Natura Impact Statement of Extensive Aquaculture operations in Mullet/Blacksod Bay Complex SAC [00470] and Blacksod Bay/Broad Haven SPA [004037]

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1 Introduction

1.1 Overview of this document

This is a report supporting the Appropriate Assessment of extensive aquaculture operations in Mullet/Blacksod Bay Complex SAC [Site Code: 00470] and Blacksod Bay/Broad Haven SPA [Site code: 004037]. It details the Natura Impact Statement and subsequent appropriate assessment and follows from a Screening exercise carried out and reported in Marine Institute (2023a).

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

1.2 Legislative Context

Articles 3 - 16 of the European Community (EC) Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the **Habitats Directive**[1]) provide the legislative means to protect habitats and species of Community interest through the conservation of an EU-wide network of protected sites, known as **Natura 2000** sites[2]. The Habitats Directive was originally transposed into Irish law by the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. Articles 3 - 16 of the European Community (EC) Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the **Habitats Directive**[3]) provide the legislative means to protect habitats and species of Community interest through the conservation of an EU-wide network of protected sites, known as **Natura 2000** sites[4]. The Habitats Directive was originally transposed into Irish law by the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997). The 1997 Regulations were subsequently replaced by the *European Communities (Birds and Natural Habitats) Regulations 2011*[5], as amended (referred to as the *2011 Birds and Natural Habitats Regulations*). Natura 2000 sites are referred to as European sites in these Regulations.

The terms Natura 2000 sites and European sites are synonymous - the term Natura 2000 sites is used in this report. Natura 2000 sites in Ireland form part of the Natura 2000 European network of protected sites. SACs are designated due to their significant ecological importance for habitats and for species protected under Annex I and Annex II respectively of the Habitats Directive. SPAs are designated for the protection of populations and habitats of bird species protected under the Birds Directive, EC 79/409/EEC[6]. The National Parks and Wildlife Service (NPWS) are the competent authority for the management of Natura 2000 sites in Ireland.

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

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

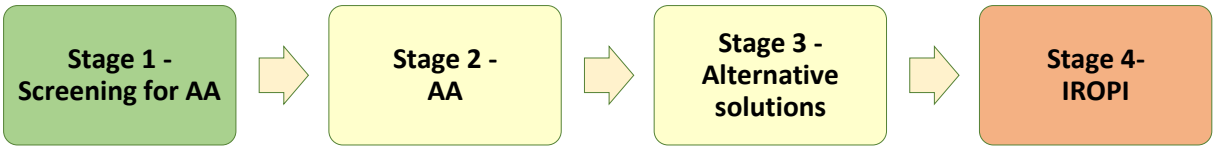
Under Article 6(3) of the Habitats Directive any plan or project likely to significantly affect the integrity of a Natura 2000 site must be subject to an Appropriate assessment (AA). The AA focuses on the likely significant effects of a plan or project on a Natura 2000 site and considers the implications for the site in view of its Conservation Objectives (COs). Every Natura 2000 site has COs which are set out by the NPWS.

DAFM has responsibility for foreshore licensing functions in respect of activities wholly or primarily for the use, development or support of aquaculture under the 1933 Foreshore Act, as amended. DAFM is also the aquaculture licensing authority under the *Fisheries (Amendment) Act (1997)*[7] and determines applications for new, or renewal of, aquaculture licences. They are also the competent authority responsible for undertaking AA of aquaculture licence applications. As part of the licensing process DAFM must determine if the proposed aquaculture activities, individually or in-combination with other activities, are likely to significantly impact the Conservation Status of QIs and the integrity of the Natura 2000 site. DAFM must base its determination on an AA and is also responsible for ensuring that an AA is carried out.

1.3 Appropriate Assessment (AA) Process

The requirement for an AA derives directly from Article 6(3), which outlines the decision-making tests for considering plans and projects that may have a significant effect on a Natura 2000 site. No definition of the content or scope of AA is given in the Habitats Directive, but the concept and approach are set out in EC guidance [8]. The *Guidance on Appropriate Assessment of Plans and Projects in Ireland* document[9] published by the Department of Environment, Heritage and Local Government in 2009, sets out how an AA of plans or proposals in Natura 2000 sites in Ireland should be carried out in alignment with EC guidance. In 2021, the Office of the Planning Regulator (OPR) published a practice note on AA Screening[10], which provides guidance on how a planning authority should screen an application for planning permission for AA.

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



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

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

1.3.1 Stage 1: Appropriate Assessment Screening

Stage 1 AA Screening is the process that addresses and records the reasoning and conclusions in relation to whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of the site's COs. If the effects, on the basis of objective information, are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to *Stage 2 Appropriate Assessment*. Screening should be undertaken without the inclusion of mitigation. The triggers for appropriate assessment screening are based on a '*likelihood*' (read as '*possibility'*) of a potential significant effect occurring and not on certainty. This test is based on the precautionary principle[11]. The greatest level of evidence and justification will be needed in circumstances when the process ends at screening stage on grounds of no effect..

1.3.2 Stage 2: Appropriate Assessment

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

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

1.4 Structure of Report

This report provides:

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

1.5 Data sources

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

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

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

- The Application
- DAFM Aquaculture & Foreshore Management website
- DAFM - Aquaculture viewer – AquaMIS
- National Parks & Wildlife (NPWS) protected site information
- NPWS Guidance documents
- BIM profiling reports
- Targeted scientific studies
- Primary research literature
- Grey literature, reviews and report documents
- Expert opinion
- Direct queries to applicants through DAFM
- Fisheries (Amendment) Act 1997
- Foreshore Act, 1933
- Aquaculture (Licence Application) Regulations, 1998
- Aquaculture (Licence Application) (Amendment) Regulations 2018
- Ireland's Marine Atlas
- MI/BIM Inshore fishing reports
- DHLGH Foreshore licencing database
- EPA GeoHive
- EPA maps tool
- NPWS Status of EU Protected Habitats and Species in Ireland – Article 17 (Habitats & species
- EU Commission assessments of birds population status and trends web tool
- Marine Life Information Network
- EPA Catchments.ie dashboard
- Ordnance Survey of Ireland (OSI)
- Birdwatch Ireland website
- National Biodiversity Data Centre
- European Environmental agency
- OPR, 2021. Appropriate Assessment Screening for Development Management. March 2021; Office of Planning Regulator.
- DEHLG, 2009. Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. NPWS, 2009 – updated in 2010 with reference to Natura Impact Statement.
- Möckel, S., 2017. The European ecological network "Natura 2000" and the appropriate assessment for projects and plans under Article 6 (3) of the Habitats Directive. Nature Conservation, 23.
- EC Article 6 - Managing and protecting Natura 2000 sites
- EC Management of Natura 2000 sites: Best Practice
- EC 2000. Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg.
- EC 2002. Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg.
- EC 2006. Nature and biodiversity cases: Ruling of the European Court of Justice. Office for Official Publications of the European Communities, Luxembourg.
- EC 2018. Guidance on Aquaculture and Natura 2000 Sustainable aquaculture activities in the context of the Natura 2000 Network.

- EC 2012. Common methodology for assessing the impact of fisheries on marine Natura 2000. Service Contract No. 070307/2010/578174/SER/B. DGEnv Brussels.
- Poelman *et al*., 2022. Study on state-of-the-art scientific information on the impacts of aquaculture activities in Europe.
- Federal Agency for Nature Conservation information for the FFH impact assessment
- ABPMer, 2013a – h. Tools for Appropriate Assessment of Fishing and Aquaculture Activities in Marine and Coastal Natura 2000 Sites. Marine Institute.
- Marlin.ac.uk
- AMBI Sensitivity Scale
- MarESA
- Marine Institute (2013). A risk assessment framework for fisheries in Natura 2000 sites in Ireland: with case study assessments. Version 1.3., Galway, 31pp.

Open Street Maps, Google Earth, and Bing aerial photography

1.6 Assumptions made for Appropriate Assessment Reports

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

- All aquaculture sites considered in this assessment report are assumed to be fully operational and that the operations (as well as environmental impacts) are occurring across the entire area of the sites, at a minimum.
- Any aquaculture applications which were submitted prior to that being considered here, but still pending decisions (e.g., in process, under appeal, etc.), are also assumed to be fully operational across the entire area of the relevant sites. This ensures a conservative approach, in that it assumes these activities will be operational to the maximum extent possible.
- Where multiple species might be proposed to be cultured at a site, the assessment assumes that the species most likely to result in the greatest likely ecological effects on the surrounding environment will be the culture species considered. Furthermore, it will be assessed on the basis that it is cultured throughout the entire area of the proposed site. This ensures that the report considers the highest potential impact in relation to the prospective culture species interaction with the surrounding environment.
- Other assumptions identified on a case-by-case basis and clearly communicated in the AA report.

2 Overview of Existing and Proposed Aquaculture Activities in the Mullet/Blacksod Bay Complex SAC [00470]

This document assesses the potential effects of proposed extensive aquaculture activities in combination with existing aquaculture activities on those Qualifying Interests (QIs) of the Mullet/Blacksod Bay Complex SAC (Site code: 00470), among others. Extensive aquaculture is defined in Regulation 3(iii) of the Aquaculture (Licence Applications) (Amendment) Regulations 2018 as "aquaculture activities where there is no external supply of feed and the culture depends entirely on natural processes for production and supply of feed". Shellfish (molluscs, echinoderms, bivalves and gastropods) and seaweed aquaculture fall within this definition, finfish aquaculture does not.

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

This document considers the potential ecological interactions between the proposed extensive aquaculture activities and the Conservation Objectives (COs) of the Mullet/Blacksod Bay Complex SAC, among others.

Currently within the Mullet/Blacksod Bay Complex SAC [000470] there are 11 sites at different stages within the licencing process (Table 2-1 and Figure 2-1):

- 3 sites licensed in 2018:
    - 2 subtidal seaweed sites using longlines at sub-tidal sites (T10-296A and T10-320)
    - 1 intertidal shellfish site for Pacific and native oysters, mussels and periwinkles (T10-237A)
- 3 sites in Renewal / Review (application) stage:
    - Native Oyster – extensive culture on seabed (T10-028A, T10-028B, T10-028C)
- 5 new Applications:
    - 1 x Pacific oysters – intertidal (T10-347A)
    - 1 x seaweed – longlines to replace existing licence T10/296A subtidally (T10-344A)
    - 1 x seaweed – longlines subtidally (T10-355A)
    - 2 x multispecies – primarily seaweeds, other shellfish species (mussels, oysters and scallops) on longlines (T10-351A and T10-352A)

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

Site No.	Status	Activity/Species	Total Area (ha.)*	Occurring with Site 00470
T10-237	Licensed	Pacific and Native Oyster, Blue Mussel, Periwinkle	3.42	Yes
T10-296A	Licensed	Brown Seaweeds, Red Seaweeds	10.09	Yes
T10-320	Licensed	Brown Seaweeds	10.00	Yes
T10-028A	Application	Native Oyster - *Ostrea edulis*	205.59	Yes

T10-028B	Application	Native Oyster - *Ostrea edulis*	571.27 [12]	Yes
T10-028C	Application	Native Oyster - *Ostrea edulis*	172.89	Yes
T10-344A[13]	Application	Brown, Red and Green Seaweeds	29.98	Yes
T10-347A	Application	Pacific Oyster – *Magallana gigas*	10.99	Yes
T10-351A	Application	Native Oyster - *Ostrea edulis* Pacific Oyster – *Magallana gigas*, Blue Mussel – *Mytilus edulis*, King Scallop – *Pecten maximus*, Queen scallop – *Aequipecten opercularis*, Brown, Red and Green Seaweeds	23.99	Yes
T10-352A	Application	Native Oyster - *Ostrea edulis* Pacific Oyster – *Magallana gigas*, Blue Mussel – *Mytilus edulis*, King Scallop – *Pecten maximus*, Queen scallop – *Aequipecten opercularis*, Brown, Red and Green Seaweeds	11.99	Yes
T10-355A	Application	Brown, Red and Green Seaweeds	23.99	Yes

** Site area is taken from the AquaMIS on-line database.*

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

[12] The area of site applied for has been reduced to 564.56 ha following consultation - this assessment has continued to conservatively use the previous applied for 571.27 ha area.

[13] T10-344A if issued to replace T10/296A

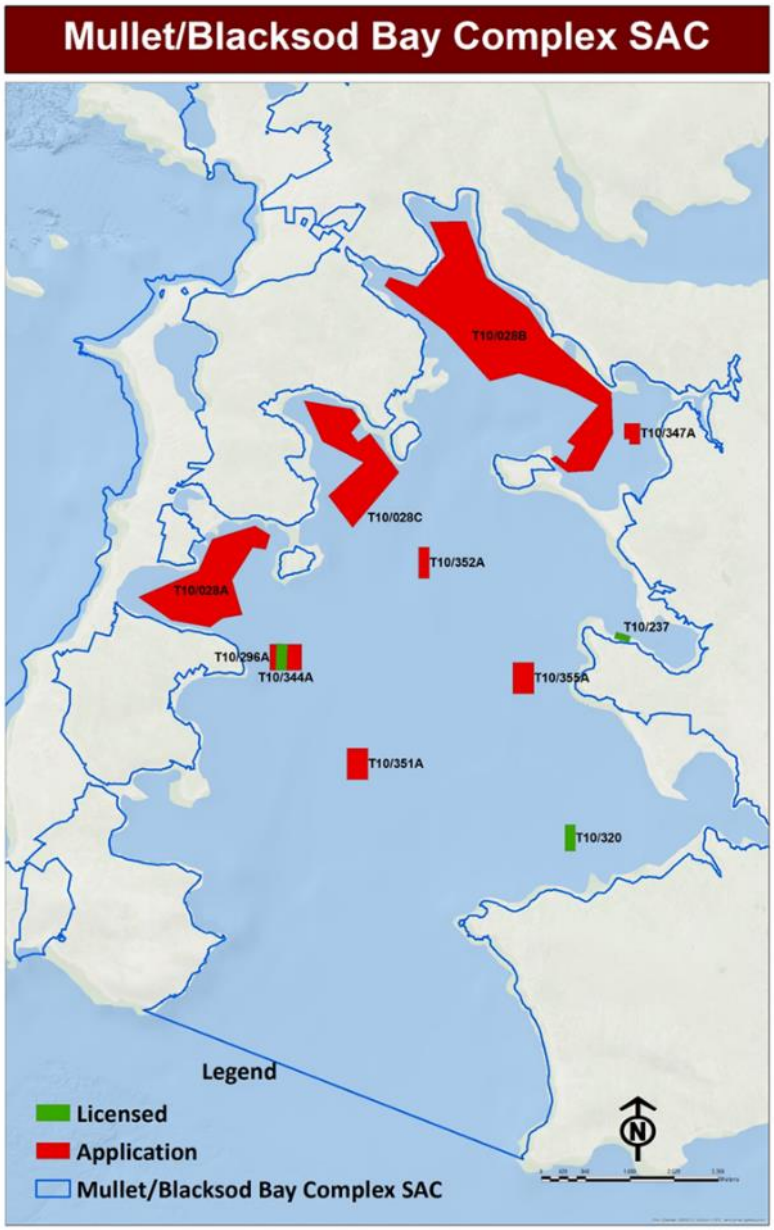


Figure 2-1 Existing and proposed aquaculture sites (Licenced and Applications) in Mullet/Blacksod Bay Complex SAC.

2.1 Native Oysters Cultivation

The natural flat oyster (*Ostrea edulis*) beds of Blacksod Bay are of importance as they are one of only nine such native oyster beds in Ireland. The North Mayo Oyster Development Co-operative manages the naturally occurring beds of native oysters of Inner Blacksod Bay. The original oyster beds were seeded and managed in the 19th Century by local landlords Binham and Carter. The beds lay unmanaged and dormant for much 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 circa 148 members. The Co-operative was successful in being granted an aquaculture licence for native oysters for two areas in 1993.

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 broodstock 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 February and 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 within the Co-ops licensed areas. Each vessel has to obtain a dredging licence from Inland Fisheries Ireland. 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 fishing is permitted.

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.

It should be noted the boundaries of the native oyster sites are redrawn on foot of the findings of a previous Natura assessment carried out in 2017. This found that then proposed licence areas were incompatible with the conservation of marine habitats and in particular, a number of sensitive marine community types. The current licence review areas (T10-28 A, B and C) take into account the findings of this previous assessment and avoid overlap with mapped sensitive habitat areas.

2.2 Pacific Oyster Cultivation

There is one new application for the culture of the Pacific oyster (*Magallana gigas*) at Trawmore Bay (T10-347A) and one existing licence at Doolough Point (T10-237A) which is a multi-species licence (for Pacific and native oysters, mussels and winkles).

In the 1990s and early 2000s there was Pacific oyster production in this area for a number of years. These sites lapsed in the 2000s and there are currently some abandoned trestles on one of the old sites. There is one new application in Trawmore Bay (Blacksod Bay) (T10- 347A) for the cultivation of Pacific oysters in the general same area as where Pacific oysters were successfully grown in the past. At present there is no Pacific oyster production in the Bay. Pacific oyster seed will be sourced from hatcheries in France, Ireland and UK.

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 5 metres in length, are approximately 1 metre in width and stand between 0.5 and 0.7 metres in height. Oyster bags are made of plastic (HDPE) mesh, and vary in mesh size (4 mm, 5 mm, 6 mm, 9 mm and 14 mm) depending on oyster stock grade and size. The bags can be fastened to the trestles with rubber straps and hooks. Trestles can be laid out in rows of four or two.

The Pacific oyster is a bivalve mollusc that filter feed plankton and seston from the sea when submerged during high tide periods. The proposed new oyster farm 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 – 10 mm) oyster seed is introduced from hatcheries. On rare occasions seed can be brought in at a smaller size of less than 4 mm and are put into 2 and 3 mm plastic mesh pouches within 4mm oyster bags where they remain for few months until they reach 6 mm and are ready to be transferred to the 4 mm oyster bag.

All seed and larger oysters brought into the Bay will to be sourced from hatcheries - French, UK or Irish. In the 1990s and early 2000's when there was cultivation in the Bay, seed was diploid which was sourced from hatcheries.

While there is no production in Pacific oysters at present, seed is generally imported between January and June, and between August and November. Sourcing of seed is often dependent on availability. In general, it takes between 2 and 4 years to reach market size 65 gram plus, 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 ½ grown oysters takes place from September to April, and harvesting of stock for mature oysters for market takes place from October to May, but can happen all year round as market dictates sales. 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 in year 3, the stocking density is reduced 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.

In general, oyster farms sites are accessed by tractor and trailer using one routes from farmer's land base facilities ashore. 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.

At the Doolough site (T10-237) the species licenced are 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 mussel seed will be naturally locally sourced seed settlement either on site or from bay or from mussel farms in Mayo. The ½-grown mussels will be grown in oyster bags on trestles. The producer will be directly selling the mussels to the public though 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.

2.3 Seaweed – Longline Cultivation

There are currently two seaweed aquaculture licenced sites for the cultivation of various species of seaweed using semi-submerged longlines at two sites in Blacksod Bay (T10–296A, T10-320A). One of these producers has applied for a new licence in order to expand existing site (T10-296A) in same area of Blacksod Bay. There are an additional 3 new applications for seaweed longline cultivation (T10-351A, 352A, 355A), 2 of which (T10-351A and T10-352A) have also applied to include other shellfish

species (mussels, pacific and native oysters, and scallops) using longlines and hanging cultivation systems.

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 taken place in Ireland since the 1990s.

The native seaweeds currently grown in Blacksod Bay are browns, kelps and to a lesser extent red seaweeds – *Porphyra* and *Palmaria*. All are sourced from an Irish hatchery on seeded rope-twine as shown on above photo. This seeded rope-twine is deployed onto the semi-submerged single longlines during months October to February each year. The seaweeds are fast growing and are harvested within a few months usually during months April to May. Both sites have been in production since 2019 and are serviced by boat from Blacksod Pier.

The single seaweed longlines are suspended at circa 1 metre depth using grey and black floats. Currently it takes six days over the months October – November to deploy the seeded string onto the 25 longlines on the existing 2 licensed sites which vary 150 to 220 metres in length. The sites are visited and checked once or twice per month until the following spring when harvesting begins. At the moment it takes a maximum of six days to harvest the seaweed crop over the months April to May and possibly with to end of June with sugar kelp. It is envisaged that the number of days for harvesting will decrease to three days in the coming year when a new specialised barge will be brought in by one of the producers. Once seaweed is brought ashore it is sent to a specialised drying facility where seaweed is dried and processed for various markets, primarily into higher end human food chain in a number of products.

2.4 Shellfish – Longline Cultivation

Two of the seaweed licence applications includes application for the cultivation of rope mussels, scallops and oysters using longline rope system for mussels and hanging baskets and lantern for oysters and scallops (T10-351A and T10-352A). All seed will be locally settled seed in the case of mussels and native oysters. Pacific oyster seed will be sourced from hatcheries (French, Irish and UK) and scallops seed from local settlement or from other parts of Ireland e.g. Mulroy Bay or from hatcheries if available. The production of these species will be on a trial basis initially in the first few years and if successful it is intended to cultivate these on a quarter of each site area. It is envisaged that the sites will be visited when seed is deployed / collected on sites and then when need to grade and thin cultivation systems during growing cycle and then when harvesting. Most of the work will be carried out in the summer to autumn months. Both sites will be accessed from Blacksod pier.

3 Appropriate Assessment - Screening Summary

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

The proposed aquaculture activities are found within the Mullet/Blacksod Bay SAC and are also considered adjacent to 16 SACs (within 15km).

The screening exercise concluded that the existing and proposed aquaculture activities spatially overlap with and have the potential to adversely affect the following QIs in Mullet/Blacksod Bay Complex SAC (Site 00470);

- Annex I Habitat 1140 - Mudflats and sandflats not covered by seawater at low tide
    - Sand with *Angulus tenuis* and *Pygospio elegans* community complex
- Annex I Habitat 1160 - Large shallow inlets and bays;
    - Sand with *Angulus tenuis* and *Pygospio elegans* community complex
    - Fine sand with *Angulus fabula* community complex
    - Intertidal reef community complex
    - Sheltered subtidal reef community complex; and
- Annex I Habitat 1170 - Reefs;
    - Intertidal reef community complex;
    - Sheltered subtidal reef community complex.
- Annex II Species 1355 Otter (Lutra lutra)

The Screening exercise also identified that while there is no spatial overlap between existing and proposed activities with sensitive marine community types (i.e. *Zostera*-dominated community, Maërl-dominated community and *Serpula vermicularis*-dominated community complex). Such communities are key contributors to biodiversity in the Mullet/Blacksod Bay Complex SAC, are sensitive to disturbance and should be afforded a high degree of protection.

The determination of the significance of potential adverse effects of the proposed aquaculture activities on the Annex II Species, Otter (*Lutra lutra*), is carried forward for further consideration.

In-combination effects of the scallop fishery on SPA must also be considered further.

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

A Technical Review of Screening for Appropriate Assessment for SPA was carried out by WS Atkins Ireland Limited. The full report is found in the appendix to this document. The outcomes for this screening process for SPAs are screened in the following species, for further consideration:

- Red-throated Diver (*Gavia stellata*) [A001]
- Great Northern Diver (*Gavia immer*) [A003]
- Slavonian Grebe (*Podiceps auritus*) [A007]
- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]
- Common Scoter (*Melanitta nigra*) [A065]
- Red-breasted Merganser (*Mergus serrator*) [A069]
- Ringed Plover (*Charadrius hiaticula*) [A137]
- Sanderling (*Calidris alba*) [A144]
- Dunlin (*Calidris alpina*) [A149]
- Bar-tailed Godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Sandwich Tern (*Sterna sandvicensis*) [A191]
- Dunlin (*Calidris alpina schinzii*) [A466]
- Wetland and Waterbirds [A999]
- Arctic Tern (*Sterna paradisaea*) [A194]
- Herring Gull (*Larus argentatus*) [A184]
- Common Gull (*Larus canus*) [A182]
- Lesser Black-backed Gull (*Larus fuscus*) [A183]
- Cormorant (*Phalacrocorax carbo*) [A017]
- Shag (*Phalacrocorax aristotelis*) [A018]

4 Appropriate Assessment - Natura Impact Statement

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

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

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

- Annex I Habitat 1140 - Mudflats and sandflats not covered by seawater at low tide
- Annex I Habitat 1160 - Large shallow inlets and bays
- Annex I Habitat 1170 - Reefs
- Annex II Species 1355 - Otter (*Lutra lutra*)

In addition, the risk of naturalisation posed by the culture of the Non-native species, the Pacific oyster (Magallana gigas) could not be dismissed.

4.1 Impact statement of proposed activities on Habitats

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

- Pacific oyster (*Magallana gigas*) with other shellfish species in suspended culture (bags & trestles) confined to intertidal areas (T10-237, T10-347A).
- Native oyster (*Ostrea edulis*) dredged from subtidal natural beds (T10-028A, T10-028B, T10-028C).
- Native Seaweeds using longlines at sub-tidal sites (T10-320, T10-344A/T10-296A, T10-355A).
- Shellfish (mussels, oysters, and scallop) and seaweed on longlines at sub-tidal sites (T10-351A, T10-352A)

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

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

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

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

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

- Hydrography – low current speeds (or small tidal range) may result in material being deposited directly beneath the trestles. Under normal circumstances, i.e. where trestles are

held 0.5-1m above the seafloor and where tidal height is high resulting in large volumes of water moving through the culture area an acceleration of water flow can occur beneath the trestles and bags, resulting in a scouring effect or erosion and little to no accumulation of material. However, culture systems that are located very close to the seabed will result in impeded water flow and thus, greater impact as a result of accumulation of organic matter all of which will likely resulting in hypoxia and impact on biota. Structures held close together will also likely impede water flow through the site. Any hindrance in water flow can also impact oyster production levels as well as benthic communities.

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

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

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

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 into deeper areas. The concentration of oysters in a confined area may result in a risk of increased organic 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 through the addition (at high % cover) of an epi-benthic species (living on the seabed) to an infaunal sedimentary community.

The activities typically 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.

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

Furthermore, the culture of a non-native species (e.g. the Pacific Oyster - *Magallana gigas*) may also presents a risk of establishment of this species in the SAC. Recruitment of *M. gigas* has been documented in a number of Bays in Ireland and appears to have become naturalised in Ireland (Kochmann et al 2012; 2013) and may compete with the native species for space and food (Green and Crowe 2013). The culture of the Pacific oysters may increase the risk of successful reproduction in Mullet/Blacksod Bay Complex SAC.

4.2 Impact of the proposed activities on Species (Otter)

In relation to Otter (*Lutra lutra*), potential interactions with shellfish culture practices could lead to disturbance or displacement on the basis of activities (human and vehicular) at the site. Furthermore, the use of suspended ropes may present a risk of entanglement to the otters. The structures utilised (both intertidally and subtidally) may represent an obstruction or a barrier to movement of this species.

5 Appropriate Assessment - Overview of Habitat Impact Assessment Method

5.1 SACs

The significance of adverse effects is determined on the basis of scientific studies on likely impacts of proposed activities on conservation features allied with Conservation Objective guidance for constituent community types of 1140, 1160 and 1170 and Annex II species in NPWS guidance documents. The guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by activities. Some activities are deemed to be wholly inconsistent with long term maintenance of certain habitats while other habitats can tolerate a range of activities. For the practical purpose of management of seabed habitats other than sensitive habitats, (e.g. Maërl-dominated communities), a 15% threshold of overlap between disturbing activities and both the QI and community types is established in the NPWS guidance (NPWS. 2014b.). Below this threshold, disturbance is deemed to be non-significant.

