to a number of reasons and circumstances. One site in Blacksod Bay has applied for renewal. There is a new application in Trawmore Bay in the northeast section of Blacksod Bay for the cultivation of oysters and clams in generally the same area as where Pacific oysters and clams were successfully grown in past. Pacific oysters are grown intensively using the traditional bag and trestle method within the intertidal zone. Trestles can be either 5-bag, 6-bag or 7-bag trestles. They are made of steel and measure between 3 and 5m in length, are approximately 1m in width and stand between 0.5 and 0.7m in height. Oyster bags are made of plastic (HDPE) mesh, and vary in mesh size (4mm, 5mm, 6mm, 9mm and 14mm) depending on oyster stock grade and size. The bags are fastened to the trestles with rubber straps and hooks. Trestles can be laid out in rows of four or two as shown in Figure 7 below.



Figure 7. Oyster trestles

The Pacific oyster is a bivalve mollusc that filter feed plankton and other nutrients from the sea when submerged during high tide periods. All the Blacksod Pacific oyster farms are and will be positioned between mean Low Water Spring and mean Low Water Neap, allowing on average between 2 and 5 hours exposure depending on location, tidal and weather conditions. Maintenance activities on-site include shaking and turning of bags, and hand removal of fouling and seaweed to ensure maintenance of water flow through the bags when submerged.

The production cycle begins when G4 to G8 (6 – 10mm) oyster seed is introduced from hatcheries. On rare occasions seed can be brought in at a smaller size of less than 4mm and are put into 2 and 3mm plastic mesh pouches within 4mm oyster bags where they remain for few months until they reach 6mm and are ready to be transferred to the 4mm oyster bag.

All seed and larger oysters brought into the Bay will to be sourced from hatcheries Irish, French or UK. For the past 8 years it has principally been triploid oyster seed that has been deployed on Irish Pacific oyster farms. Although in the past 2 years there has been a movement back to using more diploid along with triploid seed to satisfy the marketplace. It is reported in both bays that no one has witnessed or are aware of any successful settlement and recruitment of pacific oysters to the wild as a consequence of diploid culture within Blacksod Bay in the past.

Hatcheries from which pacific oyster seed are sourced are:

- Seasalter, England
- Guernsey , Channel Isles
- France Naissain, France
- France Turbo, France
- Satmar, France
- Gran Ocean, France
- Irish Hatcheries – Lissadell, Cartron Point and Tralee

While there is no production in Pacific oysters at present, seed is generally imported between January and June and between August and October. Therefore sourcing of seed is often dependent on availability. In general it takes between 2 and 4 years to reach market size $\geq 65g$, depending on site location and water quality and other conditions.

Stocking densities and stock management (thinning, splitting and grading stock) varies with each oyster producer. In general grading and exporting of $\frac{1}{2}$ grown oysters takes place from September to April, and harvesting of stock for mature oysters for market takes place from October to May. Initial stocking densities when deployed into 4mm bags can vary from 800 up to 5000 oyster seed per bag. As the oysters grow stocking densities are reduced. Generally seed if stocked over 2000/bag is split in the first couple of months to lower density and by the end of year one the density is between 400 and 1000 oysters per bag. By the time they reach market size of $\geq 66g$ in year 3, the stocking density is down to between 100 and 150 per bag. Thinning, grading and harvesting activities entails removing oyster bags from the trestles by hand and transporting them on tractor and trailers from the intertidal zone to the grower's land based facilities almost all located close by.

In general oyster farm sites are accessed by one tractor and trailer using one or two routes from farmer's land base facilities ashore (Figure 5). For farms that have high production of over 100 tonnes, more than one tractor and trailer will be in use. On days when tractors and trailers are not required, producers can access sites by foot. It is envisaged that the oyster sites in Blacksod Bay will be accessed up to between 8 and 16 days each month depending on time of year and work required on farms.

There are two shellfish intertidal farms (one renewal and one new application) within the Mullet Blacksod SAC site.

1. Site Trawmore Bay – Blacksod Bay. Species: Manila clam, Pacific Oysters, and Native Clam. In the 1990s and early 2000s there was pacific oyster production in this area for a number of years. This site has now lapsed although there is currently some abandoned trestles on site. Trials also took place with the cultivation of manila clams which proved successful. There is currently one new application in this part of Blacksod. It is the applicants' intention to grow both Pacific oysters in bag and trestles, and clams in trays and under mesh on this site. Both Pacific oyster seed and clam seed will be sourced from hatcheries Ireland, UK and France. Clams seed will be brought in at size 8mm to 12mm and will be grown in trays and bags on frames and trestles for one year after which they will be sown on the intertidal ground under mesh. They will reach adult market size in one year. The ground will then be left fallow for one year as there will be a plot rotation plan put in place within the licensed site.



Figure 8. Example of mobile clam tray nursery on right and clams under clam mesh on the left.

2. Site Doolough – Blacksod Bay. Species: oysters – native and Pacific, mussels and winkles. There has been no recent production of oysters on this site. The site has been mainly used to grow mussels (trays and bags) and winkles (holding and fattening containers). The producer has applied to renew his licence and he intends to grow both native and Pacific oysters by the bag and trestle method.

The Pacific oyster seed will be from hatcheries – Irish, UK and France. It may be possible to buy Irish hatchery native oyster seed in the future. Oysters will be grown in oyster bags and trestles. The mussel seed will be naturally locally sourced seed settlement either on site or from bay or from mussel farms in Mayo. The mussel seed $\frac{1}{2}$ grown mussels will be grown in oyster bags on trestles. The producer will be directly selling the mussels to the public through other food business. The winkles will be sourced from local area as small grade and will be on grown on site in containers and trays before exported to France and Holland.

5.3 Seaweed – Longline Cultivation

There are two new licence applications for the cultivation of various species of seaweed using semi-submerged longlines at two sites in Blacksod Bay.

The seaweed, both brown and red, will be sourced from an Irish hatchery on seeded rope-twine. This seeded rope-twine will be deployed onto the semi-submerged single longlines within the proposed sites once licensed. The sites will be serviced by boat from Blacksod Pier. Figure 9 shows an example of a seaweed longline.



Figure 9. Example of a seaweed longline.

Worldwide a wide range of techniques are used to cultivate seaweed depending on the species being farmed, the lifecycle and the biogeographical factors. In general fragments of adult plants, juvenile plants, sporelings or spores are seeded onto either rope or other substrata in hatcheries or nurseries, and the plants are on-grown to maturity at sea. Trials on various native species have been taken place in Ireland since the 1990s.

5.4 Access Routes

In the Mullet/Blacksod Bay SAC, operators access the existing and proposed culture sites using a combination of boats and tractors across the shore to farm areas (Figure 5).

Calculation of area of access routes in the SAC is generated by assigning a putative route width of 10m, which is considered a sufficiently precautionary estimate. The resulting estimates represent the maximum length of travel route to/from and between the culture locations. The spatial coverage of access routes on QI habitats is presented in Tables 3.

Table 3. Spatial extent (ha) of aquaculture activities overlapping with the qualifying interest (1140 Mudflats and sandflats not covered by seawater at low tide, 1160 Large shallow inlets and bays and 1170 Reefs) in Mullet/Blacksod Bay Complex SAC (Site Code 000470), presented according to culture species, culture type and license status.

Species	Status	Culture Type	1140 – Mudflats and sandflats not covered by water at low tide (1,428 ha)		1160 - Large shallow inlets and Bays (11,169 ha)		1170 – Reefs (1,531 ha)	
			Area (ha)	% Feature	Area (ha)	% Feature	Area (ha)	% Feature
Native Oysters	Licensed	Extensive	113.99	7.99	1710.55	15.33	49.16	11.09
Clams	Application	Intensive	10.62	0.74	18.99	0.17	-	-
Pacific Oysters	Application	Intensive	1.00	0.07	1.00	0.01	-	-
Pacific Oysters ⁴	Licensed	Intensive	2.39	0.17	3.42	0.03	-	-
Seaweed	Application	Intensive	-	-	20.09	0.18	-	-
Access Routes			0.68	0.05	0.68	<0.01	-	-
Totals			128.67ha	9.02%	1754.73ha	15.71%	49.17ha	11.09%

⁴ This application also includes mussels (in bags on trestles) and winkles (in containers and trays)

6 Natura Impact Statement for the proposed activities

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

6.1 Aquaculture

Within the qualifying interest of the Mullet/Blacksod Bay Complex SAC, the species cultured are:

- Pacific oysters (*Crassostrea gigas*) in suspended culture (bags & trestles) confined to intertidal areas.
- Native oysters (*Ostrea edulis*) dredged from subtidal natural beds.
- Clams (Manila and Venus) on the seafloor intertidally.
- Mussels in oyster bags and trestles confined to intertidal areas
- Winkles held in containers and trays in the intertidal areas.