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

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

1. *Zostera*-dominated community
2. Maërl-dominated community
3. *Serpula vermicularis*-dominated community complex,

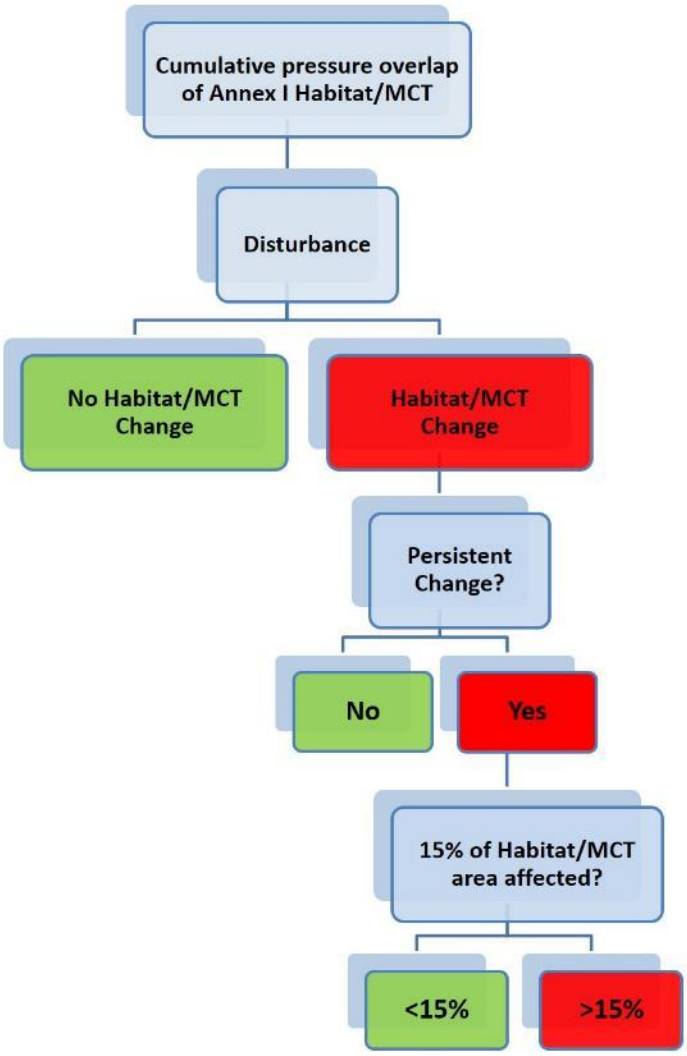
5.1.1 Determining Significance

A schematic outlining the determination of significant effects on marine habitats and marine community types is presented in **Figure 5-1**. For the Annex I habitats and their constituent community types, potential effects are identified in relation to, first and foremost, spatial overlap. Subsequent disturbance and the persistence of disturbance are considered as follows:

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

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

Figure 5-1: Schematic outlining the determination of likely significant effects on habitats and marine community types (MCT) (following NPWS 2014b). MCT- Marine Community Type.



5.1.2 Sensitivity and Assessment Rationale

This assessment used a number of sources of information in assessing the sensitivity of the characterising species of the community types recorded within the QIs 1140, 1160 and 1170.

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

It must be noted that the NPWS have acknowledged that given the wide range of community types that can be found in marine environments, the application of conservation targets to these would be difficult. On this basis, they have proposed broad community complexes as management units. These

complexes (for the most part) are very broad in their description and do not have clear surrogates which might have been considered in targeted studies and thus reported in the scientific literature. On this basis, the confidence assigned to likely interactions of the community types with anthropogenic activities are, by necessity, relatively low, with the exception of community types dominated by sensitive taxa, e.g. maërl and *Zostera sp*. Directed research investigating the effect of aquaculture on the benthic environment does provide a greater degree of confidence in conclusions; for example, the output of Forde et al. (2015) and O'Carroll et al (2016) has provided greater confidence in terms of assessing likely interactions between intertidal oyster culture and marine habitats. Similarly, Wilding et al (2013) and Wilding et al (2012) provide greater confidence in benthic assessments for mussel and finfish farming.

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

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

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

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

- Sensitivity of certain taxonomic groups such as emergent sessile epifauna to physical pressures is expected to be generally high or moderate because of their form and structure (Roberts et al., 2010). Sensitivity is also expected to be high for species with large bodies and with fragile shells/ structures, but low for those with smaller body size. Body size (Bergman and van Santbrink, 2000) and fragility are regarded as indicative of a

high intolerance to physical abrasion caused by fishing gears (i.e. dredges). However, even species with a high intolerance may not be sensitive to the disturbance if their recovery is rapid once the pressure has ceased.

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

Table 5-1 Codes of sensitivity and confidence applying to species and pressure interactions presented in Table 5-2.

Species x Pressure Interaction Codes for Table 5.2	
NA	Not Assessed
Nev	No Evidence
NE	Not Exposed
NS	Not Sensitive
L	Low
M	Medium
H	High
VH	Very High
*	Low confidence
**	Medium confidence
***	High Confidence

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

Pressure Type	Physical Damage								Change in Habitat Quality									Biological Pressures					Chemical/ Physical Pressures	
Pressure	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 hydrocarbons	Prevention of light reaching seabed/features
Sand with *Angulus tenuis* and *Pygiospio elegans* 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 (*)	L(*)	NS (*)
Fine sand with *Angulus fabula* community complex (A5.242)	M(*)	M (*)	M (***)	NE	NE	N-L (*)	L-M (*)	N(*)	L(*)	H(*)	H(*)	H(*)	H(*)	M (***)	H(*)	M (*)	M (*)	NE	L (***)	NE	H (*)	H (*)	M (*)	H(*)
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 (*)
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 (*)

5.2 SPAs[14]

5.2.1.1 *Seaweed Cultivation*

In recent years the harvesting of seaweed from coastal bays in Ireland has been subject to ecological assessment, stock assessment and market analysis (Kelly *et al*., 2001; Werner *et al*., 2004; McLaughlin *et al*., 2006; EHS, 2007 & Walsh *et al*. n.a.; Guiry & Morrison, 2013). More recently this has led to proposals being advanced for the harvesting of seaweeds, notably *Ascophyllum nodosum*, in a number of bays in the West of Ireland; and, where relevant, the preparation of Natura Impact Statements (e.g., Aquafact, 2013 – Trawbreaga Bay) in order to assess the potential impact of such harvesting on Natura 2000 sites. This continues "*a long tradition of sustainable seaweed harvesting in the west of Ireland, which began with kelp ash production from kelp kilns around 1700 and which continued sporadically until 1948*" (Guiry and Morrison, 2013).

The cultivation of seaweeds in Ireland is much rarer and little studied. As demand expands, international experience has found that seaweeds are initially harvested from the wild; with progressive movement initially to small scale cultivation and as is the case in East Asia to large scale cultivation.

Based on Table 7.1, the potential for impact associated with seaweed culture are considered below for species favouring subtidal waters, namely Common Scoter, Great Northern Diver, and Red-breasted Merganser.

5.2.1.1.1 Potential Impacts from seaweed culture

Cultivation of seaweed is an extensive system that relies on a natural nutrient supply; there is no input of food and it is not proposed to apply fertilisers at any of the proposed sites. In contrast to the culture of many animals, there is therefore no organic waste associated with seaweed farming. In fact, they are often used as part of a multi-species system to prevent water quality issues arising from the cultivation of shellfish. Furthermore, seaweed culture is more commonly regarded as being beneficial to marine ecosystems as it can remove pollution-loaded nutrients from the water, which often originate from landbased pollution sources such as agriculture (e.g., removing ammonia and phosphorous and releasing oxygen into the water; Goldburg *et al*. 2001) and in this way can provide positive ecosystem services.

Site preparation (such as removal of rocks etc.) is not required nor will there be any chemicals applied to control predators, competing species and / or fouling organisms. Furthermore, no prophylactive application of chemicals to prevent disease is proposed.

As noted above on-growing of seaweed will be from ropes located along the surface. Apart from longline anchors, there will therefore be limited introduction of physical structures into the environment. While, in Asia seaweed farms can be extremely large with the potential to alter the physical characteristics and habitat surrounding them; this is not the case here. As noted, the sites in Blacksod Bay would all be considered small in scale. Furthermore, none of the four sites overlap with sensitive marine habitats such as reefs, *Zostera* beds etc.

[14] *All shaded references are detailed in the document in the appendix.*

There is very little evidence to suggest that seaweed farms of this scale would have serious consequences for the surrounding habitat. In fact, seaweeds are known to be habitat-creators, forming refuges, and feeding grounds for a variety of fishes and invertebrates (Kelly, 2005). In this way they may in fact be a positive impact on fish eating species such as Red-breasted Merganser and Great Northern Diver.

All four sites are to be located in subtidal waters in large, open bays; furthermore, they are small in scale with respect to the overall size of the bays within which they are located. The scale of operation is not likely to result in localised nutrient depletion; alter patterns of sedimentation or alter patterns of water flow. While there may be some re-direction of nutrients to macroalgae and thus away from phytoplankton – the scale of operations proposed is such that this is unlikely to be significant and would be swamped by larger bay-wide patterns of water / nutrient exchange and circulation.

Coastal Water quality in both Blacksod and Broadhaven is recorded as unpolluted by the EPA (inner waters around licenced T10/319A are not classified (for all areas are defined as "*Strongly expected to achieve good status*" by the EPA (Source: Envision; EPA map viewer).

We are not aware of any published evidence of bird entanglement seaweed cultivation structures (see e.g., published evidence on mussel long lines).

5.2.1.2 *Native oyster cultivation*

This activity involves the bottom culture of native oysters (*Ostrea edulis*) at sites T10/028A (Elly), T10/028B (inner bay at Belmullet), T10/028C (Saleen Bay), T10/351A (central Blacksod Bay) and T10/352A (central Blacksod Bay).

The following text is extracted from the Aquaculture Profile for the site (BIM, 2016a) and summarises activities on oyster sites.

> *"The natural flat oyster (Ostrea edulis) beds of Blacksod Bay are of both national and international importance as they are one of only nine such national native oyster beds in Ireland. The North Mayo Oyster Development Co-operative manages the naturally occurring beds of native oysters 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 circa 148 members. The Cooperative 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 bi-valve 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 degree Celsius 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. 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 picture from Blacksod Bay.

As mentioned earlier 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 Bonamiasis 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.*

Native oysters and King scallop (Pecten maximus) are also fished outside the Co-op's licensed site by licensed fishing vessels."

Generally, the culture of oysters in this way can be considered to include three main phases.

5.2.1.2.1 Nursery Phase

A nursery phase which can often take place in the intertidal zone. However, as noted above the Blacksod Bay fishery is dependant to a large extent on natural settlement and is also based around natural oyster beds dating back to the 19th Century. Settlement can, however, also be supplemented by the suspension of bags of mussel shells from buoys / floats in areas of good oyster spatfall; it is assumed that this would take place in subtidal waters.

No activities associated with oyster bottom culture will occur within the intertidal. As noted a number of areas of intertidal reef are located within licence areas; notably within T10/028, while *Zostera*, a favoured food of Light-bellied Brent Geese is present in both T10/028A and T10/028B. There will be no overlap in dredging activity permitted with sensitive habitats such as reef, maërl and *Zostera*.

The SAC AA describes the ongrowing of oysters in subtidal waters as follows: -

"It is proposed that suitably-sized oysters (> 15 g) are spread within the licensed area. Oysters will be checked periodically when the progress (growth and mortality) of the oysters will be monitored and intervention will be necessary if anomalies are discovered. For example, oysters may need turning-over if excessive fouling or siltation is noted on the animals. Such intervention, as well as harvesting (when oysters are approximately 100 g), is carried out using oyster dredges deployed from boats. The dredges are typically 1.5 m wide and have contact with the substrate via a flat blade".

There is no information available on the current, or proposed, occupancy of subtidal habitat within licensed plots. Therefore, we have made the unrealistic assumption of an occupancy rate of 100% (as advised by the Marine Institute). It is noted, however, that this is an unrealistic assumption given the extensive beds of *Zostera* as well as other sensitive habitats within that are located in T10/028A and T10/028B (see above).

In general, it is considered that the areas used for oyster bottom culture will be below the lowest astronomical tide because the operators will not want to be constrained by the tide whilst dredging (Francis O'Beirn, Marine Institute, pers. comm.).

5.2.1.2.2 Potential impacts on habitat structure and prey resources

The SAC AA states that bottom culture of oysters is "*considered disturbing*" to the subtidal biotopes affected, due to the sensitivity of some of the characteristic species to organic enrichment, smothering and/or physical disturbance from dredging.

It is considered unlikely that increases in oyster density (even to 10's per m^2) would impact negatively on fishes. In fact, it is possible that fish production/abundance would increase. The oysters, along with shell 'hash', provides a low relief habitat that will increase general heterogeneity in overall structure and which has been shown to increase diversity and abundance of fish species. However, it should be noted that these conclusions relate to work conducted on a different oyster species, *Crassostrea virginica* in the US (Francis O'Beirn, Marine Institute, *pers. comm*; see also Lenhert and Allen, 2002; Scyphers, *et al.*, 2011; Tolley and Volety, 2005).

Mapped densities of oysters recorded in the subtidal zones of the licensed oyster plots during Marine Institute surveys are very low (<0.5m^2) with low overall biomass (~25 Tonnes) (Tully and Clarke, 2012). If this is representative of recent years, it is reasonable to assume that the existing levels of oyster cover are not significantly affecting waterbird distribution in the subtidal zone. Therefore, waterbird distribution patterns can be used to assess the potential impact of the ongrowing of oysters in subtidal waters.

5.2.1.2.3 Further ongrowing of oysters in subtidal waters

The SAC AA states that oyster harvesting "*is carried out using oyster dredges deployed from boats"* and that *"the dredges are typically 1.5 m wide and have contact with the substrate via a flat blade*".

The Aquaculture Profile notes that the number of harvesting days are restricted to a short season normally in the spring time, February to March. It is normally 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. 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. We have no detailed information on whether all licenced boats would be active across the 8 fishing days.

Oyster harvesting will result in the removal of oyster biomass that would otherwise have been available for birds to feed on. However, there are no SCI species at Blacksod Bay that are likely to feed on oysters in subtidal waters.

5.2.1.2.4 Other SPA / Species

As noted above adjoining SPAs support a range of species whose foraging range could theoretically overlap with the areas of oyster beds. These include e.g., Cormorant, Shag, gulls (Herring, Common and Lesser Black-backed) and terns, such as Arctic and Little.

In the case of Cormorant these are widely distributed throughout the SPA, with large numbers in the inner bay as well as Elly Bay (OD479) and off Claggan (OD494) (Suddaby, 2016). In contrast, while Shag also occur in small numbers through Blacksod Bay, the main site is off Blacksod Point. The key harvesting period is from February to March when breeding Arctic and Little Tern are absent from the site. Nesting gulls, such as Herring, Common and Lesser Black-backed, can feed on a range of terrestrial, intertidal, and subtidal prey items. After breeding they can disperse widely, with for example many Lesser Black-backed migrating as far south as Portugal for the winter.

The scale of the proposed harvesting activities and associated low risk of disturbance, relative to the distance from known breeding sites and the availability of large areas of alternated foraging grounds is such that these species are unlikely to be impacted. Furthermore, as fish eating species, the potential for the oyster beds to enhance habitat structural diversity and in this way provide greater foraging opportunities for fish eating species cannot be discounted.

5.2.1.2.5 Conclusions

Therefore, for most species there are no potentially significant impacts that are likely to arise from the cultivation and harvesting of oysters in subtidal waters. While the potential for impacts on Red-breasted Merganser would appear to be low, a potential mitigation measure worth considering is that harvesting does not occur within all three favoured areas on the same days; thus, if birds are displaced suitable alternate habitat does occur within which they can temporally forage. The status of Red-breasted Merganser in Blacksod Bay should also continue to be monitored against annual fishing effort / location.

5.2.1.3 *Intertidal oysters*

5.2.1.3.1 Background

The following text is largely extracted from the Aquaculture Profile prepared by BIM (2016a).

Pacific oysters (*Magallana gigas*) have been grown in Blacksod Bay since the 1990's, 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 and intends to increase production once licences are approved. There is a new application in Trawmore Bay – Blacksod Bay for the cultivation of oysters and clams in generally same area as where pacific oysters and clams were successfully grown in past. At present there is no production in the Bay.

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 5 metres in length, are approximately 1 metre in width and stand between 0.5 and 0.7 metres 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 Plate 8.1.

The Pacific oyster is a bivalve mollusc that filter feeds on plankton and other nutrients from the sea when submerged. All the Blacksod Bay 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 oyster seed (G4 to G8) between 6-10 mm in size) is introduced from hatcheries. On rare occasions seed can be brought in at a smaller size of less than 4 mm; these are put into 2 and 3 mm plastic mesh pouches within 4mm oyster bags where they remain for few months until they reach 6 mm and are ready to be transferred to the 4 mm oyster bag.

All seed and larger oysters brought into the Bay will to be sourced from Irish, French or UK hatcheries. 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. Sourcing of seed is often dependent on availability. In general, it takes between 2 and 4 years to reach market size (65 gram plus), 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 ½ 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 5,000 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 1,000 oysters per bag. By the time they reach market size of 66 gram plus 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 farms sites are accessed by one tractor and trailer using one or two routes from farmer's land base facilities ashore. 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.

6 Assessment

6.1 SACs

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

At sites where longline shellfish cultivation is proposed, these can result in high densities of culture organisms over a confined area and in the case of bivalves results in the deposition of faecal and pseudofaecal material to the seabed thereby causing sedimentation of the water column, smothering effects, and organic enrichment of the seabed. At bottom culture sites, some similar sedimentation effects as well as the potential physical disturbance caused by dredging is noted.

It is further noted that at two application sites (T10/351A and T10/352A), it is proposed to culture a variety of species of shellfish in addition to seaweed (Section 2). Of those species, the blue mussel is most likely to be cultured at the highest densities and result in the highest level of organic deposition at the site, thus producing the highest possible level of adverse effects of all the proposed species. For the purpose of this report, it is assumed that the blue mussel will be cultured across the entirety of these sites thereby making this a worst-case scenario assessment in terms of potential environmental effects.

The significance of the possible effects of the proposed activities on habitats, as outlined in the Natura Impact statement (Section 4) and habitat impact assessment method (Section 5), is determined here in the assessment. The significance of effects is determined on the basis of Conservation Objective guidance for constituent habitats and species (NPWS 2014a, b).

Within the Mullet/Blacksod Bay Complex SAC the qualifying interests carried further, from the screening exercise, (Marine Institute, 2023) in this assessment are:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1160 Large shallow inlets and bays
- 1170 Reefs

1140 - Mudflats and sandflats not covered by seawater at low tide

The qualifying interest, Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) has a number of attributes (with associated targets) relating to the following broad habitat features as well as its constituent community types (NPWS 2014a,b);

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

This community type 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 on-bottom culture - these activities may alter the current regime, cause surface disturbance and shading, introduce non-native species, disease, and organic enrichment.

Table 5-2 lists the marine community types (or surrogates) found within this SAC (including Intertidal sand with nematodes and polychaetes community complex) and provides an estimate of sensitivity to a range of pressures. The risk scores in Table 5-2 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Mullet/Blacksod Complex SAC - aquaculture activities comprises shellfish production. Considered in the assessment for this qualifying interest are intertidal oyster and mussel culture (bag and trestle), and subtidal native oyster on-bottom culture.

Tables 6-1 provides an estimate of spatial overlap of aquaculture activities over the constituent community type (Sand with *Angulus tenuis* and *Pygospio elegans* community complex) within the QI 1140.

Table 6-1 Habitat utilisation i.e. spatial overlap in hectares and percentage of aquaculture activity over relevant Marine Community Types (MCT) within the qualifying interest 1140 - Mudflat and sandflats not covered by seawater at low tide of Mullet/Blacksod Bay SAC. (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2011 – supporting docs marine and coastal).

Site No.	**Status**	**Species**	**Site Area (ha)**	**Sand with *Angulus tenuis* and *Pygospio elegans* community complex (1,231ha)**	
				Area overlapping MCT (ha)	**% MCT**
T10-237	Licensed	Shellfish	3.42	2.4	0.19
T10-296A	Licenced	Seaweed	10.09	-	-
T10-320	Licensed	Seaweeds	10.00	-	-
T10-028A	Application	Bottom Oyster	205.59	0.1	<0.01
T10-028B	Application	Bottom Oyster	571.27	35.04	2.85
T10-028C	Application	Bottom Oyster	172.89	-	-
T10-344A	Application[15]	Seaweeds	29.98	-	-
T10-347A	Application	Pacific Oyster	10.99	6.60	0.54
T10-351A	Application	Shellfish and seaweed	23.99	-	-
T10-352A	Application	Shellfish and seaweed	11.99	-	-
T10-355A	Application	Seaweed	23.99	-	-
Access Routes				1.6	0.13

[15] (T10-344A to replace T10/296A)

It is noted that 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), the size of the equipment to be used (currachs and/or half-deckers using 4 foot dredges) and the large area under consideration, this activity is unlikely to cause significant and persistent disturbance to the sedimentary community. It is appropriate to consider these activities over the extent of the proposed licence areas as not representing a continuous or ongoing source of disturbance over time and space. This may arise for intermittent or episodic activities for which the receiving environment has resilience and may be expected to recover within a reasonable timeframe.

On the basis of targeted research (Forde et al., 2015) intertidal oyster culture on trestles is considered non-disturbing to sedimentary habitats similar to those identified in this SAC. Identified access routes are considered disturbing as a result of the compaction of sediments by vehicles on the shore. The likely extent of access route disturbance on this community type (and habitat 1140) is 1.6ha. **This represents 0.13% and 0.1% over community type Sand with *Angulus tenuis* and *Pygospio elegans* community complex and Habitat 1140, respectively.**

1160 - Large shallow inlets and bays

The qualifying interest, Large shallow inlets and bays (1160) has a number of attributes (with associated targets) relating to the following broad habitat features as well as its constituent community types within the Mullet/Blacksod Bay Complex SAC (NPWS, 2014 a, b).

1. **Habitat Area** – it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Large shallow inlets and bays. The habitat area is likely to remain stable.

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

This attribute considered interactions with 11 of the community types listed above. Of the 11 communities, 7 have no overlap with aquaculture activities and no mechanism for likely interaction (e.g. hydrological link). Therefore, the following 4 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

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 can result in physical disturbance to infaunal communities and intertidal oyster a 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 5-2 lists the habitats (or surrogates) provides a commentary of sensitivity to a range of pressures. The risk scores in Tables 5-1 and 5-2 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the 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, and subtidal culture of shellfish or seaweed by rope culture.

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. The likely extent of disturbance from access route (to intertidal oyster sites) on the QI 1160 and Sand with *Angulus tenuis* and *Pygospio elegans* community complex is 1.6ha. **This represents 0.13% and 0.014% over Sand with *Angulus tenuis* and *Pygospio elegans* community complex and Habitat 1140, respectively.**

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), the proportions of the equipment to be used (currachs and/or half-deckers and 4 foot dredges) and the extent of the area under consideration, it is unlikely to cause significant disturbance to the two sedimentary communities (Sand with *Angulus tenuis* and *Pygospio elegans* community, Fine sand with *Angulus fabula* community complex) which have high recoverability from surface abrasion. This activity is unlikely to cause significant and persistent disturbance to the sedimentary community. It is appropriate to consider these activities over the extent of the proposed licence areas as not representing a continuous or ongoing source of disturbance over time and space. This may arise for intermittent or episodic activities for which the receiving environment has resilience and may be expected to recover within a reasonable timeframe. 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.

The environmental effects of longline shellfish (i.e. mussel) culture are well studied especially as they relate to sedimentary communities. The longline structures have a physical influence on the hydrodynamic processes and have been demonstrated to alter currents and increase sedimentation locally (McKindsey et al., 2011). Deposition of organic matter from cultured mussels increases benthic organic loading and influences biogeochemical processes and community structure (Chamberlain et al., 2001; Christensen et al., 2003; Crawford et al., 2003; McKindsey et al., 2011; Wilding 2012; Wilding and Nickell 2013; Casado-Coy et al 2022; Sean et al 2022). While these effects may alter the benthic environment beneath the culture systems, the extent of any change will be a function of the density of cultured organisms, the food availability within the water column, and the local hydrodynamic regime. It is likely that the distribution of sedimentary communities within the proposed sites will be modified relative to their respective COs as a result of the proposed culture activities; however, it is also probable that certain functions (e.g., the ability to assimilate organic matter) will be retained (Wilding and Nickell 2013; Casado-Coy et al 2022). Notwithstanding, this modification of community distribution, while spatially restricted, is likely to persist for the duration of culture activities and in that sense can be considered as a disturbance (as defined in NPWS 2014b) which extends to the area of the proposed site. It is accepted that this QI and the one community type likely affected (Fine sand with *Angulus fabula* community complex) are sufficiently resilient such that once activities stop the benthic habitats within these sites will have the capacity to fully recover. The likely extent of mussel culture overlap (and potential disturbance) from applications, T10-351A and T10-352A, on this community type (and habitat 1160) is 36ha**. This represents 0.6% and 0.32% over community type Fine sand with *Angulus fabula* community complex and Habitat 1160, respectively**. **When considered in-combination with access route disturbance above the total disturbance on QI 1160 is 0.334%.**

The culture of seaweed is reliant upon ambient nutrient levels in the water column and solar Illumination and no waste is produced. None of these resources are considered limiting in the bay. The only community type overlapped by existing and proposed seaweed culture is Fine sand with *Angulus fabula* community complex which would not be considered sensitive to the aquaculture practice (i.e. photosensitive). This activity, suspended culture of seaweeds, is considered non-disturbing to the QI 1160.

The aquaculture sites in Blacksod Bay will be accessed by boats from piers around the bay. As a consequence, noise and pollution e.g. as a result of a fuel spill may present a risk to features of adjoining Natura sites. The risks are, however, not considered significant. Furthermore, it is considered that any impacts would be localised and minor.

Table 6-2 Habitat utilisation i.e. spatial overlap in hectares and percentage of aquaculture activity over relevant Marine Community Types (MCT) within the qualifying interest 1160 – Large Shallow Inlet and Bays of Mullet/Blacksod Bay Complex SAC. (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2011 – supporting docs marine and coastal).

Site No.	Status	Species[16]	Site Area (ha)	Sand with *Angulus tenuis* and *Pygospio elegans* community complex (1,182ha)		Fine sand with *Angulus fabula* community complex (6,289ha)		Intertidal reef community complex (254ha)		Sheltered subtidal reef community complex (81ha)	
				Area overlapping MCT (ha)	% MCT	Area overlapping MCT (ha)	% MCT	Area overlapping MCT (ha)	% MCT	Area overlapping MCT (ha)	% MCT
T10-237	Licensed	Shellfish	3.42	3.42	0.29	-	-	-	-	-	-
T10-296A	Licenced	Seaweed	10.09	-	-	10.09	0.16	-	-	-	-
T10-320	Licensed	Seaweed	10.00	-	-	10.00	0.16	-	-	-	-
T10-028A	Application	Bottom Oyster	205.59	0.10	0.008	205.45	3.27	-	-	-	-
T10-028B	Application	Bottom Oyster	571.27	35.14	2.97	525.13	8.35	10.7	4.21	-	-
T10-028C	Application	Bottom Oyster	172.89	-	-	167.19	2.66	-	-	5.57	6.88
T10-344A[17]	Application	Seaweed	29.98	-	-	29.98	0.48	-	-	-	-
T10-347A	Application	Pacific Oyster	10.99	6.6	0.56	4.39	0.07	-	-	-	-
T10-351A	Application	Shellfish and seaweed	23.99	-	-	23.99	0.38	-	-	-	-
T10-352A	Application	Shellfish and seaweed	11.99	-	-	11.99	0.19	-	-	-	-
T10-355A	Application	Seaweed	23.99	-	-	23.99	0.38	-	-	-	-
Access Routes				1.6	0.14	-	-		-	-	-

[16] Table 3-1 provides greater details of specific species cultured

[17] T10-344A to replace T10/296A

1170 – Reefs

The qualifying interest, Reef (1170) has a number of attributes (with associated targets) relating to the following broad habitat features as well as its constituent community types (NPWS 2014a,b);

1. **Habitat Area** – it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Reefs. The habitat area is likely to remain stable.