Details of the potential biological and physical effects of these aquaculture activities on the habitat features, their sources and the mechanism by which the impact may occur are summarised in Table 4, below. The impact summaries identified in the table are derived from published primary literature and review documents that have specifically focused upon the environmental interactions of mariculture (e.g. Black, 2001; McKindsey *et al.*, 2007; NRC, 2010; O'Beirn *et al.*, 2012; Cranford *et al.*, 2012; ABPMer, 2013a-h; Callier *et al.* 2017).

Filter feeding organisms, for the most part, feed at the lowest trophic level, usually relying primarily on ingestion of phytoplankton. The process is extractive in that it does not rely on the input of feedstuffs in order to produce growth. Suspension feeding bivalves such as oysters and mussels can modify their filtration to account for increasing loads of suspended matter in the water and can increase the production of faeces and pseudofaeces (non-ingested material) which result in the transfer of both organic and inorganic particles to the seafloor. This process is a component of benthic-pelagic coupling (Table 4). The degree of deposition and accumulation of biologically derived material on the seafloor is a function of a number of factors discussed below.

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

in the wild (open water) for a prolonged period (i.e. ½-grown stock). Furthermore, the culture of a non-native species (e.g. the Pacific Oyster - *Crassostrea gigas*) may also present a risk of establishment of this species in the SAC. Recruitment of *C. gigas* has been documented in a number of bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann *et al.*, 2012; 2013) and may compete with the native species for space and food.

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

- Hydrography – low current speeds (or small tidal range) may result in material being deposited directly beneath the trestles. If tidal height is high and large volumes of water moved through the culture area an acceleration of water flow can occur beneath the trestles and bags, resulting in a scouring effect or erosion and no accumulation of material.
- Turbidity of water – 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 culture structures.
- Density of culture – the density of oysters in a bag and consequently the density of bags on a trestle will increase the likelihood of accumulation on the seafloor. In addition, if the trestles are located in close proximity a greater dampening effect can be realised with resultant accumulations. Close proximity may also result in impact on shellfish performance due to competitive interactions for food.
- Exposure of sites - the degree to which the aquaculture sites are exposed to prevailing weather conditions will also dictate the level of accumulated organic material in the area. As fronts move through culture areas increased wave action will resuspend and disperse material away from the trestles.

Shading may be an issue as a consequence of the structures associated with intertidal oyster/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.

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

Subtidal shellfish culture: the subtidal culture of native oyster in Blacksod Bay has always depended on the natural settlement for recruitment of young stock. This has been supplemented by hand harvesting bloodstock from very shallow parts of the bay and relaying them in deeper areas. There may be increased enrichment due to production of faeces and pseudofaeces. The existing infaunal community may be changed as a result. Seabed habitat change may also change as a result of dredging during maintenance and harvesting. Uncontained high density subtidal shellfish culture may lead to change in community structure and function through the addition (at high % cover) of an epi-benthic species (living on the seabed) to an infaunal sedimentary community.

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

Seaweed culture: The primary effect relating to the culture of seaweed relate to the impacts of the structures and subsequent culture stock on the lines. It is likely that shading and current alteration will be the primary impacts in and near the culture systems.

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

Oyster culture poses a risk in terms of the introduction of non-native species as the Pacific oyster (*Crassostrea gigas*) is a non-native species. Recruitment of *C. gigas* has been documented in a number of Bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann *et al.*, 2012; 2013) and may compete with the native species for space and food. The culture of large volumes of Pacific oysters may increase the risk of successful reproduction in Mullet/Blacksod Bay Complex SAC. The use of triploid (non-reproducing) stock is the main method employed to manage this risk. Furthermore, the introduction of non-native species as 'hitchhikers' on and among culture stock is also considered a risk, the extent of which is dependent upon the duration the stock has spent 'in the wild' outside of Mullet/Blacksod Bay. Half-grown stock (15-30g oysters) which would have been grown for extended periods in places (in particular outside of Ireland) present a higher risk. Oysters grown in other bays in Ireland and 'finished' in Blacksod Bay,

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/>). The manila clam, *Ruditapes philippinarum*, has been cultured in the bay during trials in the 1990s and early 2000s. No record of this species has been recorded in the wild in Ireland since its introduction in 1984.

Table 4. Potential indicative environmental pressures of aquaculture activities within the qualifying interests (Mudflats and sandflats not covered by water at low tide (1140), Large shallow inlets and bays (1160) and Reefs (1170)) of the Mullet/Blacksod Bay Complex SAC.

Activity	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
<u>Aquaculture</u>							
Intertidal Pacific Oyster, Mussel, Clam and Winkle Culture	Physical	Current alteration	Structures may alter the current regime and resulting increased deposition of fines or scouring.	Trestles and bags and service equipment	365	All year	At low tide only
		Surface disturbance	Ancillary activities at sites, e.g. servicing, transport increase the risk of sediment compaction resulting in sediment changes and associated community changes.				
		Shading	Prevention of light penetration to seabed potentially impacting light sensitive species				
	Biological	Non-native species introduction	Potential for non-native species (<i>C. gigas</i>) to reproduce and proliferate in SAC. Potential for alien species to be included with culture stock (hitch-hikers).				

Activity	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
		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				
Subtidal Native Oyster Culture	Physical	Surface disturbance	Abrasion at the sediment surface and redistribution of sediment	Oyster dredge	8	February - March	Co-op permission, IFI licence, weather for site access, size of oysters, market constraints
		Shallow Disturbance	Sub-surface disturbance to 25mm				
	Biological	Monoculture	Habitat dominated by single species and transformation of infaunal dominated community to epifaunal dominated community				
		By-catch mortality	Mortality of organisms captured or disturbed during the harvest, or damage to structural fauna of reefs.				
		Disease risk	In the event of epizootic the ability to manage disease in uncontained subtidal oyster populations would likely be compromised.				
		Nutrient exchange	Increased primary production. N ₂ removal at harvest or				

Activity	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
			denitrification at sediment surface.				
		Deep Disturbance	Sub-surface disturbance to >25mm				
Longline Seaweed Cultivation	Physical	Shading	Prevention of light penetration to seabed potentially impacting light sensitive species				Sheltered areas necessary
	Biological	Nutrient removal	N ₂ removal at harvest. N ₂ (among others) assimilated to facilitate seaweed growth				

Aquaculture and Otter Interactions:

There is little literature regarding the 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 main interactions between otter and aquaculture are listed in Table 5.

The most recent otter survey in Ireland was carried out in 2010/11 (Reid *et al.*, 2013), which 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.

The 2007 Article 17 conservation assessment for otters in the Republic of Ireland under the Habitats Directive (NPWS, 2008) deemed the species as in Unfavourable or poor status. This was principally due to a decline in species incidence from 92.5% (Chapman & Chapman, 1982) to 89.5% (Lunnon & Reynolds, 1991) to 70.5% (Bailey & Rochford, 2006) translating into a 24% overall decline in estimated numbers from 8,400 to 6,400 adult breeding females (Marnell *et al.*, 2011). This apparent decline was also reflected in the Near Threatened assessment given to the species in the most recent Irish Red Data List for terrestrial mammals (Marnell *et al.*, 2009). The 2013 Article 17 conservation assessment for otters in the Republic of Ireland under the Habitats Directive (NPWS, 2013) deemed the species as Favourable. The most recent national survey of the otter shows the species to be widespread throughout Ireland and present in a wide variety of habitat types. Similar results have been reported from N. Ireland. Previous concerns about population decline have been allayed by these results with the latest estimates suggesting a very healthy adult female population of between 7,000 and 10,000. Overall, the otter is considered to be in good conservation status.

The risk posed to otter by the proposed shellfish culture activity stated is considered low. Given the crepuscular nature of the otter, likely interactions (and disturbance) with operators on the foreshore are considered low. Furthermore, shellfish culture (intertidal and suspended) are not considered a threat to otters. 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 mariculture.

Table 5. Potential interactions between aquaculture activities and the Annex II species Otter (*Lutra lutra*) within the Mullet/Blacksod Bay Complex SAC.

Culture Method	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
All Aquaculture Methods	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 seals in the water.	Site services, human, boat and vehicular traffic	365	All year	Seasonal levels of activity relating to seeding, grading, and 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

7 Screening of Aquaculture Activities

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

In this assessment screening of the qualifying interests against the proposed activities is based primarily on spatial overlap i.e. if the qualifying interests overlap spatially with the proposed activities then significant impacts due to these activities on the conservation objectives for the qualifying interests is not discounted (not screened out) except where there is absolute and clear rationale for doing so. Where there is relevant spatial overlap full assessment is warranted. Likewise, if there is no spatial overlap and no obvious interaction is likely to occur, then the possibility of significant impact is discounted and further assessment of possible effects is deemed not to be necessary. Table 3 provides spatial overlap extent between designated habitat features and aquaculture activities within the qualifying interests of the Mullet/Blacksod Bay Complex SAC.

7.1 Aquaculture Activity Screening

- Table 3 highlights the spatial overlap between (existing and proposed) aquaculture activities and the habitat features of the 3 marine QI habitats (i.e. Mudflats and Sandflats not covered by water at low tide [1140], Large Shallow Inlet and Bay [1160] and Reefs [1170]).
- Tables 7, 8 and 9 provide an overview of overlap of aquaculture activities and specific community types (identified from Conservation Objectives) within the broad habitat features 1140, 1160 and 1170, respectively.

Where the overlap between an aquaculture activity and a feature is zero and no likely interactions are likely it is screened out and not considered further. Furthermore, if the aquaculture activity occurs within the SAC but does not overlap a keystone community⁵ habitat type or overlap with a feature of interest then they are excluded from further assessment.

Therefore, the following habitats and one species are also excluded from further consideration in this assessment:

- 1310 *Salicornia* and other annuals colonising mud and sand
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

⁵ NPWS. 2014b. Mullet/Blacksod Bay Complex SAC (000470): Conservation Objectives supporting document – marine habitats. Department Arts, Heritage and the Gaeltacht. Version 1 (December 2014); 23pp.

- 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
- 21A0 Machairs (* in Ireland)
- 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation
- 7230 Alkaline fens
- 1395 Petalwort *Petalophyllum ralfsii*

Furthermore, of the 11 community types (see Table 1) listed under the three habitat features (1140, 1160 and 1170), three (Mobile sand with *Bathyporeia guilliamsoniana* community, Sand with *Gastrosaccus spinifer* community complex and *Laminaria*-dominated community complex) have no spatial overlap between them and any aquaculture activities. **On this basis, these three community types are excluded from further analysis of aquaculture interactions.**

When overlap was observed it was quantified in a GIS application and presented on the basis of coverage of specific activity (representing different pressure types), licence status (licenced or application) intersecting with designated conservation features and/or sub-features (community types).

Table 6. Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activities over community types within the qualifying interest 1140 – Mudflats and Sandflats not covered by seawater at low tide (Spatial data based on licence database provided by DAFM). Habitat data provided in NPWS 2014a. 2014b). (I= Intensive; E=Extensive; A=Application; L=Licenced).

				1140 – Mudflats and Sandflats not covered by seawater at low tide	
Culture Type	Location	Method	Status	Mobile sand with <i>Bathyporeia guilliamsoniana</i> community (197 ha)	Sand with <i>Angulus tenuis</i> and <i>Pygospio elegans</i> community complex (1,231 ha)
Native oyster	Subtidal	E	L	-	113.98 (9.26)
Clams	Intertidal	I	A	-	10.62 (0.86)
Pacific oysters	Intertidal	I	A	-	1.00 (0.08)
Pacific oysters	Intertidal	I	L	-	2.39 (0.19)
Seaweed	Subtidal	I	A	-	-
Access Routes				-	0.68 (0.05)
Totals				-	128.67 (10.44)

Table 7: Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activity over community types within the qualifying interest 1160 - Large shallow inlets and bays (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2014a. 2014b). Community types, Sand with *Gastrosaccus spinifer* community complex and *Laminaria* dominated Community Complex although in QI 1160 are omitted from this table on the basis of no spatial overlap with any aquaculture activity existing or proposed. (I= Intensive; E=Extensive; A=Application; L=Licensed).

				1160 – Large Shallow Inlet and Bay							
Culture Type	Location	Method	Status	Maerl-dominated community (14 ha)	<i>Serpula vermicularis</i> -dominated community complex (855 ha)	Fine sand with <i>Angulus fabula</i> community complex (6,289 ha)	<i>Zostera</i> -dominated community (170 ha)	Sand with <i>Angulus tenuis</i> and <i>Pygospio elegans</i> community complex (1,182 ha)	Intertidal reef community complex (254 ha)	Sheltered subtidal reef community complex (81 ha)	Shingle (38 ha)
Native oyster	Subtidal	E	L	11.34 (81.0)	76.05 (8.9)	1320.73 (21.01)	91.61 (53.88)	113.98 (9.65)	44.55 (17.54)	49.17 (60.7)	3.12 (8.21)
Clams	Intertidal	I	A	-	-	8.37 (0.13)	-	10.62 (0.90)	-	-	-
Pacific oysters	Intertidal	I	A	-	-	-	-	1.00 (0.09)	-	-	-
Pacific oysters	Intertidal	I	L	-	-	-	-	3.42 (0.29)	-	-	-
Seaweed	Subtidal	I	A	-	-	20.09 (0.32)	-	-	-	-	-
Access Routes								0.68 (0.06)			
Totals				11.34 (81.0)	76.05 (8.9)	1349.18 (21.46)	91.61 (53.88)	129.7 (10.99)	44.55 (17.54)	49.17 (60.7)	3.12 (8.21)

Table 8: Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of Aquaculture activity over community types within the qualifying interest 1170 - Reefs (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2014a, 2014b). (I= Intensive; E=Extensive; A=Application; L=Licensed).

				1170 – Reefs			
Culture Type	Location	Method	Status	<i>Serpula vermicularis</i> -dominated community complex (855 ha)	Intertidal reef community complex (338 ha)	Sheltered subtidal reef community complex (81 ha)	<i>Laminaria</i> Dominated Community Complex (256 ha)
Native oyster	Subtidal	E	L	76.05 (8.9)	44.55 (13.18)	49.17 (60.7)	-
Clams	Intertidal	I	A	-	-	-	-
Pacific oysters	Intertidal	I	A	-	-	-	-
Pacific oysters	Intertidal	I	L	-	-	-	-
Seaweed	Subtidal	I	A	-	-	-	-
Access Routes				-	-	-	-
Totals				76.05 (8.9)	44.55 (13.18)	49.17 (60.7)	-

8 Assessment of Aquaculture Activities

8.1 Determining significance

The significance of the possible effects of the proposed activities on habitats, as outlined in the Natura Impact Statement (Section 6) and subsequent screening exercise (Section 7), is determined here in the assessment. The significance of effects is determined on the basis of Conservation Objective guidance for constituent habitats and species (Figures 1, 2 and NPWS, 2014a; 2014b).

Within the Mullet/Blacksod Bay Complex SAC the qualifying habitats/species that were considered further in this assessment are:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1160 Large shallow inlets and bays
- 1170 Reefs
- 1355 Otter – *Lutra lutra*

Habitats and species that are key contributors to biodiversity and which are sensitive to disturbance should be afforded a high degree of protection i.e. thresholds for impact on these habitats is low and any significant anthropogenic disturbance should be avoided. In the Mullet/Blacksod Bay Complex SAC these habitats/species include:

- *Zostera* –dominated community
- Maerl – dominated community
- *Serpula vermicularis*-dominated community complex

For broad habitats and community types (Figures 1 and 2) significance of impact is determined in relation to, first and foremost, spatial overlap (see Section 7; Tables 7, 8 and 9). Subsequent disturbance and the persistence of disturbance are considered as follows:

1. The degree to which the activity will disturb the qualifying interest. Disturb is meant as a change in the characterising species, as listed in the Conservation Objective guidance (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 8.2 below).
2. The persistence of the disturbance in relation to the intolerance of the community. If the activities are persistent (high frequency, high intensity) and the receiving community has a high intolerance to the activity (i.e. the characterising species of the communities are sensitive and consequently impacted) then such communities could be said to be persistently disturbed.
3. The area of communities or proportion of populations disturbed. In the case of community disturbance (continuous or ongoing) of more than 15% of the community area it is deemed to be significant. This threshold does not apply to sensitive habitats as listed above

(*Zostera*, *Maerl*, *Serpula*) where any spatial overlap of activities should generally be avoided.

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

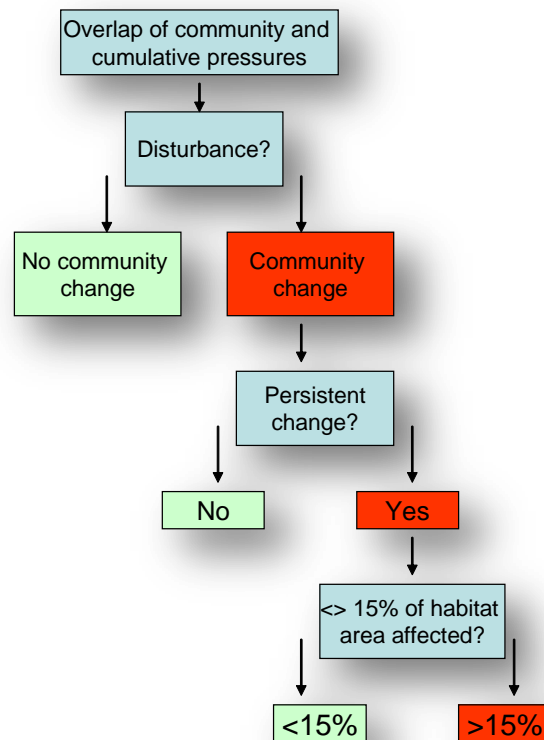


Figure 10: Determination of significant effects on community distribution, structure and function for sedimentary habitats (following NPWS, 2014b).