2. **Community Distribution** – (conserve a range of community types in a natural condition). This attribute considered interactions with 3 of the community types listed in NPWS (2014a). Of the 3 community types, 1 has no overlap with aquaculture activities and no mechanism for likely interaction (e.g. hydrological link). Therefore, the community types listed, found within the qualifying interest 1170 of the SAC have overlap with aquaculture activities:

- Intertidal reef community complex
- Sheltered subtidal reef community complex

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities proposed. Activities include dredging for native oyster which can result in physical disturbance to infaunal communities. Table 5-2 lists the habitats (or surrogates) and provides an estimate of sensitivity to a range of pressures. The risk scores in Tables 5-2 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Mullet/Blacksod Bay Complex SAC. Aquaculture activities in the Mullet/Blacksod Bay Complex SAC comprises shellfish production. Considered in the assessment of QI reefs is only subtidal native oyster on-bottom culture.

Table 6-3 provides an estimate of spatial overlap of aquaculture activities over marine habitat 1170 and its constituent community types, respectively. 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 and/or half deckers and 4 foot dredges), as noted above, it is unlikely to cause significant disturbance to the any sedimentary communities. The two reef community types ('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 QI 1170 habitat and therefore, any interactions can be discounted.

Table 6-3 Habitat utilisation i.e. spatial overlap in hectares and percentage of Aquaculture activity over relevant Marine Community Types (MCT) within the qualifying interest 1170 – Reefs of Mullet/Blacksod Bay SAC. (Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2011 – supporting docs marine and coastal).

Site No.	Status	Species	Site Area (ha)	Intertidal reef community complex (338ha)		Sheltered subtidal reef community complex (81ha)	
				Area (ha)	% MCT	Area (ha)	% MCT
T10-237	Licensed	Shellfish	3.42	-	-	-	-
T10-296A	Licenced	Seaweed	10.09	-	-	-	-
T10-320	Licensed	Seaweed	10.00	-	-	-	-

T10-028A	Application	Bottom Oyster	205.59	-	-	-	-
T10-028B	Application	Bottom Oyster	571.27	10.7	3.17	-	-
T10-028C	Application	Bottom Oyster	172.89	-	-	5.57	6.88
T10-344A	Application[18]	Seaweed	29.98	-	-	-	-
T10-347A	Application	Pacific Oyster	10.99	-	-	-	-
T10-351A	Application	Shellfish and seaweed	23.99	-	-	-	-
T10-352A	Application	Shellfish and seaweed	11.99	-	-	-	-
T10-355A	Application	Seaweed	23.99	-	-	-	-
Access Routes			1.6	-	-	-	-

Otter (*Lutra Lutra*) 1355

The Mullet Blacksod Bay Complex SAC is designated for the QI Otter; the COs for such are:

- Distribution – no significant decline.
- Extent of terrestrial habitat – no significant decline.
- Extent of marine habitat – no significant decline.
- Extent of freshwater(river) habitat – no significant decline.
- Extent of terrestrial(lake/lagoon) habitat – no significant decline.
- Couching sites and holts – no significant decline
- Fish biomass available – no significant decline
- Barriers to connectivity – no significant increase.

Figure 6-1 shows the distribution of otter habitat and commuting areas within the Mullet Blacksod Bay Complex SAC and surrounds.

[18] T10-344A to replace T10/296A

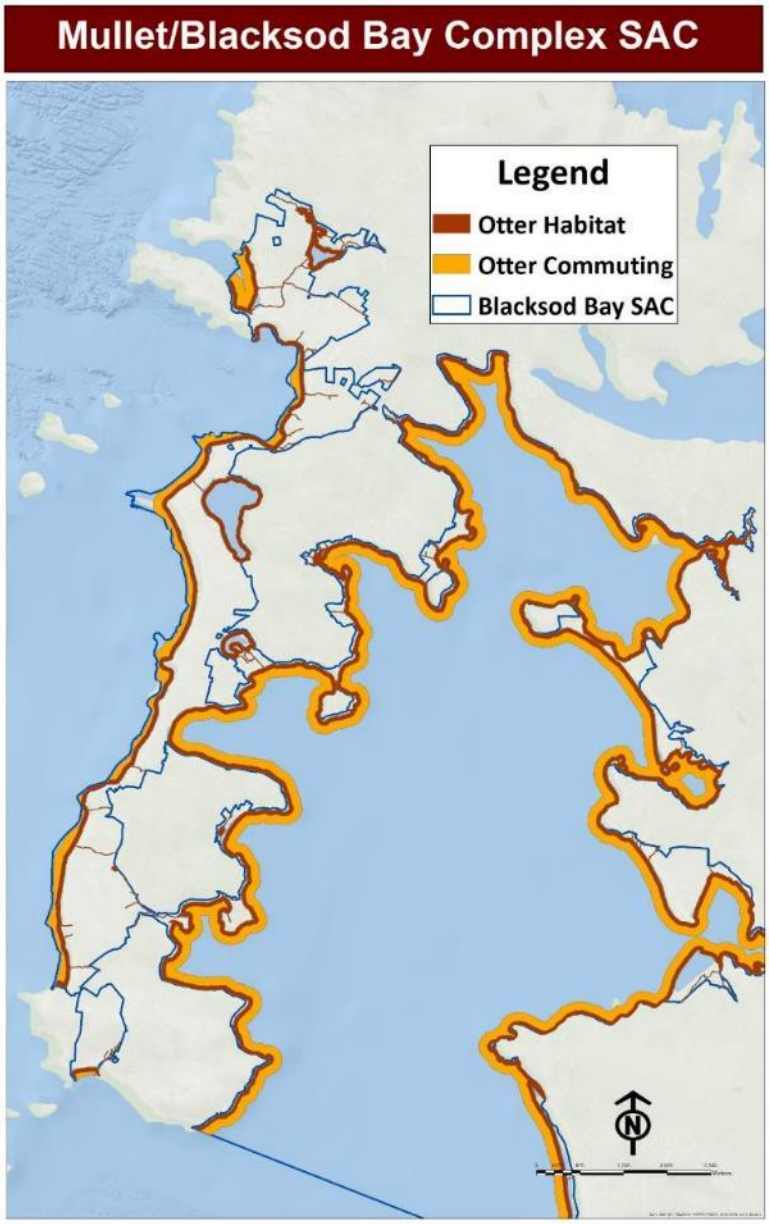


Figure 6-1 Map of Otter Habitat and Otter Commuting Corridors in the Mullet/Blacksod Bay Complex SAC. (NPWS 2014a)

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:

- The location and type of structures used in the culture operations.
- Whether or not there is a risk of entanglement or physical harm to the animals from the structures.
- Is access to locations restricted, and
- The schedule of operations on the site – such as the frequency and potential that they can cause disturbance to the animals.

The proposed 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. Disturbance associated with vessel traffic could potentially affect the distribution of otter at the site. However, the level of disturbance is likely to be very low given the likely encounter rates will be low dictated primarily by tidal state and in daylight hours. It is noted that the current conservation status of otter nationally is favourable and that aquaculture practices are not identified of threats either locally or nationally (NPWS, 2009 and NPWS 2019). It is unlikely that these culture types pose a risk to otter populations in the Mullet/Blacksod Bay SAC.

Significant adverse effects on the QI Otter can be discounted on the basis of the points below:

- The proposed activities will not lead to any modification of the extent of terrestrial, marine or freshwater habitat for otter
- The number of couching sites and holts or, therefore, the distribution, will not be directly affected by aquaculture activities.
- 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.
- Shellfish production activities are unlikely to pose any risk to otter populations through entrapment or direct physical injury.
- The structures and activities associated this form of oyster culture structures are suspended from the seabed and are oriented in rows, thus allowing free movement through and within the site.

The levels of licenced shellfish culture and proposed applications are considered non-disturbing to otter conservation features, and there will be no adverse effect.

6.2 SACs

6.2.1 Seaweed culture

6.2.1.1 *Common Scoter*

During winter and when feeding, Common Scoters are generally distributed in shallow coastal waters (BWPi, 2004). They are most often distributed across areas where there is a sandy substrate, linked to the distribution of their favoured prey of bivalve molluscs. Previous research varies somewhat in the range of dive depths reported for Common Scoter, with dive depths clearly influenced by local conditions, the depth of favoured bivalve feeding beds and the energetic costs of reaching same (Kaiser *et al*. 2006). All areas of Blacksod Bay are within the published foraging depth of Common Scoter.

Most seaducks, including Common Scoter are believed to be diurnal foragers. Lewis *et al*., 2005 found no evidence for significant night-time foraging in the closely related White-Winged Scoter (*Melanitta*

fusca) and Surf Scoter (*Melanitta perspicillata*). In these species, and indeed for Common Scoter, published evidence suggests that birds move further offshore and into deeper waters by night to roost (Lewis *et al*., 2005 etc.). Common Scoter is believed to be largely tactile feeders, e.g., in Liverpool Bay they feed in quiet turbid waters which would preclude visual foraging. However, we are unaware of any published evidence to suggest that Common Scoter forage by night (to compensate for shorter day length, such as at and higher latitudes, or to selectively target slacker tides and thus lower current speeds within which to forage). At the mid-latitudes where Ireland is located it is highly probable that scoter has sufficient daylight within which to meet their energetic demands and do not need to avail of nocturnal foraging to meet their daily energy budgets.

The diet of Common Scoters has been reviewed by Fox (2003), BWPi (2004) and Kaiser *et al*. (2005). Quantitative analyses of their diet show that it is overwhelmingly dominated by bivalves (88% or greater of the diet composition in the eight studies reviewed by Kaiser *et al*., 2005). A total of 30 species of bivalve have been recorded within their diet (Kaiser *et al*., 2005). Fox (2003) concluded that: "*Common Scoter seem to prefer foraging in clean sandy substrates that support benthic communities rich in bivalve biomass. Within such sites, prey species are probably taken in proportion to their abundance*". Literature reviews do not indicate any clear patterns of size selection of prey by Common Scoter (Fox, 2003; Kaiser *et al*., 2006). Common Scoter are reported to consume prey with a shell length within a range of 5-40mm (Kube, 1996; Meissner & Brager 1990; Durink *et al*. 1993; all quoted by Kaiser, *et al*. 2006), though an upper limit of around 50 mm shell length has also been reported (Fox, 2003). However, the maximum limit may not apply to razor clams as these are likely to be ingested lengthways (Kaiser *et al*., 2006). There is also evidence of scoter nipping off the ends of exposed inhalant or exhalant siphons from buried bivalves.

Much of the habitat along the centre and eastern side of Blacksod Bay is defined as 'fine sand with *Angulus fabula* (a species of bivalve mollusc) community complex'. While Fox (2003) did not reference direct evidence of consumption of *Angulus fabula*; he does reference the presence of large aggregations of scoter over known *A. fabula* beds in the Netherlands. Leonhard and Skov (2007), however do record *Tellina* (syn. *Angulus*) *fabula* in the diet of Common Scoter in Danish waters.

The NPWS baseline waterbird survey results suggest that Common Scoter is primarily restricted to four key subsites within Blacksod Bay. These are located in the centre and along the eastern side of the bay with birds foraging and roosting in subtidal waters of Blacksod Bay (0D439), Doolough Bay & Strand (0D490), Claggan Strand (0D494) and Kanfinalta Point (0D901). Across the full survey duration, the greatest number of Common Scoter were recorded in Doolough Bay & Strand (0D490) and Claggan Strand (0D494). These areas largely coincide with the marine biotope *Fine sand with Angulus fabula*, while there is some overlap with *Sand with Gastrosaccus spinifer* off Kanfinalta Point.

In addition to these four sites, IWeBS data suggests that Trawmore Bay (0D493) is an additional subsite of importance for Common Scoter as large flocks have been counted in this subsite in the past. The outer part of Trawmore Bay is again dominated by *Fine sand with Angulus fabula*; with *Sand with Angulus tenuis and Pygospio elegans* dominating inshore waters.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are all located in the deeper subtidal waters within low tide count sector 0D439. If seaweed is cultivated on all 4 – this equates to 102ha of floating seaweed culture which may

exclude Common scoter from diving for prey in these areas (though there appears to be no published evidence looking at the relationship between scoter and seaweed cultivation). However, the 4 no. blocks are widely spread in smaller elements through central Blacksod Bay. (Note that the bay is also subject to scallop dredging).

In 2015 BirdWatch Ireland were commissioned to assess the abundance and distribution of wintering water birds in the marine areas of Blacksod Bay (Suddaby, 2016). Land based counts were undertaken each month from December 2015 to April 2016 (a total of 10 counts). Counts were timed to coincide with optimal calm sea conditions. As well as counting flooded intertidal habitats included in IWeBS count zones, neighbouring areas of subtidal habitat were also counted. By far the most important area for Common Scoter was the waters off Claggan Strand (notably south of Claggan Point) where a mean total of 2,210 (± 205.8) birds were recorded; and to a lesser degree off Doolough Point and Doolough Bay, where 1,053 (± 174.5) birds were noted (in waters generally no more than ca. 5-6.4m deep). Actively foraging birds were noted. A mean count of 3,355 (± 203.9) birds were estimated to be present during the survey period; with a peak count of 4,314 on 10th February 2016. This is significantly higher than the number usually recorded by IWeBS or noted in NPWS, 2014.

T10/352A is >3km off Claggan Strand, the Admiralty chart shows water depth close to the area varying from 5.8m to 9.4m, with habitat characterised as *Fine sand with Angulus fabula*. While these area support habitat favoured by Common scoter, the flock distributions noted in the above surveys suggest the main density of prey are likely to be in waters of less than ca. 5-6.4m deep. This area is therefore likely to be less optimal for foraging scoter, though available.

T10/355A is located to the northwest of Doolough Strand in waters of 6-7m depth; this overlaps in part with the depths noted as being favoured (i.e., ca. 5-6.4m deep) by Common Scoter and is characterised as *Fine sand with Angulus fabula*.

T10/344A on the western side of Blacksod appears to be less favoured by Common Scoter; T10/351A is located in the central deeper waters. Both areas are characterised by *Serpula vermicularis*[19]*dominated community complex,* which, based on the above comments on distribution, appears are less favoured by Common Scoter to forage over. Licences T10/344A or T10/351A or therefore not likely to negatively impact upon Common Scoter.

As noted, scoter also seem to favour Trawmore Bay, in inner Blacksod Bay. This area is also dominated by *Fine sand with Angulus fabula* in central areas. The eastern portion of T10/028A, bottom cultivation of native oyster, overlaps with the outer reaches of Trawmore Bay. Within Trawmore Bay T10/347A is for the intertidal cultivation of Pacific oyster. These site will not impact upon Common scoter.

The area of *Fine sand with Angulus fabula* (see Figure 6.2) within the SPA is 6,289ha; Maintained in a natural condition. The total percentage exclusion based on an area of 54ha (T10/352A; T10/355A) equates to <1% habitat loss (0.86%).

We do not have any site-specific data on the response of Common Scoter to marine traffic in the Blacksod Bay area. However, this species is generally considered to be highly sensitive to such disturbance. Furness *et al*. (2013) classified its sensitivity to disturbance from ship and helicopter

[19] 38 A species of fan worm, polychaete.

traffic as 5 on a scale of 1 to 5, where 5 represents "*strong escape behaviour, at a large response distance*". Schwemmer *et al*. (2011) reported a median flush distance of 804 m during experimental disturbance work in the North Sea, with a maximum flush distance of 3.5 km, and only 0.5% of Common Scoter flocks did not flush as the boat approached. They also found a significant positive correlation between flock size and the distance at which birds flushed. Similarly, Kaiser *et al*. (2006) reported that larger flocks flushed at distances of 1-2 km, while smaller flocks flushed at distances of less than 1 km. Both studies used medium-sized vessels (lengths of 25-40 m) and Kaiser *et al*. (2006) state that "*flush distance is likely to relate to the size (height) of vessel structure above the water-line*".

Access to all sites is by boat from Blacksod Pier. Traffic along the west side of Blacksod should be >24km from waters favoured by scoter. Access to T10/355A would pass closer to areas favoured by scoter along the eastern side of the sites; boats should be required to follow a more westerly route before turning eastwards only when level with the site.

With respect to the potential for disturbance, seaweed is deployed between October and November / December when Common Scoter is on site; whereas it is harvested between April and June when scoter are largely absent from site (though the early return of non-breeding and post-breeding birds cannot be discounted). Scoters are therefore unlikely to be impacted by harvesting operations. Following initial deployment (over a number of days) we understand that maintenance visits to the site would be in the order of one per month. It is very unlikely that this level of site attendance and associated boat traffic would result in anything other than a temporary displacement of birds away from the seaweed site. We are not aware of any published material to suggest that the site itself would displace foraging scoter other than within the ca. 10 ha footprint of the site. The risk of seaweed culturing at the scale proposed causing significant disturbance to Common Scoter is therefore considered low.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are not anticipated to negatively impact upon Common Scoter.

6.2.1.2 *Great Northern Diver*

Blacksod Bay is an extremely important site for Great Northern Diver. Great Northern Diver are widespread within the SPA having been recorded in 15 subsites during the baseline waterbird survey. However, seven subsites were identified as being of particular importance as Great Northern Divers were recorded on 3 or more occasions at these subsites during the duration of the survey. These subsites included Blacksod Point (0D415), Elly Bay (0D479), Saleen Harbour (0D478), Claggan Strand (0D494), Doolough Bay & Strand (0D490) and Kanfinalta Point (0D901) within Blacksod Bay as well as Broadhaven Bay (0D438). Broadhaven Bay was highlighted as an important foraging subsite as this was the only subsite in which Great Northern Diver were recorded for all survey dates (NPWS, 2014). Other notable subsites for foraging birds included Saleen Harbour (0D478), Elly Bay (0D479) and Doolough Bay & Strand (0D490).

IWeBS data indicate a similar pattern with high counts for Great Northern Diver having been recorded at subsites including Kanfinalta Point (0D901 - peak count 52), Trawmore Bay (0D493 - peak count 51), Doolough Strand (0D490 - peak count 62), Claggan Strand (0D494 - peak count 41), Saleen Harbour (0D478 - peak count 31) and Seafield Bay (0D477 - peak count 31; north of Saleen Harbour). As with

the NPWS baseline waterbird survey, IWeBS data shows that Great Northern Diver have been recorded from across the site.

As noted, in 2015 BirdWatch Ireland were commissioned to assess the abundance and distribution of wintering water birds in the marine areas of Blacksod Bay (Suddaby, 2016). Average number of Great Northern Diver were 202 (± 13.9) during the winter increasing to 274 (± 12.4) during spring. While recorded throughout the site, generally as singles or in small groups of 3-5 birds (though larger aggregations were encountered during spring), during the winter (December – February) there was a more westerly bias in number of birds recorded towards the waters off Aghleam Bay, Elly Bay and Saleen Harbour (Suddaby, 2016). A similar pattern (though with larger numbers) also occurred in spring (March – April); though at this time of the year a slight increase in numbers was also noted off Kanfinalta Point / Doolough Bay. As well as *Fine sand with Angulus fabula*, this section of the bay includes large areas of *Serpula vermicularis-dominated* reef habitat; the latter is likely to support large numbers of crab, a favoured prey item of Great Northern Diver in Ireland (*pers obs*).

The *Serpula vermicularis-dominated* reef sub-habitat community complex is recorded off the western shore of Blacksod Bay from Barranagh Island to Moyrahan Point in water depths of 3-11m. The sediment ranges from largely fine sands (59.8% to 86.3% very fine to fine sand) to coarse material (18.5% to 28.9% very coarse and coarse sand) reflecting its co-occurrence with maërl in the southern extreme of the community. This community is dominated by the reef-building polychaete *Serpula vermicularis* which forms distinct clusters of biogenic reef in otherwise soft sediment. The tubes are frequently encrusted with coralline algae and sponges and a number of species of red algae also occur on the reef. A variety of anemones are found attached to the reef including *Metridium senile*, *Sagartia elegans* and *Anemonia viridis*. It also provides a refuge for a number of crab species including *Munida* sp., *Liocarcinus depurator* and *Cancer pagurus*.

Where fine sand is the prevailing sediment type within the complex the bivalve *Thyasira flexuosa* and the amphipod *Ampelisca brevicornis* occur in moderate to low abundances and the bivalve *Abra alba* and *Angulus fabula*, the polychaetes *Euclymene* sp., *Magelona alleni*, *M. minuta* and *Spiophanes bombyx* are recorded in low abundances. In coarser sediment the polychaete *Chaetozone christiei* occurs in moderate abundances with the crustacean *Microdeutopus* sp., recorded as locally abundant.

Roycroft *et al*., (2007) found that Great Northern Diver were not adversely affected by mussel suspension aquaculture in Bantry Bay, Co. Cork, and may in fact benefit from it. Seaweed longline cultivation is likely to interact with divers in the same way.

While divers are often regarded as highly sensitive to disturbance from boat traffic (Furness *et al*., 2013), a recent study of Great Northern Divers in Galway Bay found that were not significantly disturbed by medium-sized craft (Gittings et al., 2015). While the study was of short duration (undertaken across one day) and included a small sample size (a total of 57 observations of 64 different birds), these findings are in line with observations of Great Northern Divers in other sites such as Courtmacsherry Bay (*pers obs.)*. The risk of seaweed culturing at the scale proposed causing significant disturbance to Great Northern Diver is therefore considered low.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are not anticipated to negatively impact upon Great Northern Diver.

6.2.1.3 *Red Breasted Merganser*

The baseline waterbird survey results show that Red-breasted Merganser was recorded foraging across a number of subsites sites (12) within Blacksod Bay SPA, but was only regularly recorded across the surveys in four subsites: Broadhaven Bay (0D438), Seafield Bay (0D477), Elly Bay (0D479) and Doolough Strand (0D490). In particular, Broadhaven Bay was observed to be an important subsite for subtidal foraging. In addition, Trawmore Bay (0D493) supported significant proportions of foraging birds.

IWeBS data shows that high counts of Red-breasted Merganser have been recorded in most of the small sandy bays around the inner bay, notably at Saleen Harbour, Aghleam Bay, Seafield Bay, Claggan Strand, Elly Bay, Trawmore Bay and Doolough Bay & Strand.

Suddaby (2016) recorded the largest number of Red-breasted Merganser using shallow waters close to shore. Overall average numbers were 93 (± 7.8), with a slightly higher number noted during the winter; 108 (± 5.6) (i.e., December to February). Birds were generally encountered in mixed sex groups of 6-10; with larger groups of up to 25 particularly off Saleen Harbour (OD478) and Seafield Bay (OD477).

As noted above, the NPWS low tide survey programme found Red-breasted Merganser to be widely recorded within Blacksod Bay / Broadhaven SPA. Merganser were recorded in a total of 14 subsites, but only four subsites supported mergansers on all four low tide counts: Broadhaven (0D438), Seafield Bay (0D477), Elly Bay (0D479) and Doolough Bay (0D490). Large numbers also occurred in Trawmore Bay (0D493) (this site recorded peak subsite numbers of 58 in October 2009 surpassing the threshold for national importance in its own right). Thereafter, Broadhaven (0D438) held the largest numbers (41, Nov. 2009; 32, Dec. 2009 & 22, Feb. 2010). These sites were also noted as important foraging sites; with key foraging sites noted as being Broadhaven, Seafield Bay and Trawmore Bay. Broadhaven Bay (0D438) supported the greatest proportion of foraging merganser within all NPWS low tide survey (between 30% and 65%). IWeBS figures also show Broadhaven Bay routinely supporting as many as 50 Red-breasted Merganser (peak count of 79 on 23rd January 2011); i.e., over the national threshold for Red-breasted Merganser in its own right.

The population trend for Red-breasted Merganser is Favourable (+23.5) at a site level, and Stable for all-Ireland NPWS, 2014a). Lewis *et al* (2019) put recent national trends for Red-breasted Merganser at -18.4 (5 year) and -8.1 (12 year).

Red-breasted Merganser feed on both fish and crustaceans. Fish species taken include sand gobies, herring and sprat, coalfish etc. They also feed on invertebrates such as small shore crabs, mysids (shrimp like crustaceans) and common shrimp. Therefore, the major prey resources for the Red breasted Merganser in subtidal waters of Blacksod Bay / Broadhaven SPA may include a mixture of benthic invertebrates and demersal and pelagic fish.

Roycroft *et al*. (2004; 2007) studied the interactions of waterbirds and seabirds (mainly divers, cormorants, gulls, and auks) with suspended mussel culture in deep subtidal habitat in Bantry Bay. This study found no evidence of adverse impacts from suspended mussel culture on waterbirds and seabirds. While Roycroft et al.'s study did not include Red-breasted Merganser, the range of species covered by their study does provide evidence that fish-eating species in general are not affected by

suspended mussel culture, and suspended mussel culture may actually increase prey resources for these species (see above). As the impacts of seaweed culture are comparable (and less in terms of deposits) seaweed culturing is unlikely to cause direct impacts to Red-breasted Merganser.

T10/319A (Broadhaven Bay) and T10/320A is located just outside Doolough Bay, are both already licenced for seaweed cultivation. Normally merganser counts within the Doolough Bay are <10 (in line with Suddaby, 2016); though a count of 24 birds was recorded by IWeBS in February 2002. T10/296A is located outside Elly Bay; merganser counts here are variable, but have been as high as 29 (noted as 11-20 by Suddaby, 2016). It is probable that there is interchange of birds between subsites along the western side of the bay.

Broadhaven is a very important site for Red-breasted Merganser. As is the case for Common Scoter the placement of a ca. 10 hectare site within the inner bay will not result in a significant loss of habitat; in fact, it is possible that by acting as fish attracting devices that these might in fact have a positive impact on merganser. As noted for scoter the potential for disturbance must also be considered. In a recent study of merganser in Wexford Harbour we have found that mergansers have a high degree of behavioural sensitivity to disturbance from marine traffic (Gittings and O'Donoghue, 2016b). However, it is not clear whether this sensitivity is a general pattern, or whether it is due to some site specific factor (e.g., boat based hunting of other wildfowl in Wexford Harbour). On site works are as set out in Chapter 1.0 and paragraph 7.2.1; on this basis and given the availability of suitable alternate habitat, it is very unlikely that this level of site attendance and associated boat traffic would result in anything other than a temporary displacement of birds away from the seaweed site. The risk of seaweed culturing at the scale proposed causing significant disturbance to Red-breasted Merganser is therefore considered low.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are not anticipated to negatively impact upon Red-breasted Merganser.

6.2.1.4 *Sandwich Tern*

While Sandwich Tern also feeds in subtidal waters the main period of operation within the licence blocks is over the winter months; Sandwich Tern are absent from Blacksod Bay / Broadhaven SPA and will not be impacted during these months. The scale of operations proposed will not impact a significant proportion of the area of suitable subtidal foraging habitat used by Sandwich Tern, which can feed as far as 50km from their nesting site.