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

8.2 Sensitivity and Assessment Rationale

This assessment used a number of sources of information in assessing the sensitivity of the characterising species of each community recorded within the benthic habitats of the Mullet/Blacksod Bay Complex SAC. One source of information is a series of commissioned reviews by the Marine Institute which identify habitat and species sensitivity to a range of pressures likely to result from aquaculture 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, the application of conservation targets to these would be difficult (NPWS, 2014b). 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; O'Carroll *et al.* 2016). Sensitivity of a species to a given pressure is the product of the intolerance (the susceptibility of the species to damage, or death, from an external factor) of the species to the particular pressure and the time taken for its subsequent recovery (recoverability is the ability to return to a state close to that which existed before the activity or event caused change). Life history and biological traits are important determinants of sensitivity of species to pressures from aquaculture.

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

- For persistent pressures i.e. activities that occur frequently and throughout the year recovery capacity may be of little relevance except for species/habitats that may have extremely rapid (days/weeks) recovery capacity or whose populations can reproduce and recruit in balance with population damage caused by aquaculture. In all but these cases and if sensitivity is moderate or high then the species/habitats may be negatively affected and will exist in a modified state. Such interactions between aquaculture and species/habitat/community represent persistent disturbance. They become significantly disturbing if more than 15% of the community is thus exposed (NPWS, 2014a).
- 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 Mullet/Blacksod Bay Complex SAC to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are identified in Table 10. 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 11. 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 & 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 & Desrocher, 2004, cited in Hall *et al.*, 2008).

8.3 Assessment of the effects of aquaculture production on the Conservation Objectives for habitat features in the Mullet/Blacksod Bay Complex SAC.

Aquaculture pressures on a given habitat are related to vulnerability (spatial overlap or exposure of the habitat to the equipment/culture organism combined with the sensitivity of the habitat) to the pressures induced by culture activities. To this end, the location and orientation of structures associated with the culture organism, the density of culture organisms, the duration of the culture activity and the type of activity are all important considerations when considering risk of disturbance to habitats and species.

The constituent communities identified in the Annex 1 feature, **Mudflats and Sandflats not covered by seawater at low tide (1140)** are:

- Mobile sand with *Bathyporeia guilliamsoniana* community (no overlap with aquaculture activity)
- Sand with *Angulus tenuis* and *Pygospio elegans* community complex

For Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) there are a number of attributes (with associated targets) relating to the following broad habitat features as well as constituent community types;

1. **Habitat Area** – it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Mudflats and Sandflats not Covered by Seawater at Low Tide. The habitat area is likely to remain stable.

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

The following community type, found within the qualifying interest 1140 of the SAC, overlaps with aquaculture activities:

- Sand with *Angulus tenuis* and *Pygospio elegans* community complex

The community type listed above will be exposed to differing ranges of pressures from aquaculture activities. Some of these may result in more chronic and long term changes in community composition which were considered during the assessment process. Specifically, intertidal oyster and mussel culture (bag and trestle), native oyster subtidal culture and intertidal clam on-bottom culture. These activities may alter the current regime, cause surface disturbance and shading, introduce non-native species, disease and organic enrichment.

Table 9 lists the habitats (or surrogates) and Table 10 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores in Table 9 and 10 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Mullet/Blacksod Bay Complex SAC. Aquaculture activities in the Mullet/Blacksod Bay Complex SAC comprises shellfish production. Considered in the assessment for this qualifying interest are intertidal oyster and mussel culture (bag and trestle), subtidal native oyster cultivation and intertidal clam on-bottom culture.

Table 13 below identifies the likely interactions between the relevant aquaculture activities and the broad habitat feature (1140) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistence disturbance on the habitat. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS, 2014b).

Some activities (e.g. **access routes, intertidal clam culture**) might result in long-term change to the community type identified above (Tables 3, 6 and 12).

Dredging of oysters might be considered disturbing, however, given the level of activity proposed (currently confined to 8 days per year during February/March for 12+ vessels) and the proportions of the equipment to be used (currachs, half deckers using 4 foot dredges), it is unlikely to cause significant disturbance to the single sedimentary community. On the basis of targeted research (Forde *et al.*, 2015) intertidal oyster culture on trestles is considered non-disturbing to sedimentary habitats. Clam culture and identified access routes are considered disturbing given the methods of harvesting and use of netting in the intertidal and the compaction of sediments by vehicles on the shore.

The constituent communities identified in the Annex 1 feature, **Large Shallow Inlets and Bays (1160)** are:

1. Mobile sand with *Bathyporeia guilliamsoniana* community (no overlap with aquaculture activity)
2. Sand with *Angulus tenuis* and *Pygospio elegans* community complex
3. Sand with *Gastrosaccus spinifer* community complex (no overlap with aquaculture activity)
4. Fine sand with *Angulus fabula* community complex
5. *Zostera*-dominated community
6. Maërl-dominated community
7. *Serpula vermicularis*-dominated community complex
8. Intertidal reef community complex
9. Sheltered subtidal reef community complex
10. *Laminaria*-dominated community complex (no overlap with aquaculture activity)
11. Shingle

For **Large Shallow Inlets and Bays (1160)** there are a number of attributes (with associated targets) relating to the following broad habitat features as well as constituent community types;

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

This attribute considered interactions with 8 of the community types listed above and exclude three sensitive communities (i.e., *Zostera*-dominated community, Maerl-dominated community and *Serpula vermicularis*-dominated community complex). Of the 8 communities, 3 have no overlap with aquaculture activities. Therefore, the following 5 community types, found within the qualifying interest 1160 of the SAC have overlap with aquaculture activities:

1. Sand with *Angulus tenuis* and *Pygospio elegans* community complex
2. Fine sand with *Angulus fabula* community complex
3. Intertidal reef community complex
4. Sheltered subtidal reef community complex
5. Shingle

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities. Some of these may result in more chronic and long term changes in community composition which were considered during the assessment process. Such activities include dredging for native oyster which will result in physical disturbance to infaunal communities and intertidal oyster and clam (mussels) cultivation which results in organic loading on the seabed resulting in biogeochemical changes to sediment and a likely change in faunal compositions – whether this results in permanent change to the community type is

unclear. Table 9 lists the habitats (or surrogates) and Table 10 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores in Table 9 and 10 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Mullet/Blacksod Bay Complex SAC. Aquaculture activities in the Mullet/Blacksod Bay Complex SAC comprises shellfish production. Considered in the assessment are intertidal oyster culture (bag and trestle), subtidal native oyster on-bottom culture, intertidal clam on-bottom culture and subtidal (suspended) seaweed rope culture.

Table 13 below identify the likely interactions between the relevant aquaculture activities and the broad habitat feature (1160) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistence disturbance on the habitat. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS, 2014b).

On the basis of targeted research (Forde *et al.*, 2015) intertidal oyster culture on trestles is considered non-disturbing to both sedimentary habitats and intertidal reef habitats, further assessment (i.e. spatial analysis) is not required.

Subtidal dredging of oysters might be considered disturbing, however, given the level of activity proposed (currently confined to 8 days per year during February/March for 12+ vessels) and the proportions of the equipment to be used (currachs, half deckers and 4 foot dredges), it is unlikely to cause significant disturbance to the three sedimentary communities (Sand with *Angulus tenuis* and *Pygospio elegans* community complex, Fine sand with *Angulus fabula* community complex and shingle) which have high recoverability from surface abrasion. The two reef habitats ('Intertidal reef community complex' and 'sheltered subtidal reef community complex') are unsuitable for dredging. On this basis, native oyster cultivation is very unlikely to occur over this habitat and therefore, any interactions can be discounted.

Some activities (e.g. clam culture) might result in long-term change to the 5 community types identified above. Clam culture overlaps with two sedimentary community types, 0.13% of fine sand with *Angulus tenuis* and *Pygospio elegans* community complex and 0.9% of Fine sand with *Angulus fabula* community complex. Tables 3 and 7 provide an estimate of spatial overlap of aquaculture activities over marine habitat 1160 and its constituent community types, respectively. Table 13, provides a commentary on the likely significance of disturbance on the community types in isolation and cumulatively.

3. Community Extent and Structure – focusing upon Maerl, *Zostera* and *Serpula vermicularis* communities

The focus of these attributes are primarily upon the 3 community types, *Zostera*-dominated community, Maerl-dominated community and *Serpula vermicularis*-dominated community complex. These communities are considered highly diverse and sensitive habitat types which host a wide range of taxa. The 'keystone' species in each community type (Maerl and *Zostera*) is considered important and sensitive in their own right.

The reef building polychaete, *Serpula vermicularis* forms distinct clusters of biogenic reef in otherwise soft sediments. The tubes are encrusted with coralline algae and sponges and a number of species of red algae also occur on the reef along with a variety of anemones and crabs.