The main time where impact could occur is during the April – June harvesting window. As noted Sandwich Tern nest on Inishderry Island (along with large numbers of Black-headed Gull (170 individuals counted in 2016) and small numbers of breeding Common Gull, Herring Gull, Lesser Black-backed Gull, and Great black-backed Gulls) (note that Sandwich Tern have also bred on Carrowmore Lake to the southeast). This is close to the licence plot T10/319A (Broadhaven Bay). Association with

Black-headed gulls is a common feature of Sandwich Tern nesting sites as happens at Inishderry. Sandwich Tern are one of the earliest tern species to return from their wintering grounds; they are often back in Ireland by as early as mid-March and back on the nesting ground by mid-April. However, Sandwich Tern differ from other terns in that pre-laying activity tends to take place away from the breeding site. Most chicks hatch in late May – early June (incubation – 25 days); and fledge in late June to July (fledging – 29 days). Egg laying can be highly synchronised and is likely to be in early May on Inishderry.

This places harvesting at the same time as nest establishment and incubation on Inisherry Island (Cabot and Nisbet, 2013). T10/319A is less than 375m from Inishderry Island.

Sandwich Tern has a reputation for being easily disturbed; they are known e.g., when disturbed early in the season by a predator to abandon the site *en masse* and move to another breeding site. However, Sandwich Tern also nest on Inish Island, Lady's Island, Co. Wexford very close to an active pilgrim pathway suggesting they can readily adapt to consistent patterns of activity under certain circumstances. The concern at Inishderry relates to uncertainty as to the impact from a short, but focused, period of boat based / noisy activity coinciding with the early stages of nest establishment, egg laying and incubation; this risk cannot be entirely discounted at Inishderry due to the proximity to the nesting site.

However, as noted the numbers nesting on the island are significantly reduced – with predation seeming to be a significant issue. That said, any such risk of colony abandonment could be mitigated, however, by undertaking habitat enhancement at the nearby Carrowmore Lake site to ensure this site is managed to promote breeding by Sandwich Tern and other tern and gull species.

6.2.1.5 *Other notable diving species*

Large numbers of **Red-throated Diver** were recorded off Feorinyeoo Bay and Elly Bay; as well as south west of Doolough Point by Suddaby (2016). Boland and Crowe (2014) noted that Blacksod & Tullaghan Bay is no longer of significance for Red-throated diver (mean / peak 2004-2008 of 14 / 28 birds). However, the overall mean of 49 (± 8.2) and spring mean of 70 (± 11.3) noted by Suddaby (2016) are both well in excess of the national threshold of 20 birds.

Lough Swilly and Blacksod & Tullaghan Bay are the two sites from which Slavonian Grebe is most regularly recorded and in largest numbers (Boland and Crowe, 2014). The threshold for international importance is 55 birds; no national threshold has been specified.

An overall mean of 33 birds (± 4.3) and winter mean of 35 birds (± 6.0) was noted by Suddaby (2016); unlike the diver species numbers of **Slavonian Grebe** were higher in winter (December – February) than spring (March – April). Most birds occurred in the northern or inner parts of Blacksod Bay; as well as generally in count sectors closer to shore (unlike the divers and scoter). Slavonian Grebe is not likely to be negatively impacted by seaweed cultivation.

6.2.2 Bottom oyster cultivation

This component of the activity will only potentially affect Qualifying Interest species that make significant use of subtidal waters as a feeding habitat. Because the areas used for oyster bottom culture will generally be below the lowest astronomical tide, species that only feed in intertidal

habitats and shallow subtidal habitat are unlikely to be affected. These species generally feed in water depths of less than 0.5m and will, therefore, only be able to utilise habitat below the lowest astronomical tide level during the lowest spring tides (< 20% of all low tides). Therefore, the species potentially affected are those that can feed in deep subtidal waters. As noted, large *Zostera* beds are present in T10/028A and T10/028B; these are an important food resource for Light-bellied Brent Geese. However, as commercial dredging over this protected habitat will not be permitted (refer to SAC AA), there will be no impact on Light-bellied Brent Geese.

In the absence of any activities in the intertidal zone and the limited impact predicted for shallow subtidal waters (<0.5m); intertidal waders (i.e., Ringed Plover, Dunlin, Bar-tailed Godwit, Curlew and Dunlin *schinzii*) and Light-bellied Brent geese are unlikely to be impacted and are not considered further.

Red-breasted Merganser, Great Northern Diver and Sandwich Tern are mainly fish-eating species. As bottom oyster culture is considered unlikely to negatively affect fish populations (and may in fact have a positive impact), potentially negative impacts from habitat alteration due to bottom oyster culture to Red-breasted Merganser, Great Northern Diver and Sandwich Tern are considered unlikely and are not discussed further. Furthermore, it should be noted that the existing oyster beds covered by licence T10/028A and T10/028B coincide with those areas favoured by Red-breasted Merganser (Suddaby, 2016; IWeBS data) in Blacksod Bay; though this may also be a result of the intertidal & subtidal reefs and *Zostera* beds acting as important fish nursery areas; thereby providing fish in the size range favoured by Red-breasted Merganser.

Common Scoter feed on molluscs and other benthic invertebrates. However, oysters do not appear to have been recorded in their diets (Fox, 2003). It is not clear whether Common Scoter target blue mussel that can attached to oyster shells. Furthermore, the areas favoured by Common scoter do not overlap to any significant extent with the bays proposed for oyster culture (though they are noted from Trawmore Bay which overlaps in part with the eastern end of T10/028B).

The harvesting of oysters will cause disturbance impacts to Qualifying Interest species that use deep subtidal waters. This will occur between February and March each year in which a harvest is permitted by the Co-op. and will normally occur over a period of 8 days. Sandwich Tern will be largely absent from the site at this time. While Common Scoter are sensitive to disturbance by boats, as noted the area covered by T10/028A and T10/028B; is at its closest ca. 2.5km from these licence blocks.

Blacksod Bay is a significant site for Great Northern Diver; numbers of Great Northern Diver in Blacksod Bay also appear to increase in spring (March – April). While Great Northern Diver does occur in the northern / inner bay (including T10/028B) they do so in smaller numbers than in the outer bay (i.e., south of Ardmore Point / Claggan Point). Good numbers of Great Northern Diver occur in Saleen Harbour and Elly Bay, though they do in general appear to favour waters further offshore, including just outside the licence blocks T10/028A and T10/028B. The area characterised by *Serpula vermicularis dominated* reef, which would support large numbers of crabs, a favoured food item, seems to be especially favoured (including off Feorinyeeo Bay OD414 to the south). As noted, Great Northern Diver do not appear to be particularly sensitive to disturbance from small boats (see Gittings *et al*., 2015).

Unlike Great Northern Diver, Red-breasted Merganser favours shallow inshore waters. Key sites used coincide with the oyster cultivation sites. However, given that these beds have been in place since the

19th Century the possibility that the presence and management of oyster beds provides a habitat favoured by Red-breasted Merganser cannot be discounted. As noted recent work in Wexford Harbour has shown that Red-breasted Merganser are sensitive to disturbance by small boats (Gittings and O'Donoghue, 2016b); however, it is not clear whether this sensitivity is a general pattern or is due to some site-specific factor at Wexford (there is e.g., some evidence of hunting wildfowl from small boats; while Red-breasted Merganser is not a quarry species associated disturbance may have resulted in this sensitivity to small boats).

As noted harvesting would take place over no more than 8 days between February and March (spring). This would suggest that the potential for disturbance is quite limited. The fishery is a very small, but sustainable fishery. In the past fishing has been concentrated in the Belmullet Area (i.e., Seafield Bay and to the east in deeper water). This is consistent with the observed distribution of oyster as noted by Tully and Clark (2012). A fishery of this scale and duration is very unlikely to significantly impact Red breasted Merganser; and as noted the oyster beds do in fact appear to be a favoured habitat of Red breasted Merganser in Blacksod Bay. As such, its ongoing management to ensure thee oyster beds are sustainable would be the favoured option. Furthermore, it should be noted that the conservation status of Red-breasted Merganser in Blacksod Bay is Favourable (showing an increase of +23.5 over the 14 year period of 1995/96 – 2009/10).

6.2.2.1 *Other SPA / Species*

As noted above adjoining SPAs support a range of species whose foraging range could theoretically overlap with the areas of oyster beds. These include e.g., Cormorant, Shag, gulls (Herring, Common and Lesser Black-backed) and terns, such as Arctic and Little.

In the case of Cormorant these are widely distributed throughout the SPA, with large numbers in the inner bay as well as Elly Bay (OD479) and off Claggan (OD494) (Suddaby, 2016). In contrast, while Shag also occur in small numbers through Blacksod Bay, the main site is off Blacksod Point. The key harvesting period is from February to March when breeding Arctic and Little Tern are absent from the site. Nesting gulls, such as Herring, Common and Lesser Black-backed, can feed on a range of terrestrial, intertidal, and subtidal prey items. After breeding they can disperse widely, with for example many Lesser Black-backed migrating as far south as Portugal for the winter.

The scale of the proposed harvesting activities and associated low risk of disturbance, relative to the distance from known breeding sites and the availability of large areas of alternated foraging grounds is such that these species are unlikely to be impacted. Furthermore, as fish eating species, the potential for the oyster beds to enhance habitat structural diversity and in this way provide greater foraging opportunities for fish eating species cannot be discounted.

6.2.2.2 *Conclusions*

Therefore, for most species there are no potentially significant impacts that are likely to arise from the cultivation and harvesting of oysters in subtidal waters. While the potential for impacts on Red-breasted Merganser would appear to be low, a potential mitigation measure worth considering is that harvesting does not occur within all three favoured areas on the same days; thus, if birds are displaced suitable alternate habitat does occur within which they can temporally forage. The status of Red-breasted Merganser in Blacksod Bay (as well as other diving species) should also continue to be monitored against annual fishing effort / location.

6.2.3 Intertidal Oyster cultivation (Intertidal & Shallow Subtidal Species)

Licence application T10/347A by Dooriel Fisheries Ltd. is for the **intertidal cultivation** of Pacific oyster (*Magallana gigas*) in Trawmore Bay, Inner Blacksod Bay over an area of 11ha.

6.2.3.1 *Light Bellied Brent Goose*

Results from the NPWS baseline waterbird survey show that the highest proportions of Light-bellied Brent geese were recorded at the following subsites: Claggan Strand (0D494), Seafield Bay (0D477), Blacksod Point (0D415) and Sruwaddacon Bay (0D475) for the four low tide surveys, respectively (NPWS, 2014). In addition, Doona Strand (0D469) in Tullaghan Bay was also shown to contain high numbers of foraging geese in an area of intertidal sandy and mixed substrate shoreline which had variable levels of algal growth (NPWS, 2014). In fact, during low tide surveys the majority of Light-bellied Brent geese were recorded foraging intertidally (NPWS, 2014). At, Sruwaddacon Bay, Brent Geese were mainly recorded foraging on an area of algal-covered sand and gravel, west of Glengad at the mouth of the subsite (Sruwaddacon Bay). The same foraging pattern has been documented in previous surveys in the area (EACS, 2010; FTC, 2009; EACS/WWC, 2006 cited in NPWS, 2014).

During the roost survey for the baseline waterbird survey in February 2010, the largest aggregations of roosting Brent geese were observed in Doolough Bay & Strand (0D490 – 24 birds) and Blind Harbour (0D495 – 22 birds) (NPWS, 2014).

IWeBS counts for Blacksod and Tullaghan Bay, indicate that high counts (greater than 200 birds) have been recorded in Trawmore Bay (0D493), Doolough Bay & Strand (0D490), Claggan Strand (0D494), Seafield Bay (0D477), Corraun Bay (0D491) and Blacksod Point (0D415). Furthermore, NPWS (2014b) identify that Trawboy–Cregganroe (0D468) and Birranbaun (0D459), both in Tullaghan Bay, are regular Brent goose roosts with Doolough Strand (0D490) noted as an occasional but important roost at certain times.

Light-bellied Brent geese are feeding on intertidal habitats and shallow waters to no more than 0.5m depth. As noted Light-bellied Brent geese will not be affected by subtidal aquaculture sites such as seaweed cultivation or subtidal oyster cultivation; though they are known to float in over trestles on the rising tide and feed on attached green algae.

While they do occur in Trawmore Bay, it is not one of the more favoured areas for use by Light-bellied brent geese, and they are widely distributed around Blacksod Bay. The area of the licence application is 11 ha (T10/347A), located centrally within the bay (with a length along the tidal from likely to be ca. 325m). It is not likely to significantly impact upon Light-bellied brent geese using the SPA given the habitat type upon which it is to be placed. The structures may in fact provide additional foraging opportunities in terms of green algae that grow on the bags and trestles.

T10/347A is not therefore anticipated to negatively impact upon Light Bellied Brent Goose populations within the Blacksod Bay / Broadhaven SPA.

6.2.3.2 *Bar-tailed Godwit*

Gittings and O'Donoghue (2012; 2016a) found Bar-tailed Godwits to be negatively associated with oyster trestles; with observed numbers within the oyster trestle blocks lower than the predicted numbers.

There are very little data available on the tolerance of foraging Bar-tailed Godwit to disturbance in intertidal areas. Smit and Visser (1993) reported mean flight initiation distances of 219m (range 150225m) when approached by people walking over the tidal flats on the Dutch Wadden Sea. In the Delta area this was reduced to a mean distance of 107m (range 88-127m). The behaviour of the people was also significant as bait diggers working at the same spot for longer periods (similar to workers at oyster trestles) were tolerated at shorter distances than a walking person. However, as noted above for Sanderling these studies tended to consider people walking directly at feeding flocks of birds, rather than the consistent pattern of activity within the trestles to which birds may habituate.

Townsend and O'Connor (1993) studied the effects of bait-digging at Lindisfarne, north-east England on various wader and wildfowl species. In years when bait-digging was permitted on all parts of the study bay numbers of Bar-tailed Godwit were substantially lower (76-90%) than in years when no bait digging occurred. It was assumed that the majority of the birds were prevented from feeding here by the presence of bait-diggers. Dias *et al*. (2008) studied the effects of bait-digging and traditional shellfish gathering in waders in the Tagus Estuary, Portugal. They calculated that where the disturbers were present at a density of 0.01 per 10ha of foraging area then Bar-tailed Godwit were disturbed from a mean area of 0.6% (0.2-1.4%) of their available foraging area. They concluded that traditional shell fishing has much more potential to affect waders through disturbance than through the removal of prey. Care must be taken, however, when extrapolating from these studies as bait-digging and traditional shellfish gathering often involves gatherers widely dispersed through the estuary – resulting in a disproportionately high level of disturbance (*per obs* Ballycotton Bay, Co. Cork).

Recent observations from the trestle farm in Dungarvan would suggest that habituation may also play an important role; a flock of over 400 Bar-tailed Godwits feeding along the tideline below the trestles on-site (February 2014; T. Gittings *per obs*) were not flushed by passing tractor traffic; birds responded briefly to the presence of the tractor before resuming feeding. The above would suggest that foraging Bar-tailed Godwit can habituate to oyster maintenance activities in a specific fashion. As for Sanderling, however, dogs on site result in a significant negative impact as noted it will therefore be a condition of any licence that operators may not bring dogs onto the shore.

The peak count of Bar-tailed Godwit during the low tide counts was 910; while the peak high tide count was 1,386. The latter is of international importance. On occasion Aghleam Bay and Elly Bay have each recorded just over 70 Bar-tailed Godwit; a range of other sites do on occasion host 1-50 birds. As noted above Corraun Bay has also recently supported increased numbers (300 were recorded in November 2011 and 440 in December 2012). Trawmore Bay, however, is unequivocally the most important site for Bar-tailed Godwit in Blacksod Bay with a peak count of 1,300 birds. During the NPWS low-tide survey the site has supported 75%, 49% and 67% of the total numbers present on the 22/10/09, 03/12/09 and 18/02/10, respectively. All counts surpassed the national threshold. Flock maps from the NPWS low tide survey were also examined; these show Bar-tailed Godwit flocks in the southern part of the bay (off Srah) and north of the tidal channel; however, given the limited number of observations these data on spatial data should be interpreted cautiously.

Assuming a peak count of 1,386 birds; and a maximum occupation rate of up to 75% of the total number of foraging birds (see above) we must assume that Trawmore Bay can support routinely

support up to and over 1,000 Bar-tailed Godwit (the current threshold for international importance is 1,500 birds; Lewis *et al.,* 2019)

The baseline waterbird survey also observed that Trawmore Bay was an important high tide roosting location with additional roosting birds at Elly Bay, Saleen Harbour and Doolough Bay & Strand (NPWS, 2014b). During the dedicated roost survey, the majority of Bar-tailed Godwits were observed roosting intertidally along the tide line (NPWS, 2014b).

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. 3.4% of available habitat with Tramore Bay. Based upon a peak percentage occurrence (of the SPA population) of 75% within Trawmore Bay (0D393) this would equate to potential displacement of no more than 2.55% of Bar-tailed Godwit within the SPA. Furthermore, the length of the tideline as it passes T10/347A is 3.075km in length; approximately 325m or 10.5% of the tideline will be unavailable to Bar-tailed Godwit as it passes through the application site in Trawmore Bay. Like many waders, Bar-tailed Godwit are notable for following the tideline when foraging.

T10/347A is not therefore anticipated to negatively impact upon Bar-tailed Godwit populations within the Blacksod Bay / Broadhaven SPA.

6.2.3.3 *Dunlin*

Unlike Bar-tailed Godwit, Dunlin is typically associated with a muddier substrate. Like Bar-tailed Godwit, Dunlin is also negatively associated with oyster trestles (Gittings and O'Donoghue, 2012; 2016a). Trawmore Bay supported peak numbers of Dunlin on two of the NPWS low tide counts (NPWS, 2014b); (66 and 337 birds on 5/11/09 and 3/12/09, respectively).

Other notable sites included Tullaghan Bay (OD489; peak count of 269, February 2010), Trawkirtan (OD474; peak count of 127 in February 2010) and Mullet / Leam Lough (OD050; peak count of 407 in February 2010). As a percentage Trawmore Bay has supported as much as 31.75% and 49.6% of the Dunlin counted during the NPWS low tide surveys in Blacksod Bay / Broadhaven SPA.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with Tramore Bay. Focusing just on the Mullet / Blacksod Bay Complex SAC the area of available sandflat and mudflat not covered at high tide (1140) is 1427.82ha. The area occupied by trestles at Trawmore amounts to 0.8% of such habitat (though based on preference for muddier substrate all this habitat will not be available to Dunlin). Based upon a peak percentage occurrence (of the SPA population) of 49.6% this would equate to potential displacement of no more than 1.7% of Dunlin within the SPA.

Thus, licencing of T10/347A is not predicted to negatively impact upon Dunlin within Blacksod Bay / Broadhaven SPA.

Dunlin (*schinzii*) are not breeding near any of the proposed aquaculture operation and will not be negatively impacted by the proposed licence applications.

6.2.3.4 *Curlew*

The NPWS baseline waterbird survey results show that Curlew are the most widely distributed SCI species across the Blacksod/Tullaghan Bay/Broadhaven Bay complex, with birds recorded on most areas of exposed intertidal sediment during surveys (a total of 22 subsites). However, while four subsites were identified to hold the greatest proportions of Curlew, the proportions were still relatively low, further supporting the view that the species were widespread across the site and did not readily form large aggregations (NPWS, 2014b) (the four site were Broadhaven Bay (0D438), Trawkirtan (0D474), Sruwaddacon Bay (0D475) and Trawmore Bay (0D493)). This is supported by IWeBS data where Curlew are recorded in a large number of subsites across counts. IWeBS data also identifies Aghleam Bay, Trawmore Bay and Elly Bay as regular roosting sites (NPWS, 2014b).

During the roost survey for the baseline waterbird survey, relatively large roosting flocks were identified in Sruwaddacon Bay and Saleen Harbour, using both the intertidal and supratidal zones. The high tide survey also showed that significant numbers of roosting birds were recorded in Elly Bay, Broadhaven Bay and Aghleam Bay (NPWS, 2014b).

The relationship between Curlew and oyster trestles varied from positive to neutral across sites in a study of the impact of oyster trestles on waterbird distribution (Gittings and O'Donoghue, 2012; 2016a).

The peak percentage occurrence of Curlew within Trawmore Bay was 19.15% of the birds counted on the 5/11/2011 NPWS low tide count. Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with Tramore Bay. Focusing just on the Mullet / Blacksod Bay Complex SAC the area of available sandflat and mudflat not covered at high tide (1140) is 1427.82ha. The area occupied by trestles at Trawmore amounts to 0.8% of such habitat (though based on preference for muddier substrate all this habitat will not be available to Curlew). Based upon a peak percentage occurrence (of the SPA population) of 19.15% this would equate to potential displacement of no more than 0.62% of Dunlin within the within the Trawmore Bay (0D393), and substantially less within the SPA.

T10/347A is not therefore anticipated to negatively impact upon Curlew populations within the Blacksod Bay / Broadhaven SPA.

6.2.3.5 *Ringed Plover*

Spatial Distribution

Ringed Plover were consistently recorded in six subsites on all four baseline waterbird surveys. These subsites were Blacksod Point (OD415), Aghleam Bay (OD480 &. Feorinyeeo Bay; OD414), Elly Bay (OD479), Broadhaven Bay (OD438), Trawkirtaun Estuary (OD474) and Blind Harbour (n.a.). Based on flock numbers alone, three subsites recorded the greatest proportions of Ringed Plover during the four low tide surveys; namely were Tullaghaunnashammer (0D410), Trawboy-Cregganroe (0D468) and Trawkirtaun (0D474). Trawkirtaun estuary supported the greatest proportion of Ringed Plover on two of the low tide counts and during the high tide count. This subsite was identified as the most important

subsite for foraging Ringed Plover during the baseline waterbird survey (NPWS, 2014b). As noted there are no aquaculture sites in Trawkirtaun; or in Tullaghaunnashammer.

IWeBS data for the Blacksod and Tullaghan Bay site shows that the largest flocks of Ringed Plover have been recorded in the subsites of Trawmore Bay (OD493), Birranbaun (0D459) and Elly Bay (OD479). However, Ringed Plover are most consistently recorded in the subsites of Aghleam Bay (OD480), Elly Bay (OD479), Feorinyeeo Bay (OD414), Seafield Bay (OD477) and Leam Lough (off Elly Bay).

Overall, Elly Bay (OD479) has been identified as the most important roosting subsite for Ringed Plover where they roost in mixed flocks in the upper shore (NPWS, 2014b). The main source of potential conflict is again at Trawmore Bay (i.e., application T10/347A) though potential for land based activities to impact on e.g., roosting at other sites is also considered below.

Trawmore Bay is not noted to be one of the main sites for Ringed Plover. The peak count is generally less than 30 birds; however, on 5th November 2009 76 Ringed Plover were counted, representing 9.1% of the SPA population on that day.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with Tramore Bay. Focusing just on the Mullet / Blacksod Bay Complex SAC the area of available sandflat and mudflat not covered at high tide (1140) is 1427.82ha. The area occupied by trestles at Trawmore amounts to 0.8% of such habitat (though based on preference for muddier substrate all this habitat will not be available to Curlew). Based upon a peak percentage occurrence (of the SPA population) of 19.15% this would equate to potential displacement of no more than 0.62% of Dunlin within the SPA.

T10/347A is not therefore anticipated to negatively impact upon Ringed Plover populations within the Blacksod Bay / Broadhaven SPA.

6.2.3.6 *Sanderling*

The NPWS baseline waterbird survey shows that foraging Sanderling were recorded consistently at five subsites Blacksod Point (0D415), Aghleam Bay (0D480), Doolough Bay & Strand (0D490), Trawmore Bay (0D493) and Blind Harbour (0D495). Interestingly, the peak count for Sanderling during any given count was not within one of these five regular used subsites, with the exception of Blacksod Point; peak numbers were variously recorded in Trawboy-Cregganroe (OD468; in Tullaghan Bay), Feorinyeeo Bay (OD414), Blind Harbour (0D495) and Blacksod Point (0D415) for four of the counts, respectively (NPWS, 2014b).

During the high tide survey, the main Sanderling roost was recorded in Elly Bay (OD479). Furthermore, during the roost survey, addition roost locations were observed at Doona Strand (OD469) and Blacksod Point (0D415) (NPWS, 2014b).

Further studies quoted by NPWS (2014a) indicates that regular roosts have been recorded at Aghleam Bay and Leam Lough (off Elly Bay). Other roost locations have been noted at Doona Strand (OD469), Kanfinalta Point (OD901), Blind Harbour (n.a.) and at Termoncarragh Lake (OD020) (NPWS, 2014b).

IWeBS data shows that many of the largest flocks recorded have been observed in the Tullaghan Bay subsites, Aghleam Bay (0D480) and at Doolough Bay & Strand (OD490).

The main areas favoured coincide with *Fine sand with Angulus fabula* and *Sand to coarse sediment with crustaceans and Polyophthalmus*; a habitat also favoured by Dunlin, Bar-tailed Godwit and to a lesser degree Ringed Plover.

While sites along the western side of Blacksod Bay have been noted as being important for Sanderling there are no proposals for intertidal aquaculture in these areas.

There are no proposals for aquaculture at Trawboy–Cregganroe (0D468), Doona Strand (OD469), Kanfinalta Point (OD901), Blind Harbour (n.a.) or at Termoncarragh Lake (OD020). The main area of potential impact, as noted above for other species, is therefore at Trawmore Bay (0D493).

Sanderling does not generally occur though in Trawmore Bay in very large numbers. The peak count only coming to 10 birds on the 18/10/2010. Trawmore Bay represented 5.68% of the Sanderling SPA population on this count; however, as the overall count on this day was low, this may have inflated the percentage value. Sanderlings are notoriously difficult to count, however, and on other days during the NPWS low tide survey, when larger and more representative counts were noted the percentage importance of Trawmore Bay (by count) declined to 2.52%. Like Bar-tailed Godwit, Sanderling are believed to show a negative response to trestles (Gittings and O'Donoghue, 2016a), though the dataset was small for this species.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with Tramore Bay. Based upon a peak percentage occurrence (of the SPA population) of % this would equate to potential displacement of no more than 0.62% of Sanderling within the SPA.

T10/347A is not therefore anticipated to negatively impact upon Sanderling populations within the Blacksod Bay / Broadhaven SPA.

6.2.4 Assessment

6.2.4.1 *Wetlands and Waterbirds [A999]*

The wetland habitats within Blacksod Bay / Broadhaven SPA and the waterbirds that utilise this resource are an additional SCI (the wetlands and water birds SCI). The conservation objective for this SCI is to maintain its favourable conservation condition, which is defined by there being no significant decrease in the permanent area occupied by subtidal, intertidal, supratidal and lagoon and associated habitats. None of the activities being assessed will cause any change in the extents of subtidal, intertidal, supratidal and lagoon habitats. All structure ae temporary and can be removed from site. Therefore, the activities being assessed are not likely to have any significant impact on this SCI and it has been screened out from any further assessment.

6.3 Introduction of non-native species

As outlined in the screening exercise, oyster culture may present a risk in terms of the introduction of non-native species as the Pacific oyster (Magallana gigas) itself is a non-native species. Recruitment of M. gigas has been documented in a number of Bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann et al., 2012; 2013) and may

compete with the native species for space and food. In addition to having large number of oysters in culture, Kochmann et al., (2013) identified short residence times and large intertidal areas as factors likely contributing to the successful recruitment of oysters in Irish bays. Furthermore, increased recruitment of M gigas has been recorded in other bays in Ireland in more recent years (Marine Institute). For the most part, oyster production in Blacksod Bay is considered low, yet availability of suitable habitat intertidally is considered high. In addition, the residence time in the bay has been estimated as approximately 28 days (Dabrowski 2017) which exceed the broad threshold of 21 days considered necessary for oyster larval development. Therefore, on the basis of the risk criteria (residence time) listed above, the risk posed by oyster culture in the SAC to the QIs for habitats in the SAC cannot be discounted.