Given the highly sensitive natures of these community types and constituent taxa (Table 9 and 10) it is highly likely that aquaculture activities of any type which overlap these community type and the pressures may result in long-term or permanent change to the extent of these community types and the impact upon their structure and function cannot be discounted. This effect will come about by the physical removal or damage caused by the dredging activities on any of the highly diverse taxa associated with these community types (Table 13). Native oyster cultivation is the only aquaculture activity that overlaps these sensitive habitats. The impact of aquaculture activities on all of these community types is **considered disturbing**.

The constituent communities identified in the Annex 1 feature **Reefs (1170)** are:

1. *Serpula vermicularis*-dominated community complex
2. Intertidal reef community complex
3. Sheltered subtidal reef community complex
4. *Laminaria*-dominated community complex (no overlap with aquaculture activity)

There are a number of attributes (with associated targets) relating to **Reef (1170)** habitat features as well as associated constituent community types;

1. **Distribution and Habitat area:** The aquaculture activities in question will not, by virtue of the pressures associated with them, impact on the broad distribution of reef structures and reduce the area of these features within the SAC.
2. **Community Structure – (conserve a range of community types in a natural condition):** This attribute considered interactions with 3 of the community types listed above and excludes the sensitive *Serpula vermicularis*-dominated community complex. Of the 3 communities, 1 has no overlap with aquaculture activities. Therefore, the following 2 community types, found within the qualifying interest 1160 of the SAC have overlap with aquaculture activities:
 1. Intertidal reef community complex
 2. Sheltered subtidal reef community complex

The intertidal reef community, which is extensive within the SAC, is dominated by brown algal species with barnacles and mussels. The subtidal rocky communities are dominated by anemones, hydroids, red foliose seaweeds, cnidarians and echinoderms.

Table 9 lists the habitats (or surrogates) and Table 10 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Mullet/Blacksod Bay Complex SAC. Aquaculture activities in the Mullet/Blacksod Bay Complex SAC comprises shellfish production. Considered in the assessment are intertidal oyster culture (bag and trestle), subtidal native oyster production, intertidal clam culture and longline seaweed production. Subtidal native oyster cultivation is the only aquaculture activity that overlaps the intertidal and subtidal reef habitats. These two community types are unsuitable for dredging, therefore, native oyster cultivation is very unlikely to occur over this habitat.

3. **Community Structure – Extent and Structure – focusing upon *Serpula vermicularis* communities:**

The reef building polychaete, *Serpula vermicularis* forms distinct clusters of biogenic reef in otherwise soft sediments. The tubes are encrusted with coralline algae and sponges and a number of species of red algae also occur on the reef along with a variety of anemones and crabs.

Given the highly sensitive natures of this community type and constituent taxa (Table 9 and 10) it is highly likely that aquaculture activities (subtidal native oyster cultivation) which overlaps this community type and the pressures may result in long-term or permanent change to the extent of these community types and the impact upon their structure and function cannot be discounted. This effect will come about by the physical removal or damage caused by the dredging activities on any of the highly diverse taxa associated with this community type (Table 14). Native oyster cultivation is the only aquaculture activity that overlaps this sensitive habitats. The overlap of aquaculture activities on the *S. vermicularis* reefs **is considered disturbing.**

Introduction of non-native species: Oyster culture in Blacksod Bay may present a risk in terms of the introduction of non-native species as the Pacific oyster (*Crassostrea gigas*). 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 diploid oysters in culture (i.e. extent of culture operations), Kochmann et al (2013) identified long residence times (>21 days), large intertidal areas as factors likely contributing to the successful recruitment of oysters in Irish bays. While a recent study (Kochmann and Crowe, 2014) has identified heavy macro algal cover as a potential factor governing successful recruitment, with higher cover resulting in lower recruitment. The residence time for Blacksod Bay is *approx.* 28 days (Dabrowski 2017) suggest that the risk of retention of larvae in the bay, which might ultimately result in recruitment, is increased.

Furthermore, the fact that native oysters successfully spawn and recruit in the bay suggests that there is potential to retain larvae in the bay, alibethey requiring a shorter period in the bay. The risk of successful establishment of the Pacific oyster in Blacksod Bay cannot be fully discounted.

It is important to note that these conclusions are based upon the information provided in the aquaculture profile, i.e. that oysters are sourced from hatcheries and that all other shellfish stock are sourced from within the bay and timing and extent of activities is confined to specific times of year in the case of Native oyster cultivation. The risk posed by introducing ½-grown stock from other areas has not been assessed.

Table 9. Matrix showing the characterising habitats sensitivity scores x pressure categories for habitats in Mullet/Blacksod Bay Complex SAC (ABPMer 2013a-h). Table 12 provides the code for the various categorisation of sensitivity and confidence

Pressure Type	Physical Damage								Change in Habitat Quality								Biological Pressures				Chemical Pollution			Physical Pressures		
	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	Changes in turbidity/ Increased suspended sediment	Changes in turbidity/ decreased suspended sediment	Organic enrichment of sediments- sedimentation	Increased removal of primary production-phytoplankton	Decrease in oxygen levels- sediment	Decrease in oxygen levels-water column	Genetic impacts	Introduction of non-native species	Introduction of parasites/pathogens	Removal of Target Species	Removal of Non-target species	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
Sand with <i>Angulus tenuis</i> and <i>Pygospio elegans</i> community complex (A2.2312 [^])	NS (*)	L (*)	L (*)	NS (*)	L-NS (*)	L-M (*)	L-M (*)	L-M (*)	L-M (*)	M (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	L-NS (*)	L-NS (*)	NE	NS (***)	NE	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	NS (*)
Fine sand with <i>Angulus fabula</i> community complex (A5.242 ^{^^})	H (***)	M (*)	M (***)	NE	NE	N-L (*)	L-M (*)	N (*)	L (*)	H (*)	H (*)	H (*)	H (*)	M (***)	H (*)	M (*)	M (*)	NE	L (***)	NE	H (*)	H (*)	H (*)	H (*)	M (*)	H (*)
<i>Zostera</i> -dominated community (A5.533)	M-H (***)	M-VH (***)	M-VH (***)	M-H (***)	M-H (***)	M-VH (***)	VH (***)	VH (***)	M (*)	M (***)	M (*)	H (***)	NS (*)	H (***)	NS (*)	H-VH (*)	H-VH (*)	NE	H (**)	NE	NS	NS	NEv	NEv	NS (***)	H-VH (*)
<i>Maerl</i> -dominated community (A5.51)	H (***)	H-VH (***)	H (***)	H (*)	H (*)	VH (***)	VH (***)	VH (*)	NS (*)	NS (*)	NS (*)	H (*)	NS (*)	H (***)	NS (*)	H (**)	H (**)	NE	H (***)	NE	VH (***)	NS (*)	NEv	NEv	NEv	VH (*)
<i>Serpula vermicularis</i> -dominated community complex (A5.613 ^{^^^})	M (**)	M-H (**)	H (**)	NE	NE	H (**)	L-M (**)	M-H (*)	NS (*)	H-VH (*)	H (*)	NS (**)	NS (**)	NS (*)	NS (*)	NS (*)	H (*)	NE	M (*)	NS (*)	NS (*)	NS (*)	NA	NA	NA	NS (*)
Intertidal reef community complex (A1.21)	H (*)	NA	NA	H (*)	NE	NE	H (*)	N (*)	NA	NA	H (*)	VH (*)	VH (*)	NE	VH (*)	NE	VH (*)	NE	VH (*)	NE	VH (*)	VH (*)	VH (*)	VH (*)	VH (*)	VH (*)
Sheltered subtidal reef community complex (A3.3) ~	NS (*)	NA	NA	NE	NE	NE	NS (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)
Shingle (A2.11)	NS (*)	NE	NE	NS (*)	NS (*)	L (*)	NE	L (*)	NA	NA	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NE	NE	NE	NE	NE	NS (*)	NS (*)	NS (*)	NS (*)

[^]No sensitivity listed for this community type (A2.2312) so using scores for A2.23.

^{^^}No sensitivity listed for this community type (A5.242) so using scores for A5.24.

^{^^^} Sensitivity assessment based on Tillin *et. al.*, ABPMer *Sabellaria alveolata* sensitivity assessment and MarLIN Sensitivity Assessment

~ No sensitivity listed for this community type (A3.3) so using scores for A3.22.