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

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

The risk posed by extensive aquaculture operations are identified above. There are potentially a number of other disturbing activities that are carried out within the Mullet/Blacksod Bay Complex SAC that may act in combination with the proposed shellfish culture operations.

7.1 In-combination effects with Inshore fishing

Fishing

Inshore fishing occurs in Mullet Blacksod Bay Complex SAC. Information and Figure 7-1 are derived from Inshore Fishing Maps (Ireland's Marine Atlas - http://atlas.marine.ie/#?c=53.9108:-15.9082:6: Accessed: 27/07/2027) and the Fisheries Natura Risk Mitigation Plan in Mullet Blacksod Bay Complex SAC (Marine Institute 2015).

Aquaculture activities will have a disturbing effect on some sedimentary communities summarised above.

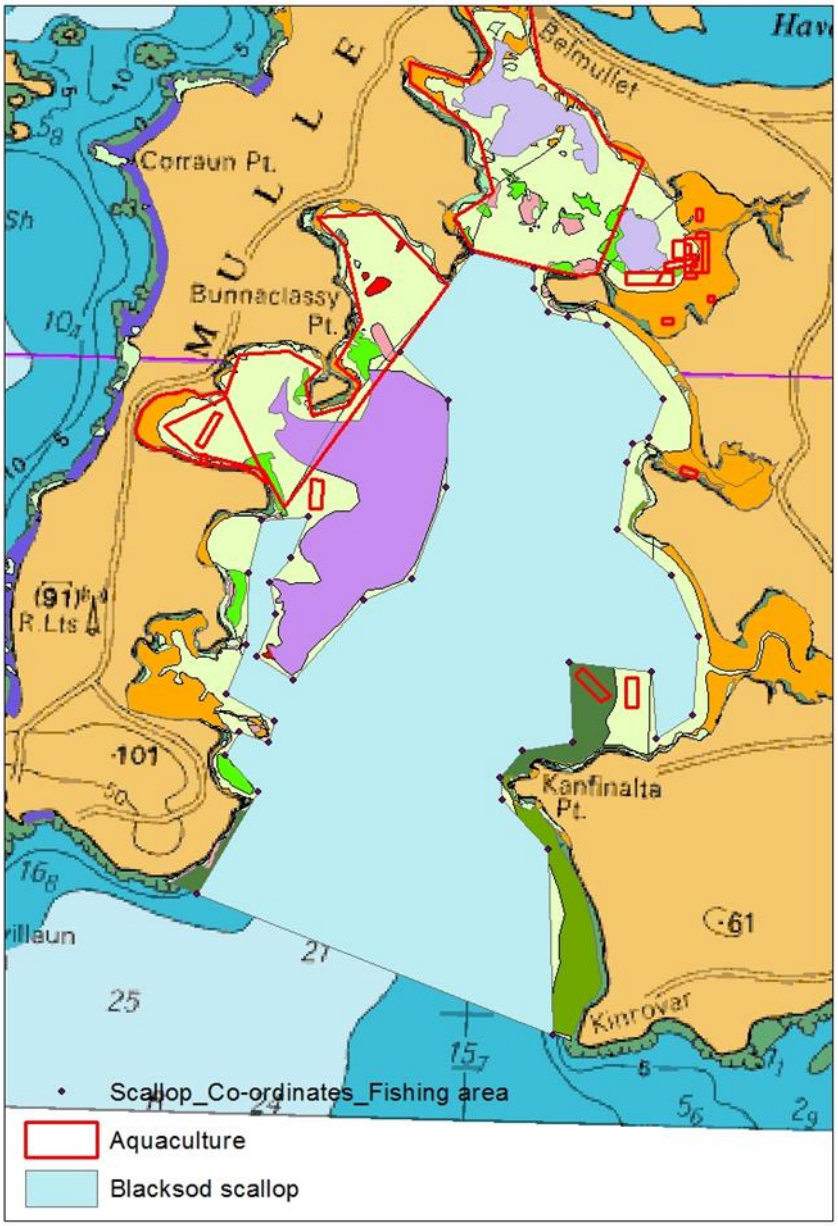


Figure 7-1 Proposed Fishing activity areas by vessels under 15m on foot of Fisheries Natura Risk Mitigation Plan in the vicinity of Mullet/Blacksod Bay Complex SAC.

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 (2015) 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, 2015). There is no overlap between intertidal aquaculture and scallop fishing. Therefore, the likely disturbance to the QI 1140 and the intertidal sedimentary communities result from access routes to aquaculture sites. These values in terms of spatial extent are low and well below the 15% threshold for all disturbing activities (Table 4-4).

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). However, given the difficulties encountered operating a dredge in the *Laminaria*-dominated area, this overlap is incidental and the activity is unlikely to occur.

The scallop fishery will overlap with greater than 15% of sedimentary habitats in QI 1160. To maintain these habitats in favourable conservation status the fishing season is limited so that the significant habitat disturbance caused by scallop dredging is not persistent. In addition, at the time of preparation of this report, there are no known applications a Classified Production Area for scallop for the area (SFPA[20]).

A shrimp fishery occurs in Blacksod Bay. 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 action. This plan removed the risk of dredge fisheries on the sensitive habitat type and limited dredging access temporally in order to reduces the extent of persistent pressure on other marine community types and habitats. On the basis of the information above, there are **no in-combination** effects identified between aquaculture and fisheries operations.

Shrimp fishing occurs in Blacksod Bay (see SAC AA prepared by the Marine Institute). This fishery is fished by 4 vessels using 200 pots between October and February for ca. 30 days per year. There is also a whelk fishery. Hook and line fishing is also undertaken in Blacksod (vessels ca. 15m; summer

[20] https://www.sfpa.ie/What-We-Do/Molluscan-Shellfish/Classified-Areas

and autumn); though there is some confusion as to whether vessels in Blacksod are sheltering from adverse weather or actively fishing.

Pots may cause localised abrasion. There is no evidence of bycatch of birds with these fisheries. By definition these are extraction industries, with e.g., removal of shrimp, whelk, and fish from the food chain.

SPAs

While the scallop fishery is mostly outside the SPA, there is the potential for dredging into bays which are within the SPA (e.g., at Doolough and Claggan); even where outside the SPA, however, the potential for impacts on species for which Blacksod Bay / Broadhaven SPA (and indeed other SPAs) has been designated must be considered. Dredging for scallops in subtidal waters is most likely to impact upon subtidal species such as Common Scoter, Great Northern Diver, and Red-breasted Merganser; as well as breeding Sandwich Tern; there is also the potential to impact upon subtidal foraging species from other SPAs, such as Cormorant, Shag, gulls, and terns. The location of dredging is such that there would be no impacts on Broadhaven Bay or Sruwaddacon Bay, though movement of birds between these bays and Blacksod cannot be discounted. However, as the fishery is subtidal there should be no negative impacts on intertidal and shallow subtidal species such as wintering waders and Light-bellied brent geese; other than perhaps disturbance from boats working close to shore.

None of the above species feed directly on scallop, so there would be no loss of food resources. Great Northern Diver feed largely on fish and crab; Red-breasted Merganser and Sandwich Tern on fish and crustaceans and Common Scoter on bivalves (other than scallop). Impacts on these species are therefore going to be due to impacts from dredging on marine communities having a knock on impact on prey availability or through direct disturbance to birds during harvesting.

There appears to be little published literature dealing directly with the risk scallop dredging poses to birds (RSPB, n.a.). There appears to be no evidence of bycatch from scallop dredges. Habitats which support scallop are known to provide refuge for juvenile fish (Løkkeborg, 2005; Craven *et al*. 2012); both Løkkeborg (2005) and Johnsen and Harbitz (2013) report dredge related mortality of sandeel an important prey species for many seabirds. However, sandeel favours sandy substrates whereas slightly coarser habitats favoured by scallop tend to be avoided (Holland *et al*., 2005) thus reducing the risk of negatively impacting birds such as Sandwich Tern and Shag which prey on them.

As previously noted Red-breasted Merganser favour inshore waters (Suddaby, 2016); available evidence would suggest that they do not occur in large numbers in the deep waters within which the majority of scallop dredging occurs. Scallop dredging will not occur in the subtidal oyster beds; these bays support significant numbers of merganser. Inshore dredging can occur in other bays; and as noted Red-breasted Merganser have shown a sensitivity to small boat disturbance in Wexford Harbour (Gittings and O'Donoghue, 2016b); though whether this sensitivity is universal or unique to Wexford is not known.

As no data is available from before the fishery, we have no information on whether Red-breasted Merganser would frequent deeper offshore waters in greater numbers in the absence of a scallop fishery; however, the depth of water relative to their preference for shallow, sheltered bays, would

suggest that the area dredged for scallop in the central bay is less likely to have been a key habitat for Red-breasted Merganser in the past.

While distributed throughout Blacksod Bay (Suddaby, 2016) Great Northern Diver do occur in large numbers along the western side of Blacksod; in an area coinciding with subtidal reef; a habitat which is not to be fished. There is, however, considerable overlap between the fishery and other areas of the bay which also support Great Northern Diver, though in lower numbers / densities. It is not clear to what degree the scallop dredge would damage fish and or crab stocks that are preyed on by divers.

There is significant overlap with the dredge fishery and the distribution of Common Scoter. It is not clear to what degree the scallop dredge would damage bivalves such as *Angulus* in communities such as fine sand with *Angulus fabula*.

Furthermore, as noted both Common Scoter and Red-breasted Merganser are sensitive to disturbance by boats; the fishery would operate between 1st October and 28th February each year; directly overlapping with the occurrence on site of these wintering birds. As noted, while we understand that 12 vessels were involved in the fishery in the spring of 2015; there is currently no data on landings or distribution and duration of dredging effort. In the absence of detailed information on the fishery and equivalent spatial data it is not possible to determine if scallop fishing has influenced the current numbers and distribution of birds.

The conservation status of Great Northern Diver and Red-breasted Merganser are, however, both Favourable (+36 & +23.5, respectively; over the 14 year period from 1995/96 to 2009/10). In contrast the conservations status of Common Scoter is Intermediate (Unfavourable) (-3); though see discussion above which indicates that the counts undertaken in calm count conditions by Suddaby (2016) recorded significantly higher counts were recorded than by IWeBS or NPWS (Cummins and Crowe, 2010; 2014b).

While there is some uncertainty as to the impact of scallop dredging on birds in Blacksod Bay; it is noted that each vessel is now required to carry VMS. When this data becomes available it should be assessed against the known spatial distribution of species for which Blacksod Bay / Broadhaven SPA has been designated in order to ensure that birds are not being displaced by dredging activity and the current population trends are not impacted negatively. Furthermore, behavioural observations should be undertaken to determine whether species such as Common Scoter and Red-breasted Merganser are being negatively impacted by the scallop fishery; while further calm weather counts of subtidal species should be undertaken to build on the data presented by Suddaby (2016). This data will allow for the potential for negative impacts from scallop fishing on birds to be monitored and the fishery managed accordingly. The potential for dredging to damage bivalves upon which Common Scoter forage should also be considered further.

7.2 In-combination effects with other activities

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 used 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 Housing, Local Government and Heritage. At the time of preparation of this report, there are no known foreshore licences for seaweed harvest currently held or proposed for Blacksod Bay.

In addition, on the basis of an examination of the Department of Housing, Local Government and Heritage foreshore database (https://www.gov.ie/en/foreshore-notices/ - Accessed: 08/08/2023) identified no existing or proposed activities on the foreshore or adjacent to the foreshore that may interact with the likely effects resulting from the proposed shellfish culture activities resulting in in-combination effects.

Similarly, a review of other licencing body databases identified no existing or potential activities likely to interact with the proposed aquaculture activities e.g., Mayo County Council planning (Map Viewer Accessed: 08/08/2023) and EPA pressures maps (www. https://gis.epa.ie/EPAMaps/Water: Accessed: 08/08/2023).

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, DHLGH). 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.

Abalone & Sea urchin

In the past, abalone and sea urchin have been commercially grown on the eastern shore of inner Broadhaven Bay at Muings. This facility was a pump ashore land based aquaculture licence which in not currently in operation (BIM, 2016b). Should this site commence operation again it will need to be subject to appropriate assessment. As it is land based the main area of concern is likely be indirect impacts on water quality in the adjoining bay.

SPAs

Beach recreation

Beaches in Blacksod and Broadhaven are popular for walking. Elly Bay (OD479), Mullaghoe (i.e., Feorinyeoo Bay; OD414) and Tramore Bay (OD493) are three of the most popular beaches in Co. Mayo (NPWS, 2014b). These beaches, tend to be most popular during the summer months when wintering waterbirds are largely absent from the SPA; while Sandwich Tern are present throughout the summer they tend not to be disturbed by beach based activities (per sobs). That said, walking (often with dogs)

can be a popular winter activity. NPWS (2014b) noted disturbance from walkers with dogs at Feorinyeoo Bay, Aghleam Bay, Claggan Strand and Blind Harbour. Feorinyeoo Bay in particular received a high disturbance score from walkers (including with dogs).

Elly Beach is backed by an extensive dune system and machair; while this habitat is often used by breeding waders, there is no evidence of recent breeding waders from around Elly (Suddaby et al., 2010). Horse riding was also frequently encountered during the course of the NPWS low tide surveys (in a total of seven subsites).

Disturbance from motorised vehicles was noted by NPWS (2014b) at Blacksod Point, Broadhaven Bay, Saleen Harbour, Aghleam Harbour, Tramore Bay and Blind Harbour.

The Geesala Festival runs from 13th to 20th August each year. This festival includes horse and greyhound racing on Doolough Beech as well as boat racing, angling competitions and an increase to water sports and clay pigeon shooting. However, this occurs outside the season when most of the qualifying interests are on site. There may be some temporary disturbance / displacement to Common Scoter arriving back on site early. Sandwich Tern should not be adversely impacted; in the event that there is localised displacement there is sufficient alternate feeding areas that this should not be significant.

Other sources of disturbance quotes included winkle pickers, aquaculture machinery, other vehicles, and cattle encroaching on the foreshore (NPWS, 2014b).

Water-based recreation

Several angling clubs and tourist businesses exist in the area and are active in both Blacksod and Broadhaven bays. These operate onshore and offshore. Sea angling festivals, which occur in July, may also add to the disturbance factor of water based activity in the area, in conjunction with increased chartered boat activity from the numerous chartered boat businesses on the Mullet Peninsula during peak tourist season; most of these charters, however, tend to head into open waters off the Mullet and not into Blacksod or Broadhaven. Equally sea-angling generally tends to take place in the outer bays and not to any large extent into inner Blacksod and Broadhaven (see e.g., http://www.sea-anglingireland.org/shore%20-%20mayo%202.htm).

A popular educational adventure centre situated in Elly Bay (http://uisce.ie/activities/) operates from April to September (largely outside the season when subtidal species such as Great Northern Diver, Common Scoter and Red-breasted Merganser are on site) and includes a number of water based sports, including wind surfing, sailing, and canoeing. These sports may, however, be practiced by members of the public throughout the year. A marine training centre operates in Broadhaven Bay, which involves the use of powerboats, jets skies and other water activities year round (http://www.marinetraining.ie/).

Hunting & Shooting

While shooting does occur on site we have no information as to its frequency or scale. Mayo shooting grounds (clay pigeons) is located east of Doolough Strand, approximately 250m from the bay. It is not known if noise from clay pigeon shooting causes any localised disturbance to waterbirds using Doolough Bay.

Hand collection of shellfish & bait digging

Hand collection of shellfish occurs on a number of beaches in the Blacksod area, e.g., Aughleam beach for mussels and cockles and Doolough beach for cockles; (from http://www.mayo.me/where-to-pickcockles-and-mussels-in-mayo). Cummins *et al*., (2002) in a *An Assessment of the Potential for the Sustainable Development of the Edible Periwinkle,* Littorina littorea*, Industry in Ireland* did sample a number of sites in Blacksod; however, we are not aware of any information on whether periwinkle picking is actively undertaken within the SPA. NPWS (2014b) recorded hand picking of molluscs in Elly Bay (OD479) and Doolough Bay & Strand (OD490).

While there is reference to bait digging for e.g., lugworm this appear to largely be along shorelines outside the SPA.

Water Treatment

There is one listed urban waste water treatment centre in the area, located south east of Belmullet and discharging into Trawmore Bay (gis.epa.ie/Envision). This UWWT plant had a failed status in 2014. Plans for a new Belmullet Sewerage Scheme are underway; construction commenced on site in July 2016. There are a significant number of individual houses located throughout the peninsula which all presumably have some form of on-site effluent treatment system.

Potential impacts

There is an extensive and complex literature on the impacts of disturbance from human activities on waterbirds in intertidal and shallow subtidal habitats. It is difficult to use this literature to make specific predictions about the nature and extent of potential disturbance impacts as the effects of disturbance vary between species and, within species, vary between sites and within sites. However, in general, with beach walks and/or when access is mainly along the shoreline (i.e., in with little activity in the intertidal or shallow subtidal zone), disturbance impacts, while causing local (a few hundred metres) displacement of birds, does not appear to affect the large-scale distribution of birds across sites (e.g., Colwell and Sundeen, 2000; Lafferty, 2001; Gill *et al*., 2001a/b; Neumann *et al*., 2008; Trulio and Sokale, 2008; Yasué, 2006; but see Burton *et al*., 2002) or survivorship (Durell *et al*., 2007; but see Stillman *et al*., 2012). Disturbance in the intertidal zone will generally have greater impacts (Stillman *et al*., 2012) and, where disturbance rates are high and/or concentrated areas of species food resources are affected, may cause significant impacts to large-scale distribution (Mathers *et al*., 2002) and/or survivorship (Durell *et al*., 2008; Goss-Custard *et al*., 2005; Stillman *et al*., 2012; West *et al*., 2008). However, some studies of shellfish gathering in the intertidal zone have concluded that it does not affect waterbird populations (Dias *et al*., 2008; Navedo and Masero (2007).

Boat activity will generally not affect waterbirds in intertidal and shallow subtidal activity. However, some types of recreational watersports activities can occur in very shallow waters and have been observed to cause disturbance to waterbirds. For example, jet skiers can on occasion travel up tidal channels and across shallowly flooded areas in some sites causing disturbance to important feeding and roosting areas. In some site, kayakers and windsurfers can come close into the shoreline causing disturbance to high tide roosts. These activities will mainly take place around the high tide period but may cause disturbance to feeding waterbirds in intertidal and shallow subtidal habitat on ebb/flood

tides. We have insufficient information on the frequency and distribution of these pressures in Blacksod Bay to comment further.

Activities affecting waterbird food resources

Bait digging and shellfish collecting

Bait digging and shellfish collecting will remove food resources that would otherwise be available for consumption by waterbirds and may also cause mortality to not-target species (Masero *et al.*, 2006). Therefore, if these activities are extensive and/or affect concentrated food resources they could cause waterbird distribution (by causing displacement from depleted areas) and/or survivorship (by reducing the overall carrying capacity of the system).

In Blacksod Bay / Broadhaven SPA, bait digging appears to be a low intensity activity; this compares to bait digger numbers of 46-544 throughout the year in the Masero *et al*. (2006) study. Therefore, it seems unlikely that bait digging is having measurable impacts in terms of resource depletion or physical habitat disturbance in Blacksod Bay / Broadhaven SPA.

Effluent discharge

Organic and nutrient inputs to estuaries increase productivity and may increase food resources for waterbirds. Therefore, adverse impacts to waterbirds might be expected to be caused by declines in organic and nutrient inputs associated with improvements in wastewater treatment There are a number of studies that document the effects of organic and nutrient loading from effluent discharges on the benthic fauna and typically the zones affected by individual discharges are restricted to within a few hundred metres of the outfall (Burton *et al.*, 2002). The available evidence on the effects of nutrient reductions on estuarine waterbird populations is limited but, to date, no significant impacts have been reported (Burton *et al.*, 2002, 2003). One study (Alves *et al.*, 2012) has reported localised (within 100 m) association between wastewater inputs and bird distribution; in this study the outfalls discharged in the intertidal zone and streams of sewage ran across the intertidal habitat. As noted, a new waste water treatment plant is currently under construction at Belmullet. It is not likely that improvements to water quality associated with the new plant outfall will cause a significant reduction in food supply for any of the Qualifying Interest species.

8 Aquaculture Appropriate Assessment Conclusion.

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 2), the likely interaction between this aquaculture and conservation features (habitats and species) of the site were considered. A summary of the conclusions is presented in Table 8-1.

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 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 *Hydrocharition* - type vegetation, and
- 7230 Alkaline fens and 1395 Petalwort *Petalophyllum ralfsii*.

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: In addition to the QIs 1140, 1160 and 1170, 4 of the 11 marine community types (MCT) listed under these QIs were considered for further assessment in the report, on the basis of likely interaction, primarily as a result of measured spatial overlap with existing or proposed aquaculture activities. These MCT are:

- Sand with *Angulus tenuis* and *Pygospio elegans* community complex,
- Fine sand with *Angulus fabula* community complex,
- Intertidal reef community complex and
- Sheltered subtidal reef community complex.

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), the low levels of spatial overlap allied with the relatively high tolerance levels of the habitats and species therein, the general conclusions relating to the interactions between current and proposed aquaculture activities with habitats is that licencing the proposed activities are not likely to result in adverse impacts on the integrity of the Mullet/Blacksod Bay Complex SAC (Site Code: 00470).

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 this species in the SAC focuses primarily upon maintaining good conservation status of the population. Based upon the specific attributes for otter, it is concluded that the current levels of licenced aquaculture operations and proposed applications are considered non-disturbing to Otter (*Lutra lutra*) conservation features.

SPAs

This report Blacksod Bay/ Broadhaven SPA [004037]: Report Supporting Appropriate Assessment of Extensive Aquaculture in Blacksod Bay SPA by Atkins, has examined the potential impacts of the proposed project on the integrity of the SPA, alone and in combination with other plans and projects, considering the site's structure, function, and conservation objectives. It is concluded that the proposed licence applications are not likely to negatively impact on European sites including Blacksod Bay / Broadhaven SPA.

As noted, this assessment draws heavily on NPWS low tide data from 2010/11. The rep[ort recommends that this survey be update in order to inform ongoing management / development of aquaculture in Blacksod Bay / Broadhaven SPA.

As subtidal diving species tend not to be comprehensively covered as part of IWeBS counts, the report also recommend that subtidal diving species, i.e., divers, Red-breasted Merganser, Common Scoter, and Slavonian Grebe be surveyed again to inform ongoing management / development of aquaculture in Blacksod Bay / Broadhaven SPA.

While the potential for impacts on Red-breasted Merganser would appear to be low, a potential mitigation measure worth considering is that harvesting does not occur within all three favoured areas on the same days; thus, if birds are displaced suitable alternate habitat does occur within which they can temporally forage. The status of Red-breasted Merganser in Blacksod Bay (as well as other diving species) should also continue to be monitored against annual fishing effort / location.

For Sanderling, dogs on site result in a significant negative impact as noted it should therefore be a condition of any licence that operators may not bring dogs onto the shore.

Non-native species

Given the residence time of Blacksod Bay (i.e., 28 days) the risk of successful reproduction of the Pacific oyster, *Magallana 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 all current and future oyster culture operations utilise 100% triploid *M. gigas* oysters and the incidence of Pacific oyster recruitment be monitored on an ongoing basis. Triploid oysters are, for the most part, considered reproductively sterile. The implementation of this measure will minimise the risk of recruitment of Pacific oysters and therefore, result in no adverse effect on the integrity of the SAC.

Table 8-1 Summary table of conclusions by site.

(N– No significant adverse effect, P - Adverse effect present, M – Mitigation proposed)

Site No.	Status	Activity/Species	Habitat (QI)	Species (QI)	Non-native species
T10-237	Licensed	Pacific and Native Oyster, Blue Mussel, Periwinkle	N	N	P, M
T10-296A	Licensed	Brown Seaweeds, Red Seaweeds	N	N	N
T10-320	Licensed	Brown Seaweeds	N	N	N
T10-028A	Review Application	Native Oyster - *Ostrea edulis*	N	N	N
T10-028B	Review Application	Native Oyster - *Ostrea edulis*	N	N	N
T10-028C	Review Application	Native Oyster - *Ostrea edulis*	N	N	N
T10-344A[21]	Application	Brown, Red and Green Seaweeds	N	N	N
T10-347A	Application	Pacific Oyster – *Magallana gigas*	N	N	P, M
T10-351A	Application	Native Oyster - *Ostrea edulis* Pacific Oyster – *Magallana gigas*, Blue Mussel – *Mytilus edulis*, King Scallop – *Pecten maximus*, Queen scallop – *Aequipecten opercularis*, Brown, Red and Green Seaweeds	N	N	P, M
T10-352A	Application	Native Oyster - *Ostrea edulis*	N	N	P M

[21] T10-344A if issued to replace T10/296A

		Pacific Oyster – *Magallana gigas*, Blue Mussel – *Mytilus edulis*, King Scallop – *Pecten maximus*, Queen scallop – *Aequipecten opercularis*, Brown, Red and Green Seaweeds			
T10-355A	Application	Brown, Red and Green Seaweeds	N	N	N

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APPENDIX 1

Copy of the Blacksod Bay/ Broadhaven Special Protection Area (004037) report supporting Appropriate Assessment of Extensive Aquaculture in Blacksod Bay SPA, prepared by Atkins for the Marine Institute.

ATKINS

Member of the SNC-Lavalin Group

Blacksod Bay / Broadhaven Special Protection Area (004037)

Report Supporting Appropriate Assessment of Extensive Aquaculture in Blacksod Bay SPA

Marine Institute

April 2023

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1.1.2 Client signoff

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1. Introduction

1.1. Background

Atkins (Ecology) was commissioned by the Marine Institute to provide ornithological services in relation to the appropriate assessment of aquaculture and shellfisheries on coastal Special Protection Areas (SPAs).

This report contains the Appropriate Assessment of aquaculture in Blacksod Bay / Broadhaven SPA (Figure 1.1). Blacksod Bay / Broadhaven SPA includes two main basins: Blacksod Bay located to the south of Belmullet on the eastern side of the Mullet Peninsula and Broadhaven Bay which opens to the sea on the north Mayo coastline; two further large estuaries within the SPA are Sruwaddacon Bay near Rossport and Tullaghan Bay southwest of Bangor. Due to the complexity of the site, we have included a figure in which all notable bays are labelled (Figure 1.2).

There are also a significant number of other SPAs in the vicinity: notably Duvillaun Islands SPA (004111); Inishkea Islands SPA (004004); Inishglora and Inishkeeragh SPA (004084); Mullet Peninsula SPA (004227); Carrowmore Lake SPA (004052) and Termomncarragh Lake and Annagh Machair SPA (004093). These SPAs are also considered. SPAs in the wider environment are also considered to rule out any usage of Blacksod Bay / Broadhaven SPA by birds from these sites. The boundaries of the SPAs are shown in Figure 1.1.