Table 10. Matrix showing the characterising species sensitivity scores x pressure categories for taxa in Mullet/Blacksod Bay Complex SAC (ABPMer 2013a-h). Table 12 provides the code for the various categorisation of sensitivity and confidence

Pressure Type	Physical Damage								Change in Habitat Quality								Biological Pressures				Chemical Pollution			Physical Pressures		
	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	Changes in turbidity/ increased suspended sediment	Changes in turbidity/ decreased suspended sediment	Organic enrichment of sediments-sedimentation	Increased removal of primary production-phytoplankton	Decrease in oxygen levels-sediment	Decrease in oxygen levels-water column	Genetic impacts	Introduction of non-native species	Introduction of parasites/pathogens	Removal of Target Species	Removal of Non-target species	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
<i>Abra alba</i>	L (*)	L (***)	L (*)	L (*)	L (*)	M (*)	NS (***)	M (*)	L (*)	NS (*)	NS (*)	L (*)	L (*)	NS (*)	NS (*)	L (***)	L-M (***)	NE	L-M (*)	NE	NS (*)	NS (*)	NS (***)	NEv	L (***)	NS (*)
<i>Alcyonium digitatum</i>	L-M (***)	NA	NA	NE	NE	NE	L (**)	M (*)	NA	NA	L (*)	NS (*)	NS (*)	NE	NS (*)	NE	M (*)	NE	NEv	NE	NS (*)	NS (*)	NEv	NEv	NS (*)	NS (*)
<i>Ampelisca brevicornis+++</i>	M (***)	L (***)	L (***)	NE	NE	M-H (*)	L (**)	L (*)	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	NS (*)	NS (*)	L (***)	L (***)	NE	L (*)	NE	NS (*)	NS (*)	NS (*)	NEv	M (*)	NS (*)
<i>Angulus fabula</i>	NS (*)	L-NS (*)	L-NS (*)	NS (*)	NS (*)	M (*)	NS (*)	M (*)	M-H (*)	L (*)	L (*)	NS (*)	NS (*)	M-H (*)	L-NS (*)	NS-L (***)	L-NS (*)	NE	M (*)	NE	NS (*)	NS (*)	NS (*)	NEv	L-M (*)	NS (*)
<i>Angulus tenuis</i>	NS (*)	L (*)	L (***)	NS (*)	L (*)	M (*)	NS (*)	H (*)	M-H (*)	NS (*)	L-M (*)	L (*)	NS (*)	NEv	L-NS (*)	NEv	NEv	NE	M (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Arenicola marina</i>	NS (*)	NS (***)	L-M (***)	NS (***)	NS (***)	L-M (*)	NS (*)	L-M (*)	L-M (***)	L-M (***)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (***)	NE	M (*)	NE	L-M (*)	NS (*)	NS (***)	M-L (*)	M-L (*)	NS (*)
<i>Ascophyllum nodosum</i>	L (*)	NA	NA	L (***)	NE	NE	NS (***)	VH (*)	NA	NA	NS (***)	L-NS (***)	NS (*)	NE	NS (*)	NE	NS (*)	NE	M (***)	NE	H (***)	NS (*)	NS (***)	NEv	NS (***)	H (***)
<i>Capitella spp.</i>	L (*)	L (**)	L (**)	L (***)	L (*)	L (*)	L (*)	NS (*)	NS (*)	NS (***)	NS (*)	NS (*)	NS (***)	NS (*)	NS (*)	L (***)	L (***)	NE	NS (*)	NE	NS (*)	NS (*)	NS (***)	L (***)	NS (***)	NS (*)
<i>Cliona celata</i>	M (***)	NA	NA	NE	NE	NE	L (**)	M (*)	NA	NA	NEv	NS (***)	NS (*)	NE	NS (*)	NE	NEv	NE	NS (*)	NE	NS (*)	NS (*)	NEv	NEv	NEv	NS (*)
<i>Dictyota dichotoma ##</i>	L (*)	NA	NA	L (***)	NE	NE	M (***)	H (*)	NA	NA	NS (*)	L-NS (***)	NS (**)	NE	NS (*)	NE	NS (*)	NE	M (***)	NE	M (***)	NS (*)	NS (*)	NEv	NS (***)	M (***)
<i>Euclymene sp.+</i>	NS (*)	NS (*)	M (*)	NE	NE	H (*)	L (***)	H (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	M (*)		NS (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NS (*)	NS (*)
<i>Fucus spp.</i>	L (*)	NA	NA	L (***)	NE	NE	M (***)	H (*)	NA	NA	NS (*)	L-NS (***)	NS (**)	NE	NS (*)	NE	NS (*)	NE	M (***)	NE	M (***)	NS (*)	NS (*)	NEv	NS (***)	M (***)
Lichens	H (***)	NA	NA	H (***)	H (***)	VH (*)	H (***)	H (*)	NA	NA	NA	NA	NA	NE	NA	NE	NEv	NE	NS (*)	NE	NS (*)	NS (*)	NE	NEv	L-H (***)	NE
<i>Littorina littorea</i>	L (*)	NA	NA	L (***)	NE	NE	L (***)	M (*)	NA	NA	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (***)	NE	L-NS (***)	NE	L (***)	NS (*)	NS (***)	NEv	M (*)	NS (*)
<i>Magelona allenii++</i>	L-NS (*)	M (***)	M (*)	L-NS (*)	M (*)	M (*)	NS (***)	M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	NS (*)	NS (***)	NS (***)	NE	M (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Magelona minuta++</i>	L-NS (*)	M (***)	M (*)	L-NS (*)	M (*)	M (*)	NS (***)	M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	NS (*)	NS (***)	NS (***)	NE	M (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Metridium senile</i>	M (**)	NA	NA	M (*)	NE	NE	L (**)	M-H (*)	NA	NA	L (*)	NS (***)	L (*)	NE	NS (*)	NE	NS (***)	NE	NS (*)	NE	NS (*)	NS (*)	NEv	NEv	NS (*)	NS (***)
<i>Mytilus edulis</i>	H-VH (*)	H-VH (*)	H-VH (*)	L-M (**)	L-M (**)	H-VH (*)	L (**)	VH (*)	M-H (**)	M-H (**)	NS (*)	NS (***)	NS (*)	NS (**)	NS (*)	L (***)	L (***)	NE	L (*)	NS (*)	L (***)	L (***)	NS	NS	NS	NS
<i>Patella vulgata</i>	M (**)	NA	NA	L (***)	NE	NE	M (***)	H (*)	NA	NA	NS (***)	NS (**)	NS (*)	NE	NS (*)	NE	NS (***)	NE	NEv	NE	NS (*)	NS (*)	NS (***)	NEv	M (***)	NS (*)
<i>Pelvetia canaliculata</i>	L (***)	NA	NA	L (***)	NE	NE	M (*)	M (*)	NA	NA	NS (**)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NS (*)	M (*)

Pressure Type	Physical Damage								Change in Habitat Quality								Biological Pressures				Chemical Pollution			Physical Pressures		
	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	Changes in turbidity/ increased suspended sediment	Changes in turbidity/ decreased suspended sediment	Organic enrichment of sediments-sedimentation	Increased removal of primary production-phytoplankton	Decrease in oxygen levels-sediment	Decrease in oxygen levels-water column	Genetic impacts	Introduction of non-native species	Introduction of parasites/pathogens	Removal of Target Species	Removal of Non-target species	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
<i>Pygospio elegans</i>	L (*)	L (**)	M (***)	L (*)	L (*)	L-M (*)	L (***)	L-M (***)	L-M (*)	NS (**)	L-M (*)	NS (*)	NS (*)	NS (***)	NS (*)	L (**)	L (**)	NE	M (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Semibalanus balanoides</i>	NS (*)	NA	NA	L (***)	NE	NE	H (*)	H (*)	NA	NA	L-M (***)	NEv	NEv	NE	L (*)	NE	NS (***)	NE	NEv	NE	NS (*)	NS (*)	NS (*)	NEv	NS (***)	NS (***)
<i>Spisula subtruncata</i>	L (*)	L (***)	L (*)	L (*)	L (*)	M-H (*)	NS (*)	M-H (*)	NS (*)	NS (*)	NS (***)	NS (*)	NS (*)	NS (***)	NS (*)	M (***)	M (***)	NE	M (*)	NE	NS (*)	NS (*)	NS (***)	NEv	NS (***)	NS (*)
<i>Thracia papyracea</i>	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	NS (*)	L (*)	NS (*)	NS (*)	NS (***)	L (*)	NS (*)	L-M (*)	NS-L (*)	NEv	NEv	NE	NS-L (*)	NE	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
<i>Thyasira flexuosa</i>	L (*)	L (***)	L (*)	L (*)	L (*)	M-H (*)	NS (*)	M-H (*)	NS (*)	NS (*)	NS (***)	NS (*)	NS (*)	NS (***)	NS (*)	M (***)	M (***)	NE	M (*)	NE	NS (*)	NS (*)	NS (***)	NEv	NS (***)	NS (*)
<i>Tubificoides sp.</i>	NS (*)	NS (*)	L (**)	L (*)	L (*)	M (*)	NS (*)	L (*)	NS (*)	NS (*)	NS (***)	NS (*)	NS (*)	NS (***)	NS (*)	NS (***)	NS (***)	NE	NS (*)	NE	NS (*)	NS (*)	NS (**)	NEv	NEv	NS (**)
<i>Zostera marina</i>	M-H (***)	M-VH (***)	M-VH (***)	M-H (***)	M-H (***)	M-VH (***)	VH (***)	VH (***)	M (*)	M (***)	M (*)	H (***)	NS (*)	H (***)	NS (*)	H-VH (*)	H-VH (*)	NE	H (**)	NE	NS	NS	NEv	NEv	NS (***)	H-VH (**)

Table 11. Codes of sensitivity and confidence applying to species and pressure interactions presented in Tables 8 and 9.