This assessment is based on consultation, a desktop review of existing information, combined with an examination of the results of a detailed study of waterbird distribution in of Blacksod Bay / Broadhaven SPA undertaken by NPWS in 2009 / 2010 (Cummins and Crowe, 2010); Irish Wetland Bird Survey data provided by BirdWatch Ireland, as well as other sources of published data and peer reviewed publications. In the case of trestle cultivation of Pacific oyster, it was also informed by data collected as part of a wider study of the effects of intertidal oyster cultivation on the spatial distribution of waterbirds (Gittings and O'Donoghue, 2012; Gittings and O'Donoghue, 2016a). Interpretation of licences and proposed activities was assisted by consultation with Bord Iascaigh Mhara (BIM), the Marine Institute and the Department of Agriculture, Food, and the Marine.

Where relevant, it identifies information gaps that may affect the reliability of the conclusions of this assessment.

1.2. Site Context

Blacksod Bay is situated on the western coast of County Mayo. It is a shallow, south facing bay located on the eastern side of the mullet peninsula. It includes a number of shallow bays / inlets, such as Elly, Saleen, Trawmore and Tullaghan. The town of Belmullet is located at the northern end of the bay, with Blacksod located on the southeaster end of the Mullet.

The NPWS site synopsis describes Blacksod Bay / Broadhaven SPA as follows (NPWS, 2018)[22]: -

> *"Situated in the extreme north-west of Co. Mayo, this site comprises the sheltered open waters of the northern part of Blacksod Bay and its various bays and inlets, such as Trawmore Bay, Feorinyeeo Bay, Saleen Harbour, Elly Bay, Elly Harbour, and others at Aghleam, Belmullet, Bunawillin, Emlybeg and Gweesalia, as well as the inner part of Broad*

[22] NPWS (2018). *Blacksod Bay / Broadhaven SPA. Site Synopsis.*

*Haven, including the bays and inlets of Sruwaddacon Bay, Moyrahan Bay, Traw-Kirtaun, Blind Harbour and Tullaghan Bay. At low tide extensive areas of intertidal sand and mudflats are exposed. These support a well-developed macro- invertebrate fauna. Talitrid amphipods occur in decomposing seaweed on the strand line, whilst polychaete worms (*Arenicola marina*), bivalves (*Cerastoderma edule*) and crustaceans, such as* Urothoe brevicornis, Ampelisca brevicornis *and* Bathyporeia pilosa, *are common in the middle shore. Eelgrass (*Zostera marina*) occurs at several localities. Salt marshes, which are often on a peat substrate, fringe parts of the site and provide useful roosts for the wintering waterfowl. Also included within the site are two small lakes on the Mullet Peninsula, Cross Lough and Leam Lough, and some areas of machair at Fahy, Doolough, Dooyork and Srah".*

1.2.1. Shellfish Waters

Article 5 of the Shellfish Directive (2006/113/EC) and Section 6 of the Quality of Shellfish Waters Regulations (S.I. No. 268 of 2006) require the development of Pollution Reduction Plans (PRPs) for designated shellfish areas in order to support shellfish life and growth and to contribute to the high quality of directly edible shellfish products. Shellfish PRPs relate to bivalve and gastropod molluscs, including oysters, mussels, cockles, scallops, and clams. They do not cover shellfish crustaceans such as crabs, crayfish, and lobsters.

Blacksod Bay is designated as a Shellfish Water (Blacksod Bay Final Characterisation Report; Map 15)[23]. The designated shellfish area within the bay is 78.2km2 in area. It encompasses all of the north of Moyrahan Point to a point north of Kanfinalta Point and south of the Belmullet canal, to the high water mark.

1.2.2. Other Designations

Blacksod Bay is also surrounded by a number of sites of national importance, e.g., Mullet/Blacksod Bay Complex pNHA (site code: 000470) and Broadhaven Bay pNHA (site code: 000472). Further sites are located in the wider environs: - such as Erris Head pNHA (site code: 001501); Eagle Island pNHA (site code: 001500); Inishglora & Inishkeeragh pNHA (000506); Inishkea Islands (site code: 000507); and Duvillaun Islands pNHA (site code: 000495).

Blacksod / Broadhaven Bay is also designated as a Ramsar site (site number 844[3]; designated in 1996). The total area of the site is 683ha, much of which overlaps with the boundaries of the SPA. To acquire designation under the Ramsar Convention, the site must contain wetland habitats of international importance. The convention encourages the conservation and sustainable utilisation of wetlands and their resources within these sites. The site is defined as "*A composite of diverse marine and coastal habitats that includes vast dune systems and extensive areas of dune grassland with saltmarshes occurring in sheltered bays and inlets. The grasslands are of considerable botanical importance. The site also includes several brackish lakes important to various species of breeding waders, large numbers of wintering waterbirds of various species, and internationally important numbers of Brent geese*".

[23] https://www.gov.ie/en/collection/0ae42-designated-shellfish-waters-in-the-galway-mayo-region/

[3] https://rsis.ramsar.org/ris/844

Blacksod Bay is not designated as a Wildfowl Sanctuary under National legislation; however, Carrowmore Lake is to the east of the bay is (WFS-37). This prohibits the hunting of birds within its boundary. Carrowmore Lake Complex is also designated as a pNHA (site code: 000476).

BirdWatch Ireland maintain a number of reserves on the Mullet, namely Termoncarragh Meadows[24], Annagh Marsh[25] and Termoncarragh Lake[26].

1.3. Existing and Proposed Aquaculture Activities

[***From: -***

Marine Institute, 2023. Report Supporting Appropriate Assessment of Extensive Aquaculture in Mullet/Blacksod Bay Complex SAC (Site Code: 0470)].

The main species currently under cultivation is the native oyster - *Ostrea edulis* and Seaweeds. In the 1990s and up into the 2000s Pacific oyster - *Magallana gigas* was grown within the intertidal zone at Trawmore Bay Inner Blacksod Bay. Trials were also carried out within this intertidal zone at Trawmore Bay with the cultivation of clams – Venus and Manilla Clam – Veneridae species - in tray frames and under clam mesh. There is currently no clam aquaculture licenced in the bay. In recent years the cultivation of seaweed on longlines was licensed at two sites and both sites are currently in production.

Currently within the Mullet Blacksod SAC 000470 designation there are 11 Aquaculture Licences, all at different stages within the licencing process: -

- 3 Sites Licensed in 2018: -
  - 2 Seaweed using longlines at sub-tidal sites,
  - 1 shellfish site (oysters, mussels, and periwinkles) – which is an intertidal site
- 3 Sites in Renewal / Review (application) stage:
  - Native Oyster –extensive fishery on seabed
- 5 new Applications:
  - 1 Pacific oysters – intertidal
  - 1 Seaweed – longlines to replace existing licence T10/296A subtidally
  - 1 x seaweed – longlines subtidally
  - 2 x multispecies – primarily seaweeds, other species mussels, oysters, and scallops on longlines.

Table 1.1 Details of proposed licence applications.

Site No.	Status	Activity/Species	Total Area (ha.)

[24] https://birdwatchireland.ie/our-work/nature-reserves/nature-reserves-termoncarragh-meadows/

[25] https://birdwatchireland.ie/our-work/nature-reserves/nature-reserves-annagh-marsh/

[26] https://birdwatchireland.ie/our-work/nature-reserves/nature-reserves-termoncarragh-lake/

T10-237	Licensed	Pacific and native Oyster, Blue Mussel, Periwinkle	3.42
T10-296A	Licensed	Brown Seaweeds, Red Seaweeds	10.09
T10-320	Licensed	Brown Seaweeds	10.00
T10-028A	Application	European Flat Oyster	205.59
T10-028B	Application	European Flat Oyster	571.27
T10-028C	Application	European Flat Oyster	172.89
T10-343A	Application	Pacific and native Oyster, Blue Mussel, Periwinkle	1.81
T10-344A[27]	Application	Brown, Red and Green Seaweeds	29.98
T10-347A	Application	Pacific Oyster	10.99
T10-355A	Application	Irish Wakame, Brown Seaweeds Red Seaweeds, Green Seaweeds	23.99
T10-351A	Application	Native and Pacific Oyster, Blue Mussel, Scallops, Brown, Red and Green Seaweeds	23.99
T10-352A	Application	Native and Pacific Oyster, Blue Mussel, Scallops, Brown, Red and Green Seaweeds	11.99

[27] T10-344A if issued to replace T10/296A

Mullet / Blacksod SAC 000470 showing Aquaculture sites

1.3.1. Native Oysters Cultivation

The natural flat oyster (*Ostrea edulis*) beds of Blacksod Bay are of importance as they are one of only nine such national native oyster beds in Ireland. The North Mayo Oyster Development Co-operative manages the naturally occurring beds of native oysters of Inner Blacksod Bay. The original oyster beds were seeded and managed in the 19th. Century by local landlords Binham and Carter. The beds lay unmanaged and dormant for much 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 circa 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 bi-valve 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 within the Co-ops licensed areas. Each vessel has to obtain a dredging licence from Inland Fisheries Ireland. 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 below picture from Blacksod Bay.

Plate 1.1 Oyster fishing boats.

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 *Bonamiasis ostreae* in 2003 does not seem to have a detrimental effect on the native oyster stock in the past 19 years as the prevalence has been low.

It should be noted the boundaries of the native oyster sites are redrawn on foot of the findings of a previous Natura assessment carried out in 2017. This found that the proposed licence areas were incompatible with the conservation of marine habitats and in particular, a number of highly sensitive community types. The current licence review areas take into account the findings of this previous assessment and avoid overlap with sensitive habitat areas.

1.3.2. Pacific Oyster Cultivation

There is one existing intertidal shellfish farm within the Mullet Blacksod SAC site. There is one new application for the culture of the Pacific oyster (*Magallana gigas*) at Trawmore Bay and one existing licence at Doolough Point which is a multi-species licence (for pacific and native oysters, mussels, and winkles).

In the 1990s and early 2000s there was pacific oyster production in this area for a number of years. These sites lapsed in the 2000s and there are currently some abandoned trestles on one of the old sites. Trials also took place with the cultivation of manila clams which proved successful. There is one new application in Trawmore Bay (T10- 347A) – Blacksod Bay for the cultivation of oysters in the general same area as where pacific oysters and clams were successfully grown in past. At present there is no pacific production in the Bay. Pacific oyster seed will be sourced from hatcheries France, Ireland, and UK.

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 5 metres in length, are approximately 1 metre in width and stand between 0.5 and 0.7 metres 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 can be fastened to the trestles with rubber straps and hooks. Trestles can be laid out in rows of four or two as shown in below photograph.

Plate 1.2 Trestle table with oyster bags.

The Pacific oyster is a bivalve mollusc that filter feed plankton and seston from the sea when submerged during high tide periods. The proposed new oyster farm 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 – 10 mm) oyster seed is introduced from hatcheries. On rare occasions seed can be brought in at a smaller size of less than 4 mm and are put into 2 and 3 mm plastic mesh pouches within 4mm oyster bags where they remain for few months until they reach 6 mm and are ready to be transferred to the 4 mm oyster bag.

All seed and larger oysters brought into the Bay will to be sourced from hatcheries - French, UK or Irish. For the past 15 years it has principally been triploid oyster seed that has been deployed on Irish pacific oyster farms. In the 1990s and early 2000's when there was cultivation in the Bay, seed was diploid which was sourced from hatcheries.

While there is no production in pacific oysters at present, seed is generally imported between January and June, and between August and November. Sourcing of seed is often dependent on availability. In general, it takes between 2 and 4 years to reach market size 65 gram plus, 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 ½ grown oysters takes place from September to April, and harvesting of stock for mature oysters for market takes place from October to May, but can happen all year round as market dictates sales. 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 in year 3, the stocking density is reduced 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.

In general, oyster farms sites are accessed by one tractor and trailer using one or two routes from farmer's land base facilities ashore. 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.

At the Doolough site (T10-237) the species licenced are 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 mussel seed will be naturally locally sourced seed settlement either on site or from bay or from mussel farms in Mayo. The ½ grown mussels will be grown in oyster bags on trestles. The producer will be directly selling the mussels to the public though 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.

1.3.3. Seaweed – Longline Cultivation

There are currently two seaweed aquaculture licenced sites for the cultivation of various species of seaweed using semi-submerged longlines at two sites in Blacksod Bay (T10 – 296A, 320). One of these producers has applied for a new licence in order to expand existing site (T10-296A) in same area of Blacksod Bay. There are an additional 3 new applications for seaweed longline cultivation (T10-351A, 352A, 355A), 2 of which (T10-351A and T10-352A) have also applied to include other shellfish species (mussels, pacific and native oysters, and scallops) using longlines and hanging cultivation systems.

Plate 1.3 Seaweed string from Irish hatchery.

Plate 1.4 Seaweed string deployed onto longline head rope.

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.

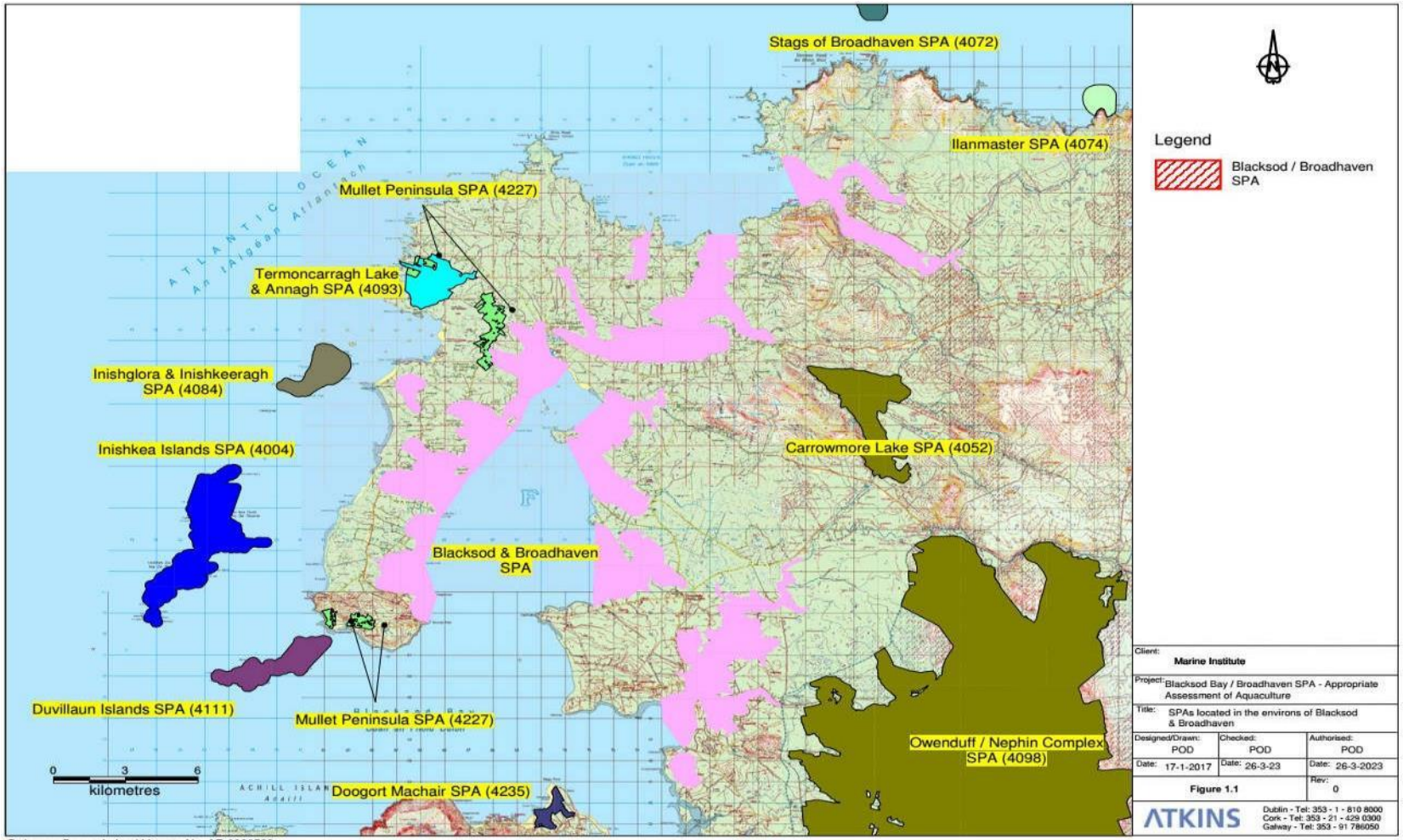
The seaweeds currently grown in Blacksod Bay are both brown – kelps and to a lesser extent and more on a trial basis are red seaweeds – *Porphyra* and *Palmaria*. Both are sourced from an Irish hatchery on seeded rope-twine as shown on above photo. This seeded rope-twine is deployed onto the semi-submerged single longlines during months October to February each year. The seaweeds are fast growing and are harvested within a few months usually during months April to May. Both sites have been in production since 2019 and are serviced by boat from Blacksod Pier.

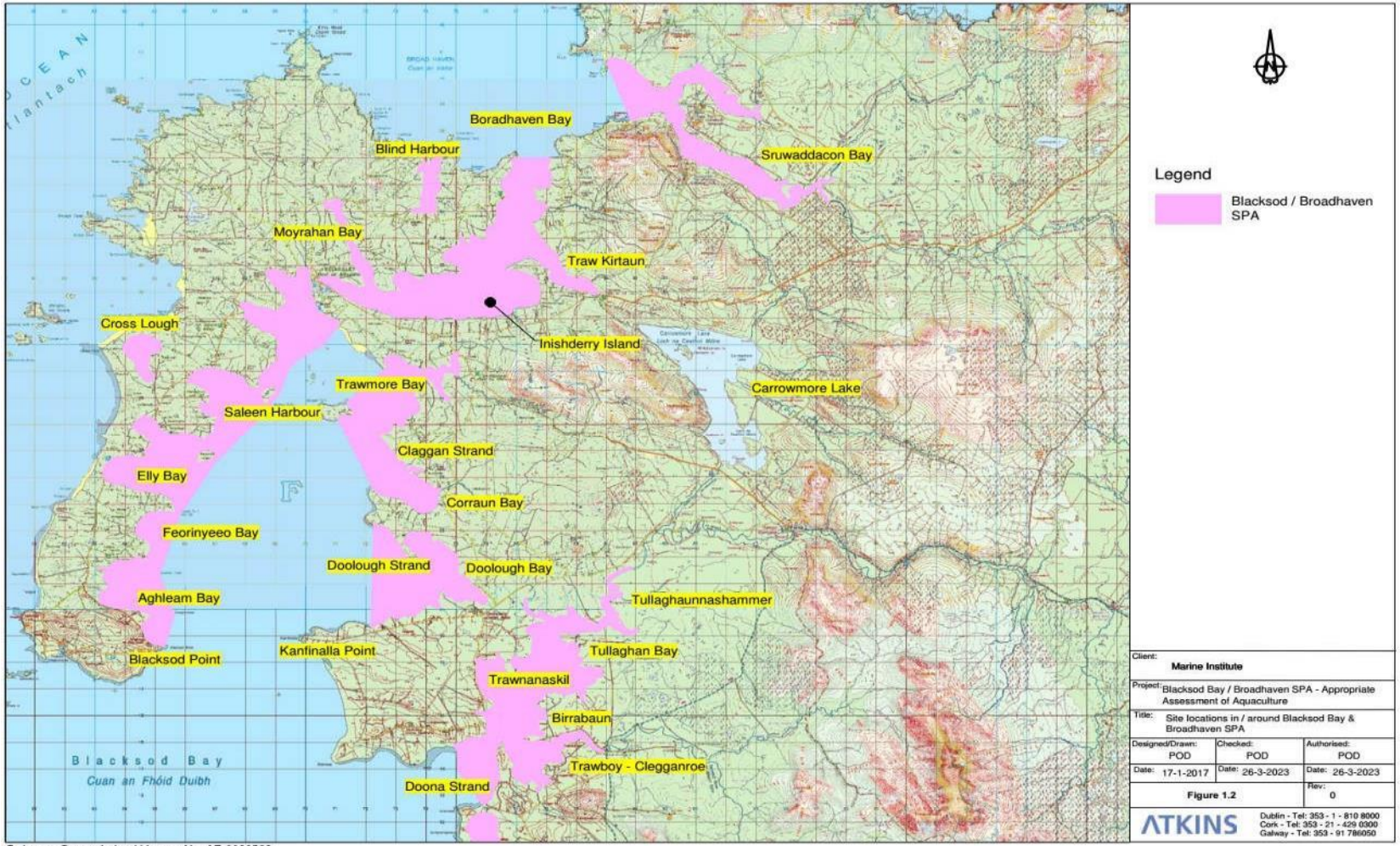
Plate 1.5 The above photos shows seaweed single longline with grey and black buoys in Blacksod Bay.

The single seaweed longlines are suspended at circa 1 metre depth using grey and black floats. Currently it takes six days over the months October – November to deploy the seeded string onto the 25 longlines on the existing 2 licensed sites which vary 150 to 220 metres in length. The sites are visited and checked once or twice per month until the following spring when harvesting begins. At the moment it takes a maximum of six days to harvest the seaweed crop over the months April to May and possibly with to end of June with sugar kelp. It is envisaged that the number of days for harvesting will decrease to three days in the coming year when a new specialised barge will be brought in by one of the producers. Once seaweed is brought ashore it is sent to a specialised drying facility where seaweed is dried and processed for various markets, primarily into higher end human food chain in a number of products.

1.3.4. Shellfish – Longline Cultivation

Two of the seaweed licence applications includes application for the cultivation of rope mussels, scallops and oysters using longline rope system for mussels and hanging baskets and lantern for oysters and scallops (T10351A and T10-352A). All seed will be locally settled seed in the case of mussels and native oysters. Pacific oyster seed will be coursed from hatcheries (French, Irish and UK) and scallops seed from local settlement or from other part of Ireland, e.g., Mulroy Bay or from hatchery if available. The production of these species will be on a trial basis initially in the first few years and if successful it is intended to cultivate these on a quarter of each site area. It is envisaged that the sites will be visited when seed is deployed / collected on sites and then when need to grade and thin cultivation systems during growing cycle and then when harvesting. Most of the work will be carried out in the summer to autumn months. Both sites will be accessed from Blacksod pier.





1.4. Description of the proposed Development

The current assessment considered 9 no. aquaculture licence applications. These are summarised in turn below.

1.4.1. Native Oyster cultivation

1.4.1.1. T10/028A

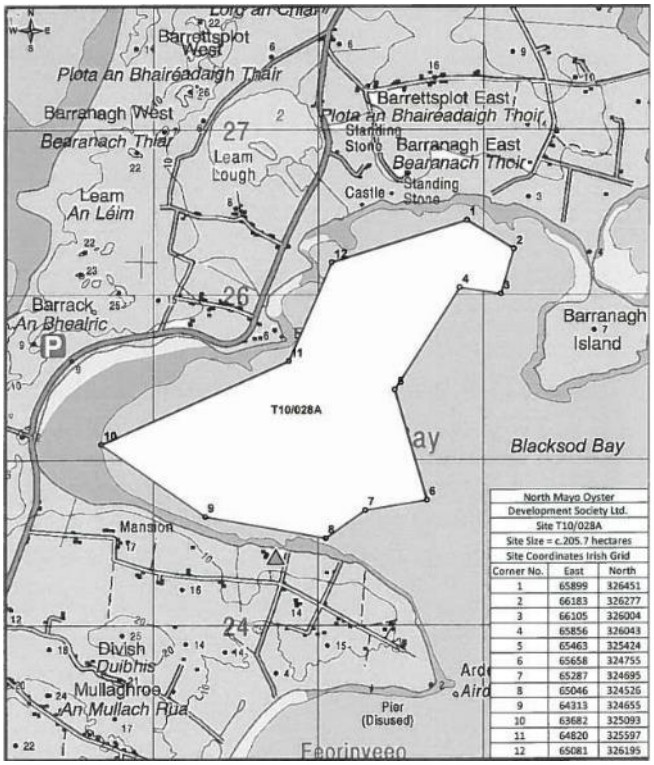
Licence application T10/028A by the North Mayo Oyster Development Co-operative Society Ltd. covers an area of 205.59ha and is for the **subtidal cultivation of Native oyster (*Ostrea edulis*)**; i.e., this is an extensive cultivation method with oyster grown on the seabed. It is located within Elly Bay on the western side of inner Blacksod Bay.

The intention is to use natural wild settlement of local stock in order to establish oyster on the seabed within the licenced area. In the future there may also be further development using native oyster from Irish hatcheries as part of stock enhancement programmes.

Current landings are ca. 15 tonnes per year. All oysters are fished and sold by individual boat operators. Each boat sells directly to mainly 2 no. Mayo based shellfish buyers who export primarily to France and the Netherlands. The Co-op does not sell the oysters. Landings are unpredictable and will vary between years. The Co-op have held this licence since 1993; the area is known to be good for growing of native oyster.

Native oyster are harvested by dredging. All boats are members of the Co-op, are registered and have a dredge permit from IFI (Inland Fisheries Ireland).

Predator control is also required to control starfish numbers; starfish are kept on board boats after being taken out of the dredge on oyster fishing days. Starfish are also removed area also removed from the fishery when other fishermen remove them when potting for shrimp or other crustaceans.



North Mayo Oyster Development Society Ltd.		
Site T10/028A		
Site Size = c.205.7 hectares		
Site Coordinates Irish Grid		
Corner No.	East	North
1	65899	326451
2	66183	326277
3	66105	326004
4	65856	326043
5	65463	325424
6	65658	324755
7	65287	324695
8	65046	324526
9	64313	324655
10	63682	325093
11	64820	325597
12	65081	326195

Figure 1.3 Boundary of T10/028A in Elly Bay (extracted from licence application).

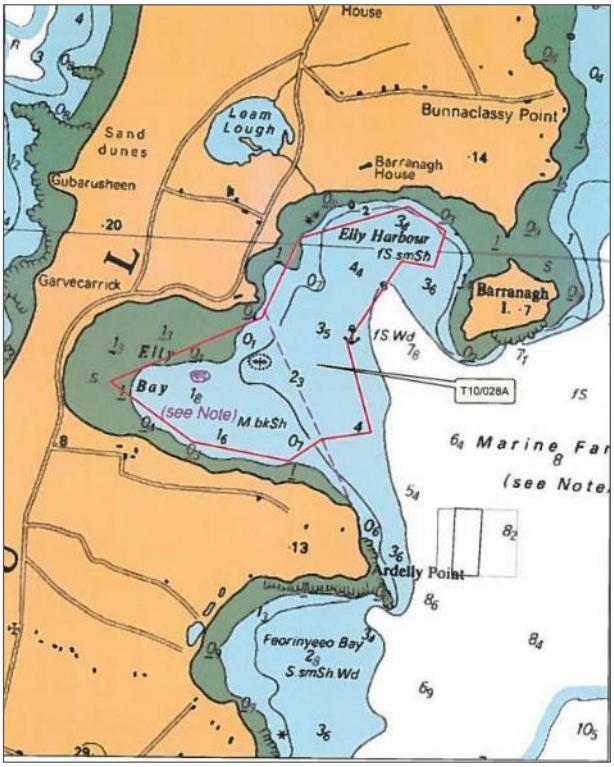


Figure 1.4 Boundary of T10/028A in Elly Bay shown on admiralty chart (2704-0) (extracted from licence application).

1.4.1.2. T10/028B

Licence application T10/028B by the North Mayo Oyster Development Co-operative Society Ltd. covers an area of 571.27ha and is for the **subtidal cultivation of Native oyster (*Ostrea edulis*)**; i.e., this is an extensive cultivation method with oyster grown on the seabed. It is located in the northern end Blacksod Bay, extending from close to Belmullet, south-eastwards towards Trawmore Bay.

The intention is to use natural wild settlement of local stock in order to establish oyster on the seabed within the licenced area. In the future there may also be further development using native oyster from Irish hatcheries as part of stock enhancement programmes.

Current landings are ca. 15 tonnes per year. All oysters are fished and sold by individual boat operators. Each boat sells directly to mainly 2 no. Mayo based shellfish buyers who export primarily to France and the Netherlands. The Co-op does not sell the oysters. Landings are unpredictable and will vary between years. The Co-op have held this licence since 1993; the area is known to be good for growing of native oyster.

Native oyster is harvested by dredging. All boats are members of the Co-op, are registered and have a dredge permit from IFI (Inland Fisheries Ireland).

Predator control is also required to control starfish numbers; starfish are kept on board boats after being taken out of the dredge on oyster fishing days. Starfish are also removed area also removed from the fishery when other fishermen remove them when potting for shrimp or other crustaceans.

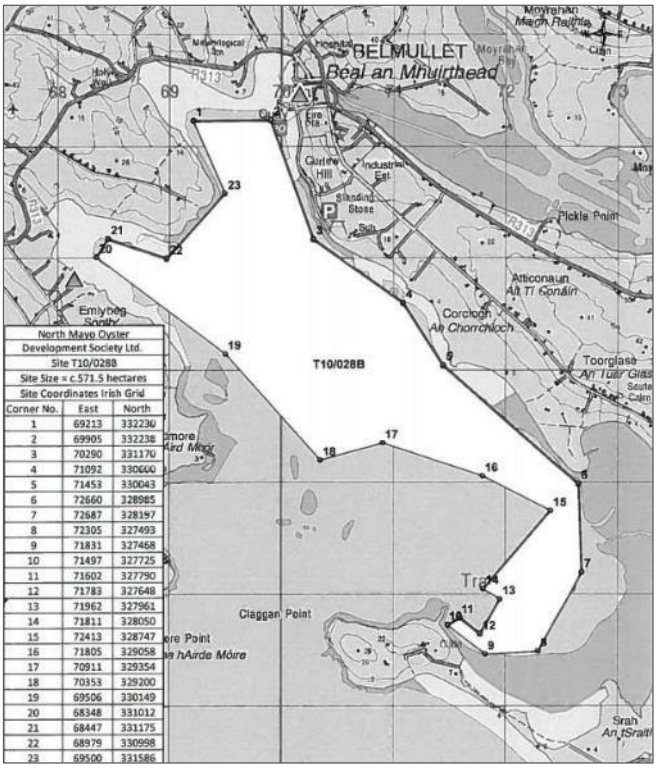


Figure 1.5 Boundary of T10/028B running from Belmullet toward Trawmore Bay (extracted from licence application).

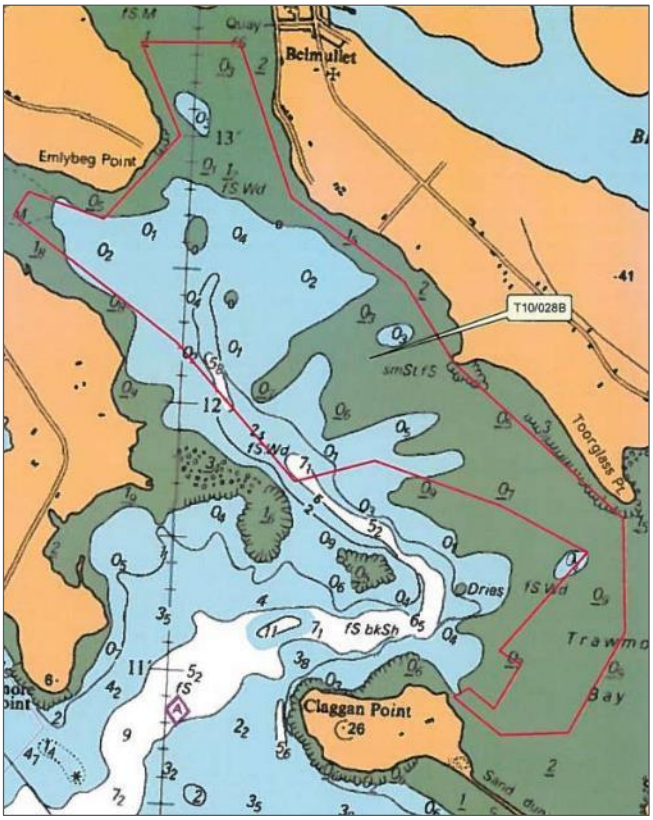


Figure 1.6 Boundary of T10/028B running from Belmullet toward Trawmore Bay shown on admiralty chart (2704-0) (extracted from licence application).

1.4.1.3. T10/028C

Licence application T10/028C by the North Mayo Oyster Development Co-operative Society Ltd. covers an area of 172.89ha and is for the **subtidal cultivation of Native oyster (*Ostrea edulis*)**; i.e., this is an extensive cultivation method with oyster grown on the seabed. It is located within Saleen Harbour on the western side of inner Blacksod Bay.

The intention is to use natural wild settlement of local stock in order to establish oyster on the seabed within the licenced area. In the future there may also be further development using native oyster from Irish hatcheries as part of stock enhancement programmes.

Current landings are ca. 15 tonnes per year. All oysters are fished and sold by individual boat operators. Each boat sells directly to mainly 2 no. Mayo based shellfish buyers who export primarily to France and the Netherlands. The Co-op does not sell the oysters. Landings are unpredictable and will vary between years. The Co-op have held this licence since 1993; the area is known to be good for growing of native oyster.

Native oyster are harvested by dredging. All boats are members of the Co-op, are registered and have a dredge permit from IFI (Inland Fisheries Ireland).

Predator control is also required to control starfish numbers; starfish are kept on board boats after being taken out of the dredge on oyster fishing days. Starfish are also removed area also removed from the fishery when other fishermen remove them when potting for shrimp or other crustaceans.

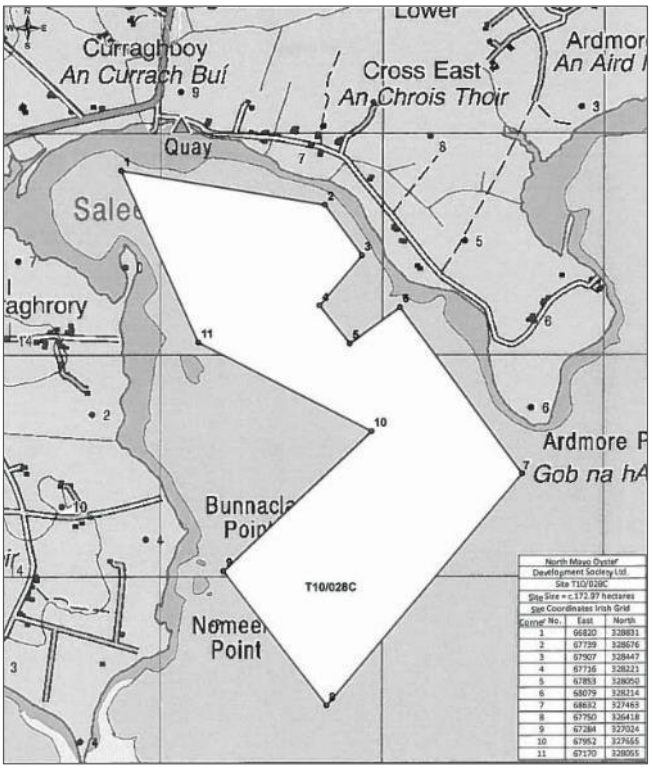


Figure 1.7 Boundary of T10/028C located in Saleen Harbour (extracted from licence application).

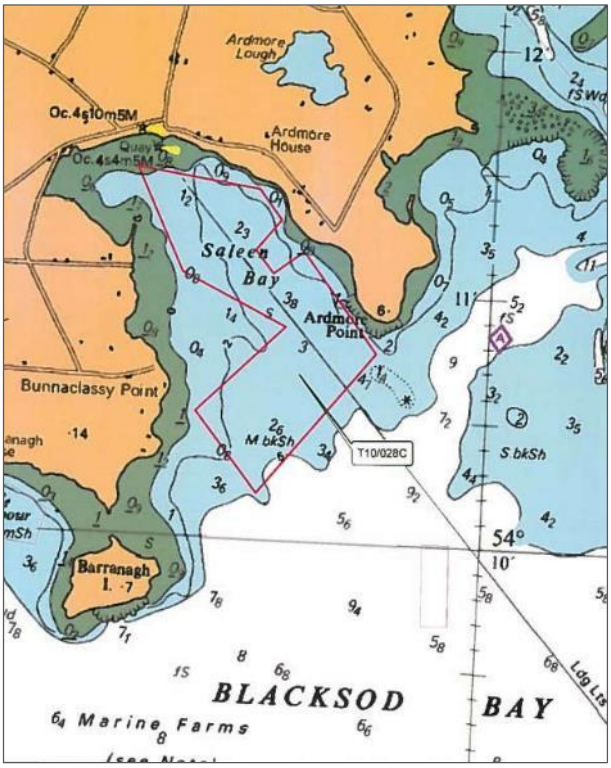


Figure 1.8 Boundary of T10/028C located in Saleen Harbour shown on admiralty chart (2704-0) (extracted from licence application).

1.4.1.4. T10/351A

Licence application T10/351A is a mixed application for both **shellfish and seaweed cultivation** covering an area of 23.99 ha. This is located to the east of Moyrhan Point in lower Blacksod Bay.

This application is for the cultivation of non-native Pacific oyster (*Magallana gigas*), as well as Native oyster (*Ostrea edulis*), mussels (*Mytilus edulis*), King scallop (*Pecten maximus*) and Queen scallop (*Aequipecten operaculris*).

Native oysters, Pacific oysters, and scallop will be sourced from Irish, UK or French hatcheries. The applicant intends to collect natural local native oyster, mussel and scallop seed using a variety of collectors (i.e., rope, mesh etc.). Seed will be transported from hatcheries in the usual transport boxes or bags and sorted into various growing structures at shore base before being brought to site.

It is proposed that a variety of growing equipment will be used on the site. On the longlines there will be hanging bags, baskets, nets, lantern nets, hanging mesh and in the case of mussel – rope and mesh droppers.

The majority of the site will be single 220m longlines for cultivation of seaweed. The applicant estimates there will be a total of 46 of these longlines once at full capacity. In addition, the applicant hopes to grow rope mussels on 12 x 110m double mussel lines and trial cultivation of scallop and oyster on 2 x 220 single longlines.

It is estimated that mussel production will rise from 0 (Year 1& 2), to 80 tons (Year 3), 100 tons (Year 4) and 110 tons (Year 5).

1.4.1.5. T10/352A

Licence application T10/352A is a mixed application for **both shellfish and seaweed cultivation** covering an area of 11.99ha. This is located to the east of Moyrhan Point in lower Blacksod Bay.

This application is for the cultivation of Native oyster (*Ostrea edulis*), Pacific oyster (*Magallana gigas*) mussels (*Mytilus edulis*), King scallop (*Pecten maximus*) and Queen scallop (*Aequipecten operaculris*).

Native oysters, Pacific oyster and scallop can be source stock from hatcheries – Irish, UK or French. The Operator intends to collect natural local native oyster, mussel and scallop using a variety of collectors (rope and mesh etc.). Seed will be transported from hatcheries in the usual transport boxes or bags and sorted into various growing structures at shore base before being brought on site.

It is proposed that a variety of growing equipment will be used on the site. On the longlines there will be hanging bags, baskets, nets, lantern nets, hanging mesh and in the case of mussel – rope and mesh droppers.

The majority of the site will be single 220m longlines for cultivation of seaweed. The applicant estimates there will be a total of 23 of these longlines once at full capacity. In addition, the applicant hopes to grow rope mussels on 4 x 110m double mussel lines and trial cultivation of scallop and oyster on 2 x 220 single longlines.

It is estimated that mussel production will rise from 0 (Year 1& 2), to 26 tons (Year 3), 34 tons (Year 4) and 40 tons (Year 5). Site access is from Blacksod Pier (3km from the licence block)

This licence also includes details of potential **seaweed cultivation**.

- Brown Algae
  - *Laminaria digitata* (oarweed)
  - *Laminaria hyperborean* (Forest kelp)
  - *Saccarina latissimi* (Sugar kelp)
  - *Alaria esculenta* (Wing kelp)
  - *Saccorhiza polyschides* (Sea hedgehog)
  - Himanthalia elongate (Sea spaghetti)
- Red Algae
  - *Chrondrus crispus* (Carrageen moss)
  - *Palmaria palmata* (Dulse)
  - *Porphyra species* (linearis, umbillicallis, dioica (Sloke/Nori)
  - *Asparagopsis armata* (Harpoon weed)
  - *Osmundia pinnatifida* (Pepper dulse)
- Green Algae
  - *Ulva lactuca* (Sea lettuce)
  - *Ulva compressa* / intestinalis (Sea grass)

Plantlets will be locally sourced from a hatchery; grown on long lien droppers and nets. 23 single lines are proposed. It is estimated that mussel production will rise from 8 tons (Year 1), to 15 tons (Year 2), 30 tons (Year 3), 34 tons (Year 4) and 34 tons (Year 5). It is not clear from the licence as to whether this is being included as an alternative option to the shellfish culture described. However, both cultivation methods involve structures floating in subtidal waters and share may of the same potential impacts.

The Operator proposes to use submerged longlines, which are the industry norm in Ireland. Harvesting will be by hand using a colleague's vessel (Rouge Wave).

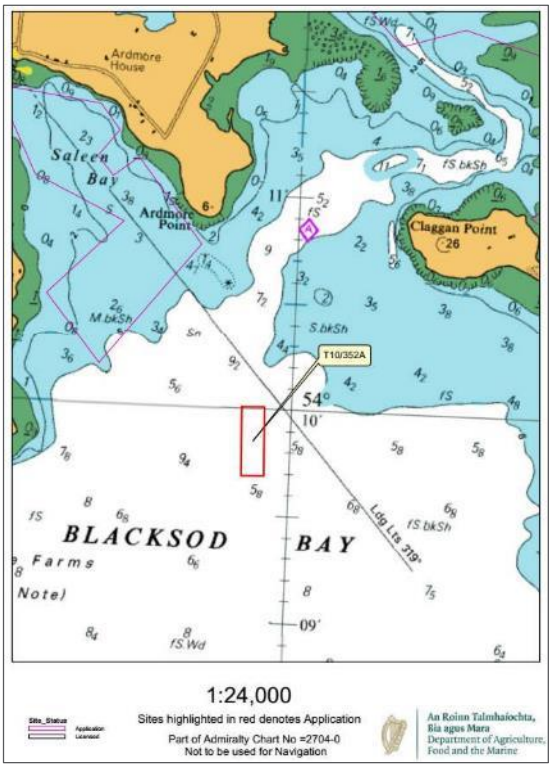


Figure 1.9 Boundary of T10/352A in central Blacksod Bay on admiralty chart (2704-0) (extracted from licence application).

1.4.2. Seaweed Cultivation

1.4.2.1. T10/344A

Licence application T10/344A by Dúlra Iorrais Teo is for **seaweed cultivation** and covers an area of 29.98ha off Ardelly Point, Elly Bay. It is for the cultivation of a number of seaweed species, namely: -

- Brown Algae
  - *Laminaria digitata* (oarweed)
  - *Laminaria hyperborean* (Forest kelp)
  - *Saccarina latissimi* (Sugar kelp)
  - *Alaria esculenta* (Wing kelp)
  - *Saccorhiza polyschides* (Sea hedgehog)
  - *Himanthalia elongate* (Sea spaghetti)
- Red Algae
  - *Chondrus crispus* (Carrageen moss)
  - *Palmaria palmata* (Dulse)
  - *Porphyra species* (*linearis, umbillicallis, dioica* (Sloke/Nori)
  - *Asparagopsis armata* (Harpoon weed)
  - *Osmundia pinnatifida* (Pepper dulse)
- Green Algae
  - *Ulva lactuca* (Sea lettuce)

- *Ulva compressa* / intestinalis (Sea grass)
- *Codium fragile* (Velvet horn)

Proposed production figures are as follows: -

Algae Type	Year 1 (tonnes)	Year 2 (tonnes)	Year 3 (tonnes)	Year 4 (tonnes)
Brown algae (kelps) – dry	0	10	15	20
Red algae – dry	0	1	3	5
Green algae - dry	0	0.5	1	3

This site is intended to replace an existing aquaculture site T10/296A held by Dúlra Iorrais Teo and is an extension of the existing site. Access to the site is from the shore ca. 1km away, as well as from Blacksod Pier (3km), where a crane is also located.

It is intended to use submerged longlines, which are the industry norm at present. Cultivation methods will be based on best practice among other seaweed farmers and on the applicant's own experience of working on their existing aquaculture site which is adjacent to the site.

Dúlra will hand harvest seaweed using its company owned 12.3m vessel Dúlra na Mara.

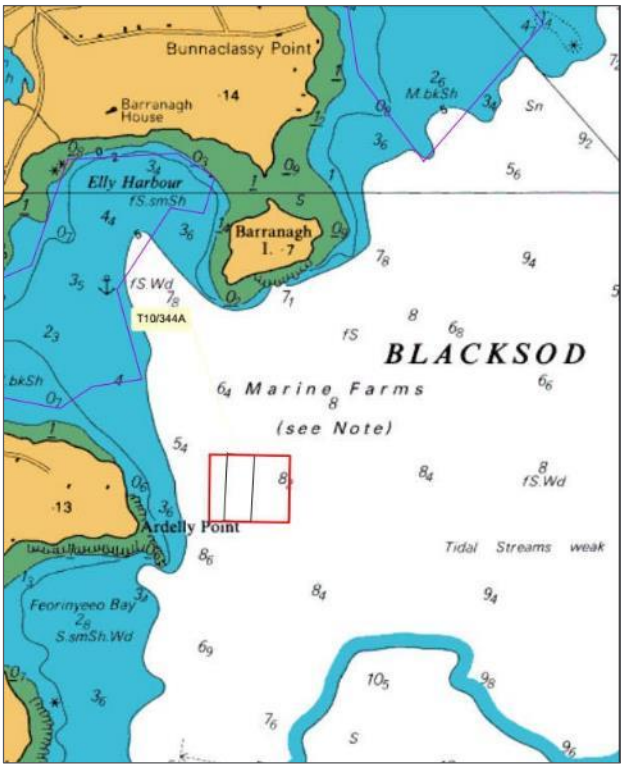


Figure 1.10 Boundary of T10/344 located off Ardelly Point, Elly Bay shown on admiralty chart (2704-0) (extracted from licence application).

This overlaps with a small Licenced site T10/296A which is already licenced for seaweed production.

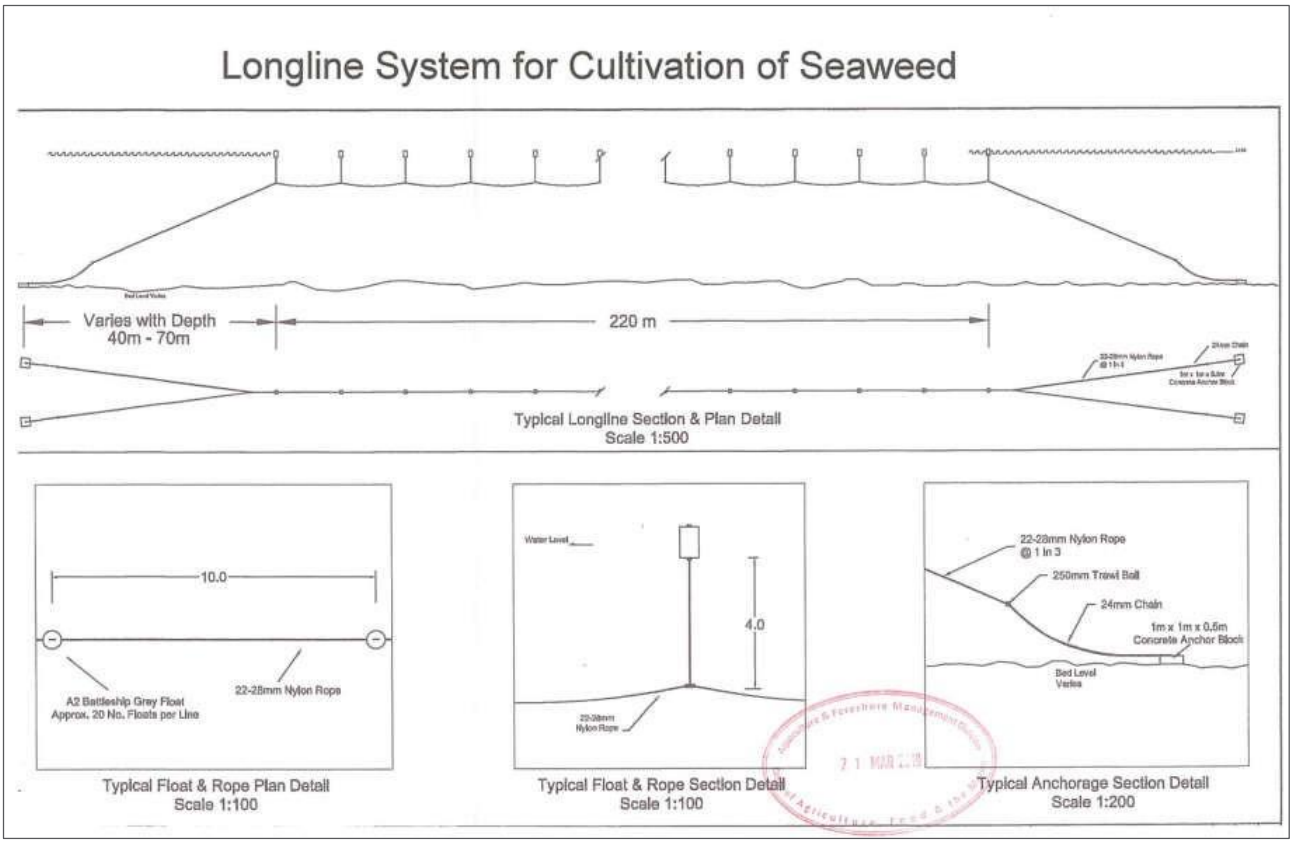


Figure 1.11 Longline system for cultivation of seaweed (extracted from licence application).

The licence application further notes, that since Dúlra received its aquaculture licence in mid-2018, they have obtained planning permission for a Research Field Station in Blacksod just 3km from the seaweed site. It is noted that the proposed field station enable access to the area by researchers from third level institutions and government agencies (from Licence Application).

1.4.2.2. T10/355A

T10/355A (24ha), located on the eastern side of Blacksod Bay to the west of Doolough Point, is for **seaweed cultivation**.

This licence includes details of the following species: -

- Brown Algae
  - *Laminaria digitata* (oarweed)
  - *Laminaria hyperborean* (Forest kelp)
  - *Saccarina latissimi* (Sugar kelp)
  - *Alaria esculenta* (Wing kelp)
  - *Saccorhiza polyschides* (Sea hedgehog)
  - *Himanthalia elongate* (Sea spaghetti)

- Red Algae
  - *Chrondrus crispus* (Carrageen moss)
  - *Palmaria palmata* (Dulse)
  - *Porphyra species* (*linearis, umbillicallis, dioica* (Sloke/Nori)
  - *Asparagopsis armata* (Harpoon weed)
  - *Osmundia pinnatifida* (Pepper dulse)
- Green Algae
  - *Ulva lactuca* (Sea lettuce)
  - *Ulva compressa* / intestinalis (Sea grass)

Plantlets will be locally sourced from a hatchery; grown on long lien droppers and nets. 60 single lines are proposed. It is estimated that mussel production will rise from 17 tons (Year 1), to 34 tons (Year 2), 68 tons (Year 3), 83 tons (Year 4) and 83 tons (Year 5). Site access is from Blacksod Pier.

The Operator proposes to use submerged longlines, which are the industry norm in Ireland. Harvesting will be by hand using a colleagues vessel (Rouge Wave).

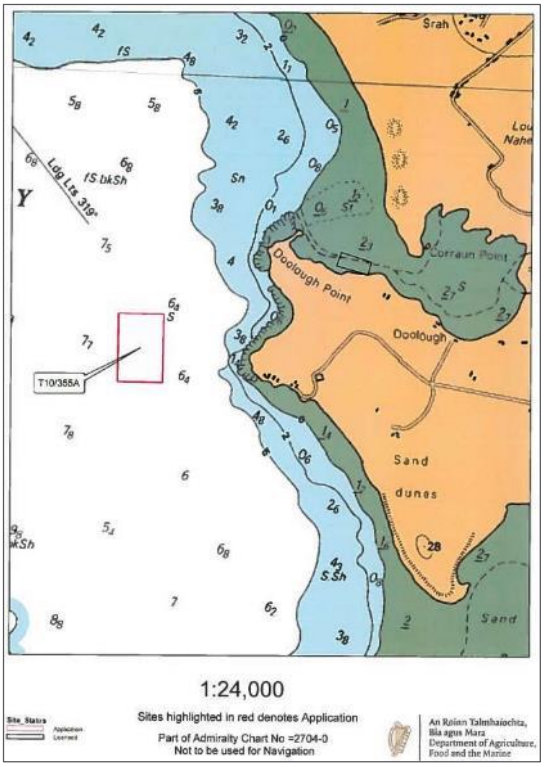


Figure 1.12 Boundary of T10/355A off Doolough Point on admiralty chart (2704-0) (extracted from licence application).

1.4.3. Intertidal shellfish cultivation

1.4.3.1. T10/343A

This application is for the **intertidal cultivation of non-native Pacific oyster (*Magallana gigas*), as well as Native oyster (*Ostrea edulis*), winkles (*Littorina littorea*) and mussels (*Mytilus edulis*)**. The area applied for is 1.81ha. It is located on the western side of Sruwaddacon Bay, close to Carnhill.

All Pacific oyster seed will be from French, UK, and Irish hatcheries. Native oyster seed will be from an Irish hatchery. Mussels and winkle will result from natural settlement. All oyster seed will be transported to a land base in Styrofoam boxes or transport bags where they will then be deployed into 2mm and 4mm oyster bags and transported to trestles at the site by tractor and trailer. Access to the site is from near the pier immediately north of the licence block and along the shore.

The means of cultivation identified on the licence includes bag and trestles, including hanging baskets; <800 trestles per hectare. The site is known to be suitable for cultivation of oyster – they were grown near the area in the 1990s.

Access is from the shoreline. All shellfish will be removed from the shore with use of tractor and trailer. Shellfish will then be graded and sorted at land based facility.

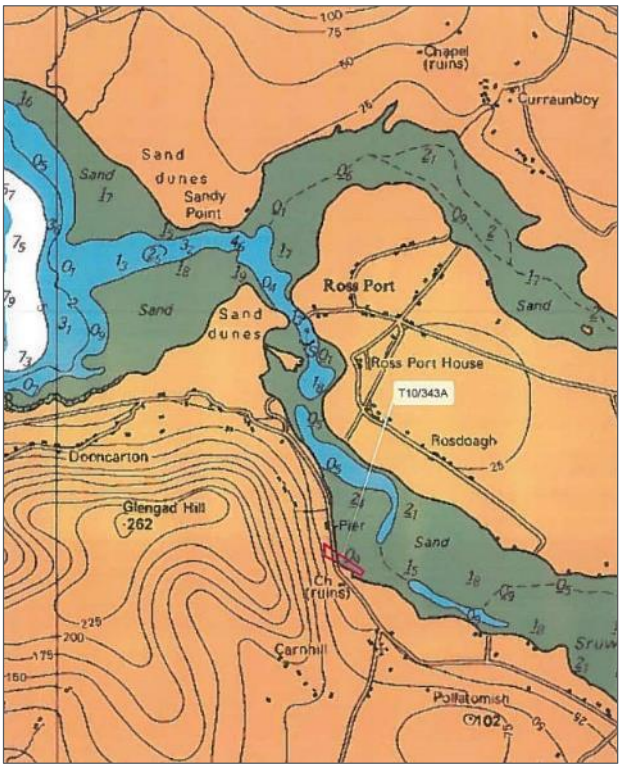


Figure 1.13 Boundary of T10/343A located in Sruwaddacon Bay close to Carnhill shown on admiralty chart (2703-0) (extracted from licence application).