Species x Pressure Interaction Codes for Tables 8 and 9	
NA	Not Assessed
Nev	No Evidence
NORTHEAST	Not Exposed
NS	Not Sensitive
L	Low
M	Medium
H	High
VH	Very High
*	Low confidence
**	Medium confidence
***	High Confidence

Conclusion 1: It is concluded that, with three exceptions, the aquaculture activities individually and in-combination do not pose a risk of significant disturbance to the conservation features for habitats (and community types) in Blacksod Bay based primarily upon the spatial overlap and sensitivity analysis (Tables 6-8 and 13-15).

The exception is the activity (extensive **native oyster 'culture'**) occurring over **Maerl dominated community, *Serpula vermicularis*-dominated community complex** and ***Zostera* dominated community**. This activity is considered disturbing to these extremely sensitive habitat types, primarily by virtue of the dredging activity associated with the culture practice.

Conclusion 2: The risk of successful reproduction and recruitment of *Crassostrea gigas* posed by the culture of diploid oysters in Blacksod Bay cannot be discounted.

Table 12. Interactions between the relevant aquaculture activities and the habitat feature Mudflats and Sandflats not covered by seawater at Low tide (1140) constituent communities with a broad conclusion on the nature of the interactions.

			1140 – Mudflats and Sandflats not covered by Seawater at Low Tide
Culture Type	Location	Method	Sand with <i>Angulus tenuis</i> and <i>Pygospio elegans</i> community complex
Oysters (<i>Crassostrea gigas</i>) /Mussels (<i>Mytilus edulis</i>) in bags & trestles	Intertidal	Intensive	Disturbing: Yes Justification: The habitat is considered tolerant to pressure from activity. However, some component species are sensitive to smothering and siltation (faeces and pseudofaeces). The risk posed by proliferation of non-native oyster species cannot be discounted on the basis the residence time in Blacksod Bay is long (i.e. 28 days).
Oysters (<i>Ostrea edulis</i>) by dredge	Subtidal	Extensive	Disturbing: No Justification: The activities associated with this culture type is unlikely to have impact mainly due to the short duration of the activity and the high recoverability of the community type.
Clams in trays and under mesh	Intertidal	Intensive	Disturbing: Yes Justification: The community type and species are considered susceptible to pressures from the activity. Disturbance cannot be discounted. The spatial overlap is 0.74% of this community type.
Cumulative Impact Aquaculture			Disturbing: Yes Justification: While the cumulative pressure of likely disturbing activities is 0.74% on this community type (<15%). The risk posed by proliferation of non-native oyster species cannot be discounted on the basis the residence time in Blacksod Bay is long (i.e. 28 days).

			1160 – Large shallow inlets and bays			
Culture Type	Location	Method	<i>Zostera</i> -dominated community	<i>Maerl</i> -dominated community	<i>Serpula vermicularis</i> -dominated community complex	Fine sand with <i>Angulus fabula</i> community complex
Oysters (<i>Crassostrea gigas</i>) /Mussels (<i>Mytilus edulis</i>) in bags & trestles	Intertidal	Intensive	N/A	N/A	N/A	N/A
Oysters (<i>Ostrea edulis</i>) by dredge	Subtidal	Extensive	Disturbing: Yes Justification: Given the highly sensitive nature of the habitat in question any activity is likely to have some impact either by increasing species (albeit native) biomass/density and the disturbance risks associated with harvest activities (dredging). In addition, this activity overlaps 53.78% of this habitat type.	Disturbing: Yes Justification: Given the highly sensitive nature of the habitat in question any activity is likely to have some impact either by increasing species (albeit native) biomass/density and the disturbance risks associated with harvest activities (dredging). In addition, this activity overlaps 83.54% of this habitat type.	Disturbing: Yes Justification: Given the highly sensitive nature of the habitat in question any activity is likely to have some impact mainly due to disturbance risks associated with harvest activities (dredging). This activity overlaps 8.9% of this habitat type.	Disturbing: No Justification: The activities associated with this culture type may have some impact mainly due to disturbance risks associated with harvest activities (dredging). However, the duration of the activities are restricted and confined to February and March; therefore, the pressure is not considered persistent, mortalities to this community type due to this activity will likely be low and recovery will be rapid.
Clams in trays and under mesh	Intertidal	Intensive	N/A	N/A	N/A	Disturbing: Yes Justification: The community type and species are considered susceptible to pressures from the activity. Disturbance cannot be discounted. The spatial overlap is 0.13% of this community type. The risk posed by NIS is minimal as culture stocks are confined in bags, is sourced from hatcheries.
Seaweed on longlines	Subtidal	Intensive	N/A	N/A	N/A	Disturbing: No Justification: Practice is extractive only and relies primarily on ambient sunlight and nutrient levels. There is no harmful waste material. The source stock is derived from within the bay or from hatchery production and the species cultures are indigenous to the bay.
Cumulative Impact Aquaculture			Disturbing: Yes Justification: This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is significant at 53.78%.	Disturbing: Yes Justification: This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is significant at 83.54%.	Disturbing: Yes Justification: This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is 8.9%.	Disturbing: No Justification: The cumulative pressure of likely impacting activities is 0.13% on this habitat.

Table 13. Interactions between the relevant aquaculture activities and the habitat feature Large Shallow Inlets and Bays (1160) constituent communities with a broad conclusion on the nature of the interactions.

	1160 – Large shallow inlets and bays
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Culture Type	Location	Method	Sand with <i>Angulus tenuis</i> and <i>Pygiospio elegans</i> community complex	Shingle	Intertidal reef community complex	Sheltered subtidal reef community complex
Oysters (<i>Crassostrea gigas</i>) /Mussels (<i>Mytilus edulis</i>) in bags & trestles	Intertidal	Intensive	Disturbing: Yes Justification: The habitat is considered tolerant to pressure from activity. The risk posed by proliferation of non-native oyster species cannot be discounted on the basis the residence time in Blacksod Bay is long (i.e. 28 days).	N/A	N/A	N/A
Oysters (<i>Ostrea edulis</i>) by dredge	Subtidal	Extensive	Disturbing: No Justification: The activities associated with this culture type is likely to have some impact mainly due to disturbance risks associated with harvest activities (dredging). However, the duration of the activities are restricted and confined to February and March; therefore, the pressure is not considered persistent, mortalities to this community type due to this activity will likely be low and recovery will be rapid.	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type given the high intertidal nature of the community type and thus the difficulty likely to be encountered operating a dredge.	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type given the difficulty likely to be encountered operating a dredge.	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type given the difficulty likely to be encountered operating a dredge.
Clams in trays and under mesh	Intertidal	Intensive	Disturbing: Yes Justification: The community type and species are considered susceptible to pressures from the activity. Disturbance cannot be discounted. The spatial overlap is 0.9% of this community type.	N/A	N/A	N/A
Seaweed on longlines	Subtidal	Intensive	N/A	N/A	N/A	N/A
Cumulative Impact Aquaculture			Disturbing: Yes Justification: While the cumulative pressure of likely impacting activities is 0.9% on this community type (<15%). The risk posed by proliferation of non-native oyster species cannot be discounted on the basis the residence time in Blacksod Bay is long (i.e. 28 days).	Disturbing: No Justification: There are no likely disturbing activities over this community type.	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type.	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type..

Table 14. Interactions between the relevant aquaculture activities and the habitat feature Reefs (1170) constituent communities with a broad conclusion on the nature of the interactions.

			1170 – Reef		
Culture Type	Location	Method	Intertidal reef community complex	<i>S. vermicularis</i> -dominated community complex	Sheltered subtidal reef community complex
Oysters (<i>Crassostrea gigas</i>) /Mussels (<i>Mytilus edulis</i>) in bags & trestles	Intertidal	Intensive	N/A	N/A	N/A
Oysters (<i>Ostrea edulis</i>) by dredge	Subtidal	Extensive	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type given the difficulty likely to be encountered operating a dredge.	Disturbing: Yes Justification: Given the highly sensitive nature of the habitat in question any activity is likely to have some impact mainly due to disturbance risks associated with harvest activities (dredging). This activity overlaps 8.9% of this habitat type.	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type given the difficulty likely to be encountered operating a dredge.
Clams in trays and under mesh	Intertidal	Intensive	N/A	N/A	N/A
Seaweed on longlines	Subtidal	Intensive	N/A	N/A	N/A
Cumulative Impact Aquaculture			Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type	Disturbing: Yes Justification: This habitat is not tolerant of any overlap of any activity..	Disturbing: No Justification: It is unlikely that the culture operation will occur over this community type

8.4 Assessment of the effects of aquaculture production on the Conservation Objectives for Otter in Mullet Blacksod Bay Complex SAC.

As the aquaculture production activities within the SAC spatially overlap with otter (*Lutra lutra*) territory, these activities may have negative effects on the abundance and distribution of populations of the species.

The Mullet/Blacksod Bay Complex SAC is designated for the otter (*Lutra lutra*); the conservation objectives for such are listed in Table 1. While the conservation status of the species is considered favourable at the site, the interactions between otters and the features and aquaculture activities carried out in the SAC must be ascertained. The risk of negative interactions between aquaculture operations and aquatic mammal species is a function of:

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

Shellfish Culture: Shellfish culture operations are likely to be carried out in daylight hours. The interaction with the otter is likely to be minimal given that otter foraging is primarily crepuscular. It is unlikely that these culture types pose a risk to otter populations in the Mullet/Blacksod Bay Complex. Impacts can be discounted on the basis of the points below:

The proposed activities will not lead to any modification of the following attributes for otter:

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

Conclusion 3: The current levels of licenced shellfish culture and applications are considered non-disturbing to otter conservation features.

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

Aquaculture activities will have a disturbing effect on sensitive habitats such as *Zostera*, maerl and *Serpula* reefs. Pressures from oyster dredging will also act on the *Zostera* habitat and pressures from potting will added to the aquaculture pressures on *Serpula* reefs.

Scallops have been fished by inshore fishing vessels in Blacksod Bay for a number of years. Fishing in spring of 2015 involved at least 12 vessels. Scallop are fished by vessels operating single dredges or 3-4 dredges on a single beam. No data are currently available on landings or effort and no stock assessment has been undertaken for this fishery. The Marine Institute (2015a) Natura-Fisheries risk assessment report indicated that the scallop fishery was located in the south of the Bay. The information was based on best estimates of the location of the fishery from information obtained in 2013. This fishery is sporadic and may not be fished every year (Marine Institute, 2015c).

- No overlap with intertidal habitats
- A Fisheries Natura Risk Mitigation Plan has been developed for scallop dredge fishing and bottom towed gears in the Mullet/Blacksod Bay Complex (Marine Institute, 2015b). The mitigation plan identifies that scallop fishing will be excluded (or in effect does not occur anyway) from the following habitats:
 - *Zostera*-dominated community
 - Maërl-dominated community
 - *Serpula vermicularis*-dominated community complex
 - Sheltered subtidal reef community complex
- Scallop fishing occurs on sedimentary habitats (97% overlap) and *Laminaria*-dominated habitat (11% overlap).
- Given the difficulties encountered operating a dredge in the *Laminaria*-dominated area, this overlap is incidental and the activity is unlikely to occur.

Scallop dredging poses a moderate risk to sedimentary habitats.

A shrimp fishery occurs in Blacksod Bay (see Figure 11). This fishery is fished by 4 vessels using 1200 pots between October and February for c. 30 days per year. Most vessels in this fishery grade and discard live juvenile shrimp. There is also a whelk fishery in the same area as the shrimp fishery.

- Trap fisheries for shrimp occurs on sedimentary habitats (97% overlap), *Serpula* reef habitat (10% overlap) and *Laminaria*-dominated habitat (11% overlap).
- Anchors, ropes and pots may pose a risk to *Serpula* reef habitat and to a lesser extent *Laminaria* habitat depending on the intensity of the activity.
- Trap fisheries pose no risk to sedimentary habitats

On foot of above, a risk to *Serpula vermicularis* dominated community complex type and *Zostera* dominated community was identified in relation to scallop dredge fisheries and potting within Blacksod Bay. In response to this risk which would result in in-combination impacts on the sensitive community

type a fisheries mitigation plan was prepared and put into action⁶. This plan removed the risk of dredge fisheries on the sensitive habitat type. There are no further in-combination effects identified between aquaculture and fisheries operations.

Other activities leading to potential impacts on conservation features relate to harvest of seaweed on intertidal reef communities. There is little known concerning the level of harvest from these intertidal reef communities. The impact is likely two-fold, direct impact upon the reefs by removal of a constituent species and impact upon intertidal sediments as a consequence of travel across the shore to the harvest sites. There is no overlap between these activities and intertidal shellfish culture as the intertidal reef habitat is not for shellfish culture in Blacksod Bay. While there is an overlap with the oyster dredge area, the overlap in reality is unlikely as difficulties would be encountered operating a dredge in intertidal reef areas. Seaweed harvesting requires a foreshore licence administered by the Department of Environment, Community and Local Government. There are no known foreshore licences for seaweed harvest currently held or proposed for Blacksod Bay.

There are a number of activities which are terrestrial in origin that might result in impacts on the conservation features of the Mullet/Blacksod Bay SAC. Primary among these are point source discharges from industrial units (Shellfish Pollution Reduction Programme, DECLG). There are three abstractions, three Section 4 licences and one quarry in the general vicinity of the SAC. The pressure derived from these facilities is a discharge that may impact upon levels of dissolved nutrients, suspended solids and some elemental components e.g. aluminium in the case of water treatment facilities. It should be noted that the pressures resulting from fisheries and aquaculture activities are primarily morphological in nature. It was, therefore, concluded that given the pressure resulting from say, a point discharge location (e.g. urban waste-water treatment plant or combined sewer overflow) would likely impact on physical/chemical parameters in the water column, any in-combination effects with aquaculture or fisheries activities are considered to be minimal or negligible.

No other activities resulting in morphological and/or disturbance pressures were identified or could be quantified.

10 SAC Aquaculture Appropriate Assessment Concluding Statement and Recommendations

In the Mullet/Blacksod Bay SAC there are a number of aquaculture activities currently being carried out or proposed. Based upon this and the information provided in the aquaculture profiling (Section 5), the likely interaction between this aquaculture and conservation features (habitats and species) of the site were considered.

An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected

⁶ <http://www.fishingnet.ie/sea-fisheriesinnaturaareas/natura2000sitesundermanagement/blacksodbay/>

to occur. The habitats and species excluded from further consideration were 1310 *Salicornia* and other annuals colonising mud and sand, 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes), 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes), 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*), 21A0 Machairs (* in Ireland), 3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharitum* - type vegetation, 7230 Alkaline fens and 1395 Petalwort *Petalophyllum ralfsii*.

10.1 Habitats

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the Annex 1 habitats 1140 (Mudflats and Sandflats not covered by Seawater at Low Tide), 1160 (Large Shallow Inlets and Bay), and 1170 (Reefs). The likely effects of the aquaculture activities (Species, structures) were considered in light of the sensitivity of the constituent community types and species of the Annex 1 habitats.

Conclusions and Recommendations: Of the 11 community types listed under the remaining habitat features (1140, 1160 and 1170), three (Mobile sand with *Bathyporeia guilliamsoniana* community, Sand with *Gastrosaccus spinifer* community complex and *Laminaria*-dominated community complex) were also excluded from further analysis as they had no overlap with aquaculture activities.

Based upon the scale (spatial and temporal) of overlap between aquaculture activities and marine community types (identified as part of the aquaculture profile and GIS analysis), and the relatively high tolerance levels of the habitats and species therein, the general conclusions relating to the interaction between current and proposed aquaculture activities with habitats is that consideration can be given to licencing (existing and applications) in the Annex 1 habitats – 1140 (Mudflats and Sandflats not covered by seawater at low tide), 1160 (Large Shallow Inlets and Bays and 1170 (Reefs) with the exception of activities overlapping the following community types:

- 1 Zostera-dominated community-** This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is 53.78%.
- 2 Maerl-dominated community -** This habitat is not tolerant of any overlap of any activity. The cumulative pressure of likely impacting activities on this habitat is significant at 83.54%.
- 3 *Serpula vermicularis* dominated community -** The cumulative pressure of likely impacting activities on this habitat is 8.9%.

It is important to note that licenced areas impacted by aquaculture that might be redrawn to exclude any overlap with sensitive habitats should include a sufficient buffer zone to allow for mapping resolution and/or visual enforcement of exclusion.

Given the residence time of Blacksod Bay (i.e., 28 days) the risk of successful reproduction of *Crassostrea gigas* in the bay cannot be excluded, in particular if production is to increase and diploid

oysters are to be used. As a mitigation measure, it is recommended that triploid *C. gigas* oysters be used in current and future oyster culture operations.

10.2 Species

The likely interactions between the proposed aquaculture and fisheries activities and the Annex II species Otter (*Lutra lutra*) were also assessed.

The objectives for these species in the SAC focus upon maintaining the good conservation status of the population. Based upon the specific attributes for otter, the current levels of licenced aquaculture operations and applications are considered non-disturbing to Otter (*Lutra lutra*) conservation features.

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