Proposed production figures using are as follows: -

Oyster production	Year 1	Year 2	Year 3	Year 4	Year 5
Tonnage	0	5.5	25	30	35

1.4.3.2. T10/347A

Licence application T10/347A by Dooriel Fisheries Ltd. is for the **intertidal cultivation of Pacific oyster** (*Magallana gigas*) in Trawmore Bay, Inner Blacksod Bay over an area of 10.99ha.

All seed will be sourced from Irish or EU hatcheries. Seed will be shipped in Styrofoam boxes to a land base at Dooriel, Ballycroy (on the south-eastern side of Blacksod Bay), where they will be deployed into oyster bags and then brought by tractor and trailer to the licence block.

The means of cultivation identified on the licence includes bag and trestles, including hanging baskets; <800 trestles per hectare. It is known from previous operators on this site in the 1990's to early 2000's that this is a good site for oyster production, with good oyster growth and easy access from the shore.

Proposed production figures using half grown oyster from Dooriel site are as follows: -

Oyster production	Year 1	Year 2	Year 3	Year 4	Year 5
Tonnage	20	40	60	80	120

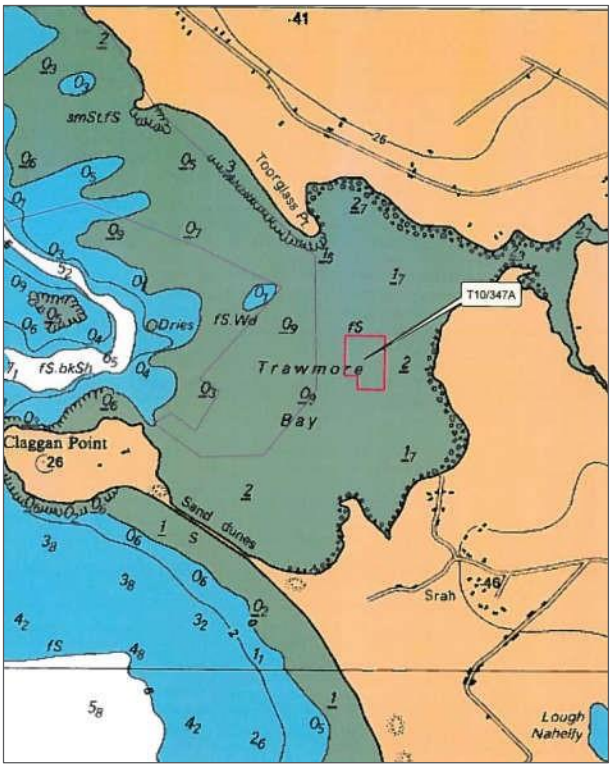


Figure 1.14 Boundary of T10/347A located in Trawmore Bay on admiralty chart (2703-0) (extracted from licence application).

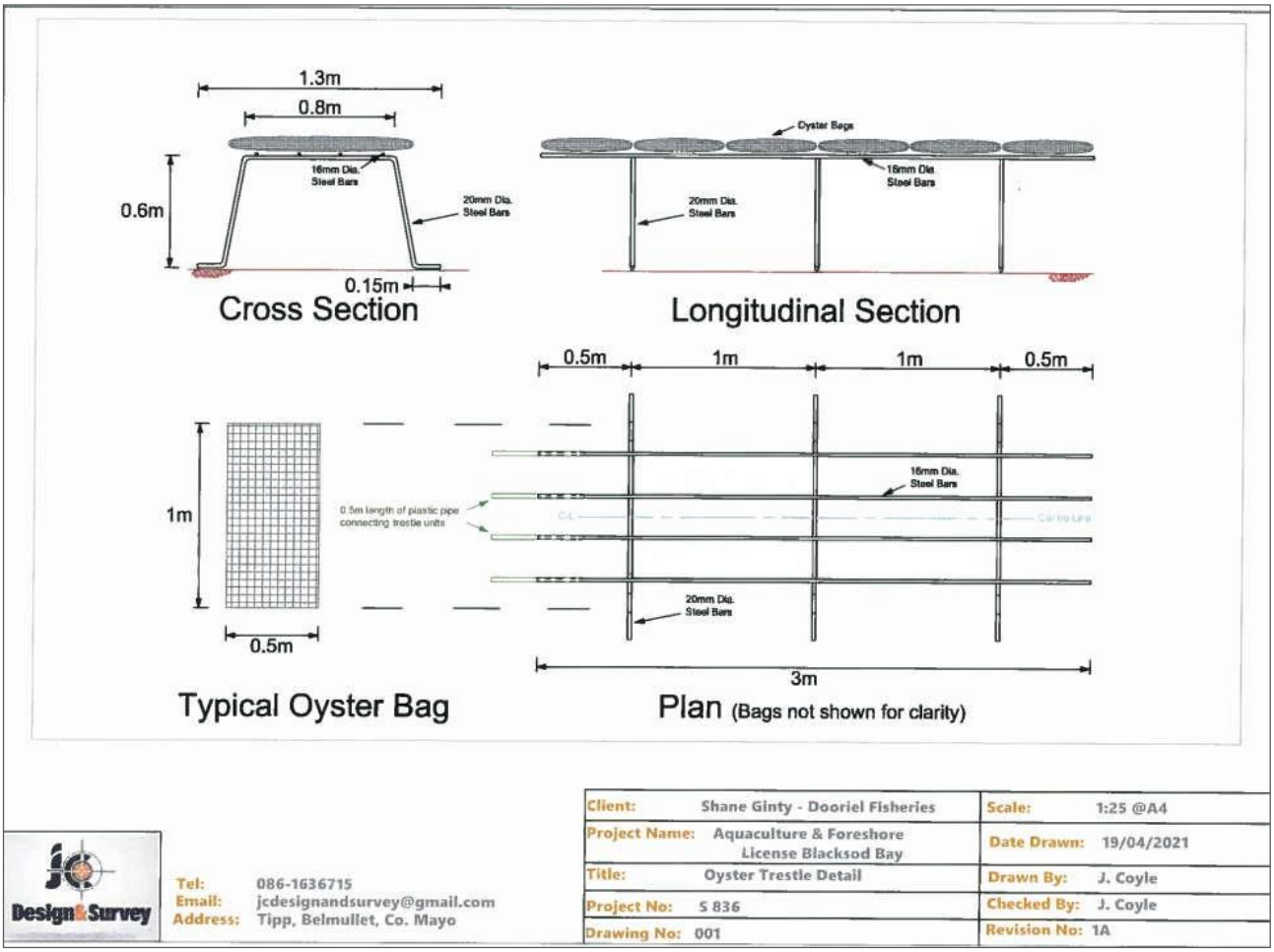


Figure 1.15 Typical Trestle detail (from Dooril Fisheries application).

2. Scope of the Study

2.1. Legislative Context

2.1.1. Natura 2000

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive") is a legislative instrument of the European Union (EU) which provides legal protection for habitats and species of Community interest. Article 2 of the Directive requires the maintenance or restoration of such habitats and species at a favourable conservation status, while Articles 3 to 9, inclusive, provide for the establishment and conservation of an EU-wide network of special areas of conservation (SACs), known as Natura 2000, which also includes special protection areas (SPAs) designated under Article 4 of Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds ("the Birds Directive"). Both SACs and SPAs are commonly referred to as "European sites" or "Natura 2000 sites".

SACs are selected for natural habitat types listed on Annex I to the Habitats Directive and the habitats of species listed on Annex II to the Habitats Directive. SPAs are selected for species listed on Annex I to the Birds Directive and other regularly occurring migratory species. The habitats and species for which a Natura 2000 site is selected are referred to as the "qualifying interests" of that site and each is assigned a "conservation objective" aimed at maintaining or restoring its "favourable conservation condition" at the site, which contributes to the maintenance or restoration of its "favourable conservation status" at national and European levels.

In this instance, this report deals exclusively with Special Protection Areas for birds. Special Areas for Conservation are addressed in a separate report prepared by the Marine Institute (MI, 2023).

2.1.2. Appropriate Assessment

Article 6 of the Habitats Directive deals with the management and protection of Natura 2000 sites. Articles 6(3) and (4) set out the decision-making process, known as "Appropriate Assessment" (AA), for plans or projects in relation to Natura 2000 sites. Article 6(3) states: -

> *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

The first sentence of Article 6(3) provides a basis for determining which plans and projects require AA, i.e., those "*not directly connected with or necessary to the management of [one or more Natura 2000 sites] but likely to have a significant effect thereon, either individually or in combination with other plans or projects*". In *Waddenzee* (C-127/02), the Court of Justice of the European Union (CJEU) ruled that significant effects must be considered "likely" if "*it cannot be excluded, on the basis of objective information*", that they would occur. This clearly sets a low threshold, such that AA is required wherever there is a reasonable possibility of significant effects on a Natura 2000 site. In the same judgment, the CJEU established that the test of significance relates specifically to the conservation objectives of the site concerned, i.e., "significant effects" are those which, "*in the light, inter alia, of the characteristics and specific environmental conditions of the site*", could undermine the site's conservation objectives. In addition to the effects of the plan or project

on its own, the combined effects arising from the plan or project under consideration and other plans and projects must also be assessed.

The last part of the first sentence of Article 6(3) defines AA as an assessment of the "*implications [of the plan or project] for the site in view of the site's conservation objectives*". In the second sentence, Article 6(3) requires that, prior to agreeing to a plan or project, the competent authority must "ascertain" that "*it will not adversely affect the integrity of the site concerned*". In *Sweetman v. An Bord Pleanála* (C-258/11), the CJEU ruled that a plan or project "*will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of sites*". On that basis, EC (2018) described the "integrity of the site" as "*the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated*". As such, the "integrity" of a specific site is defined by its conservation objectives and is "adversely affected" when those objectives are undermined. In *Waddenzee*, the CJEU ruled that the absence of adverse effects can only be ascertained "*where no reasonable scientific doubt remains*".

The "precautionary principle" applies to all of the legal tests in AA, i.e., in the absence of objective information to demonstrate otherwise, the worst-case scenario is assumed. Where the tests established by Article 6(3) cannot be satisfied, Article 6(4) applies (see explanation in Section 2.2 below).

2.1.3. Competent authority

The requirements of Articles 6(3) and (4) are transposed into Irish law by, inter alia, Part 5 of the European Communities (Birds and Natura Habitats) Regulations, 2011 (as amended) ("the Habitats Regulations") and Part XAB of the Planning and Development Act, 2000 (as amended) ("the Planning and Development Acts"). As per the second sentence of Article 6(3), it is the "competent national authorities" who are responsible for carrying out AA and, by extension, for determining which plans and projects require AA. The competent authority in each case is the authority responsible for consenting to or licensing a plan or project, e.g., local authorities, An Bord Pleanála, Transport Infrastructure Ireland (TII) or a Government Minister. In all cases, it is the competent authority who is ultimately responsible for determining whether or not a plan or project requires AA and for carrying out the AA, where required.

2.2. Appropriate Assessment Process

The AA process can be described as being made up of three distinct stages, as described below, the need to progress to each stage being determined by the outcome of the preceding stage.

Stage 1: Screening – This stage involves a determination by the competent authority as to whether or not a given plan or project required AA. As explained in Section 2.1, AA is required in respect of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but for which the possibility of likely significant effects on one or more Natura 2000 sites cannot be excluded. In *People Over Wind* (C-323/17), the CJEU ruled that measures intended to avoid or minimise harmful effects on a Natura 2000 site cannot be considered in making this determination. Consideration of the potential for in-combination effects is also required at this stage.

Stage 2: Appropriate Assessment – This stage involves a detailed assessment of the implications of the plan or project, individually and in combination with other plans and projects, for the integrity of the Natura 2000 site(s) concerned. This stage also involves the development of appropriate mitigation to address any adverse effects

and an assessment of the significance of any residual impacts following the inclusion of mitigation. In *Kelly v. An Bord Pleanála* (IEHC 400), the High Court ruled that a lawful AA must contain complete, precise, and definitive findings based on examination and analysis, and conclusions and a final determination based on an evaluation of the findings. In the same judgment, the High Court stressed that, in order for the findings to be complete, precise, and definitive, the AA must be carried out in light of best scientific knowledge in the field and cannot have gaps or lacunae. In *Holohan v. An Bord Pleanála* (C-461/17), the CJEU clarified that AA must "*catalogue the entirety of habitat types and species for which a site is protected*" (i.e. the qualifying interests of the site) and assess the implications of the plan or project for the qualifying interests, both within and outside the site boundaries, and other, non-qualifying interest habitats and species, whether inside or outside the site boundaries, "*provided that those implications are liable to affect the conservation objectives of the site*". The proposer of a plan or project requiring AA is furnishes the competent authority with the scientific evidence upon which to base its AA by way of a Natura Impact Statement (NIS) or Natura Impact Report (NIR). If it is not possible to ascertain that the plan or project will not adversely affect one or more Natura 2000 sites, authorisation can only be granted subject to Article 6(4).

Stage 3: Article 6(4) – If a plan or project does not pass the legal test at Stage 2, alternative solutions to achieve its aims must be considered and themselves subject to Article 6(3). If no feasible alternatives exist, authorisation can only be granted where it can be demonstrated that there are imperative reasons of overriding public interest (IROPI) justifying its implementation. Where this is the case, all compensatory measures must be taken to protect the overall coherence of Natura 2000.

The three stages described above are illustrated in Figure 2.1 below.

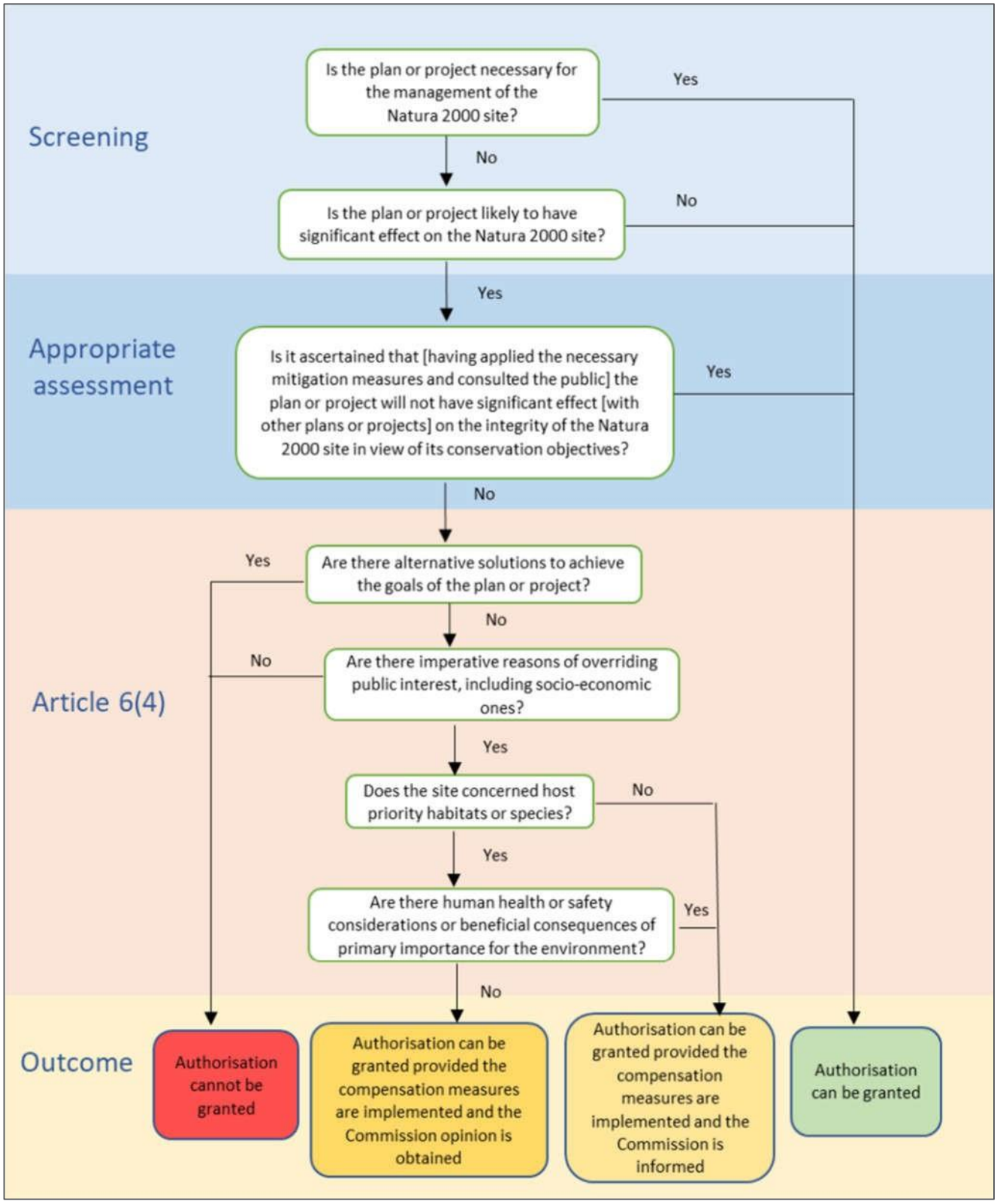


Figure 2.1 Stages of the Appropriate Assessment process (EC, 2021a).

3. Methods

3.1. Guidance documents

The Screening for Appropriate Assessment was prepared with reference and due consideration to the following documents and case law, including but not limited to: -

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna. *Official Journal of the European Communities* L 206/7-50.
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. *Official Journal of the European Union* L 20/7-25.
- European Communities (Birds and Natural Habitats) Regulations, 2011. *S.I. No. 77/2011* (as amended) ("the Habitats Regulations").
- Planning and Development Act, 2000. *No. 30 of 2000* (as amended) ("the Planning and Development Acts").
- EC (2018) *Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.* European Commission, Brussels.
- EC (2021) *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC.* European Commission, Brussels.
- DEHLG (2010a) *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Revised 11/02/2010.* Department of the Environment, Heritage and Local Government, Dublin.
- DEHLG (2010b) *Circular NPW 1/10 & PSSP 2/10. Dated 11/03/2010.* Department of the Environment, Heritage and Local Government, Dublin.
- NPWS (2012a) *Marine Natura Impact Statements in Irish Special Areas of Conservation. A Working Document. April 2012.* National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.
- OPR (2021) *Appropriate Assessment Screening for Development Management. OPR Practice Note PN01.* Office of the Planning Regulator, Dublin.
- Case law, including *Waddenzee* (C-127/02), *Sweetman v. An Bord Pleanála* (C-258/11), *Kelly v. An Bord Pleanála* (IEHC 400), *Commission v. Germany* (C-142/16), *People Over Wind* (C-323/17), *Holohan v. An Bord Pleanála* (C-461/17), *Eoin Kelly v. An Bord Pleanála* (IEHC 84) and *Heather Hill* (IEHC 450).

Guidance documents, published literature etc. with respect to shorebird ecology, distribution and conservation are referenced below as appropriate.

3.1.1. General

This assessment is based on consultation, a desktop review of existing information, combined with an examination of the results of a detailed study of waterbird distribution in of Blacksod Bay / Broadhaven SPA undertaken by NPWS in 2009 / 2010 (Cummins and Crowe, 2010); Irish Wetland Bird Survey data provided by BirdWatch Ireland, as well as other sources of published data and peer reviewed publications. In the case of trestle cultivation of Pacific oyster, it was also informed by data collected as part of a wider study of the effects of intertidal oyster cultivation on the spatial distribution of waterbirds (Gittings and O'Donoghue, 2012; Gittings and O'Donoghue, 2016a). Interpretation of licences and proposed activities was assisted by consultation with Bord Iascaigh Mhara (BIM), the Marine Institute and the Department of Agriculture, Food, and the Marine.

3.1.2. Data sources

The SPA boundaries are derived from NPWS shapefiles[28]. The boundary for Blacksod Bay/Broad Haven SPA (Map Version 2.01) was publicly notified in June 2011. In June 2013 an extension to this SPA (called Blacksod Bay/Broad Haven (Part Of) SPA 4037 - Map Versions 1.0) was publicly notified. The rationale for the extension related to breeding Dunlin (*Calidris alpina schinzii*). The boundary maps of Blacksod Bay/Broad Haven SPA (Map Version 2.01) and the extension Blacksod Bay/Broad Haven SPA (Part Of) 4037 (Map Version 1.0) were merged by this Department's GIS to produce a revised set of maps for the entire site – Map Version 2.02. The boundary for Blacksod Bay/Broad Haven SPA 4037 as shown on the NPWS Map Viewer is Map Version 2.02; i.e., the boundary incorporates the 2013 extension to SPA 4037 (NPWS, Sites & Designations, *pers comm*).

The spatial extents of the aquaculture plots have been derived from shapefiles supplied by the Marine Institute. Information on the development and current practices of aquaculture activities in Blacksod Bay / Broadhaven SPA was obtained from the aquaculture profile document compiled by Bord Iascaigh Mhara in December 2015 (BIM, 2016a & b), as well as consultation with BIM, the Marine Institute and the Department of Agriculture, Food, and the Marine. Updated information was provided by the Marine Institute to inform this assessment. During the assessment process, queries to individual operators went through BIM.

Blacksod Bay / Broadhaven Bay does not currently have a CLAMS plan (i.e., Co-ordinated Local Aquaculture Management Systems. CLAMS is a "*is a nationwide initiative to manage the development of aquaculture in bays and inshore waters throughout Ireland at a local level. In each case, the plan fully integrates aquaculture interests with relevant national policies*" (BIM, n.a.). A characterisation report (among others) has been prepared for Blacksod Bay (http://www.housing.gov.ie/water/water-quality/shellfish-waters/galway). In addition, a Shellfish Pollution Reduction Programme. Site Characterisation Report (No. 15) was published (Anon, n.a.); this provides a large body of background environmental data on Blacksod Bay.

Water quality data were sourced from the EPA's online map viewer (https://gis.epa.ie/EPAMaps/).

Breeding wader data, notably Dunlin (*Calidris alpina schinzii*) was extracted from Suddaby *et al*. 2010; Suddaby *et al*. 2020; and further examined through appropriate follow-up consultation with NPWS. Data on site usage by Barnacle Geese was extracted from NPWS site synopses; as well as results of the 2013 census of Barnacle Geese in Ireland (Crowe *et al*., 2014).

The bird data sources used for the assessment are as follows: -

Areas of Qualifying Scientific Interest (Goodwille, 1979).

- Irish Wetland Bird Survey (IWeBS) counts 1994/95-2020/21.

[28] http://www.npws.ie/maps-and-data/designated-site-data/download-boundary-data

- NPWS Baseline Waterbird Survey (NPWS BWS) 2009/10 counts (see also Cummins & Crowe, 2010).
- The descriptions of waterbird distribution within Blacksod Bay / Broadhaven SPA in the SPA Conservation Objectives Supporting Document (NPWS, 2014b).
- Additional survey data prepared as part of the Corrib Onshore Pipeline at Sruwaddacon Bay (EACS, 2010).

The distribution of biotopes in Blacksod Bay / Broadhaven SPA is taken from a number of sources: the biotope mapping presented in MERC (2008); the maps showing the distribution of benthic communities in the Mullet / Blacksod SAC (NPWS (2014c) and Broadhaven Bay SAC (NPWS, 2014d). Impacts on both SAC's are considered separately by the Marine Institute. Biotope GIS / mapping was downloaded from NPWS online Habitats and Species data portal (http://www.npws.ie/maps-and-data/habitat-and-species-data).

The extent of intertidal and subtidal habitats in key bays are based on Admiralty Chart data, and represent the depth below the lowest astronomical tide; supplemented by available aerial imagery.

Data on the timing and height of low tides were obtained from the United Kingdom Hydrographic Offices Admiralty EasyTide website (http://easytide.ukho.gov.uk/).

Information on other activities (such as recreational use and shellfish gathering) was obtained primarily from the data on potentially disturbing activities recorded during the NPWS low tide counts, supplemented by desktop research and consultation.

3.1.2.1. Data Limitations

The main limitation associated with this assessment is the age of the low tide data collected by the NPWS (2010/2011). While more recent high tide IWeBS data was sourced (up to 2020/21), the age of the low tide data on spatial distribution of birds must be noted.

3.1.2.2. Subsites

Blacksod Bay / Broadhaven SPA is divided into 30 subsites for IWeBS counts. Fahy Lake (northwest of Ballycroy) and Blind Harbour (northeast of Belmullet), which both lies within the SPA, are covered in IWeBS surveys, but boundary information is not currently available (BWI, *pers comm*) (see Figure 2.1).

IWeBS surveys are not currently undertaken in Sruwaddacon Bay; the most recent count data from this subsite is March 2012. However, this subsite has continued to be the focus of substantial bird survey work associated with the Corrib Gas Pipeline. Moyrahan Bay, which runs north from the south-western corner of Belmullet Bay (Broadhaven) does not appear to be counted.

Broadly speaking the NPWS 2009 / 2010 low tide counts utilised IWeBS subsite boundaries, with the following exceptions (see NPWS, 2014b; Figure 2.1): -

- 0D079 - IWeBS subsite was not counted as part of the NPWS baseline waterbird survey.
- 0D438 - Moyrahan Bay was include in 0D438 as part of the NPWS baseline waterbird survey.
- 0D439 – Blacksod Bay (sea) (largely overlapping with the scallop fishery).

- 0D475 – Sruwaddacon Bay: Broadhaven.
- 0D495 – Blind Harbour.
- 0D079 - IWeBS subsite was not counted as part of the NPWS baseline waterbird survey.
- 0D438 - Moyrahan Bay was include in 0D438 as part of the NPWS baseline waterbird survey.
- 0D439 – Blacksod Bay (sea) (largely overlapping with the scallop fishery).
- 0D475 – Sruwaddacon Bay: Broadhaven.
- 0D495 – Blind Harbour.

3.1.2.3. Definition of habitat zones

Three broad habitat zones have been defined for this assessment: intertidal, shallow subtidal (< 0.5 deep) and deep subtidal (> 0.5 m deep). The rationale for the distinction between the shallow and deep subtidal zones is that Light-bellied Brent Geese generally does not feed in waters greater than 0.5 m deep (Clausen, 2000). This was done only in specific bays as determined by aquaculture profile and species distribution.

The biotope maps presented in below illustrate the characteristic intertidal and subtidal habitats within both Blacksod Bay and Broadhaven; this includes areas outside of the SPA, but within the Mullet/Blacksod Bay Complex SAC (000470) and Broadhaven Bay SAC (00472); but not Blind Harbour or Sruwaddacon Bay (Figure 3.2).

Areas of mudflat and sandflat not covered by seawater at high tide (i.e., Annex I habitat 1140) are illustrated in Figure 3.2. These areas appear to match the boundaries between the intertidal and subtidal zones as illustrated on the OSI Discovery Series mapping; the Discovery Series mapping appears to be based on the 1930s six-inch mapping. Therefore, the details of the boundaries between the intertidal and subtidal zones are likely to have changed. Supplementary information included Admiralty Chart mapping as well as aerial photographic coverage from Ordnance Survey Ireland (OSI), Bing Maps and Google Earth.

3.1.3. Analyses of waterbird distribution

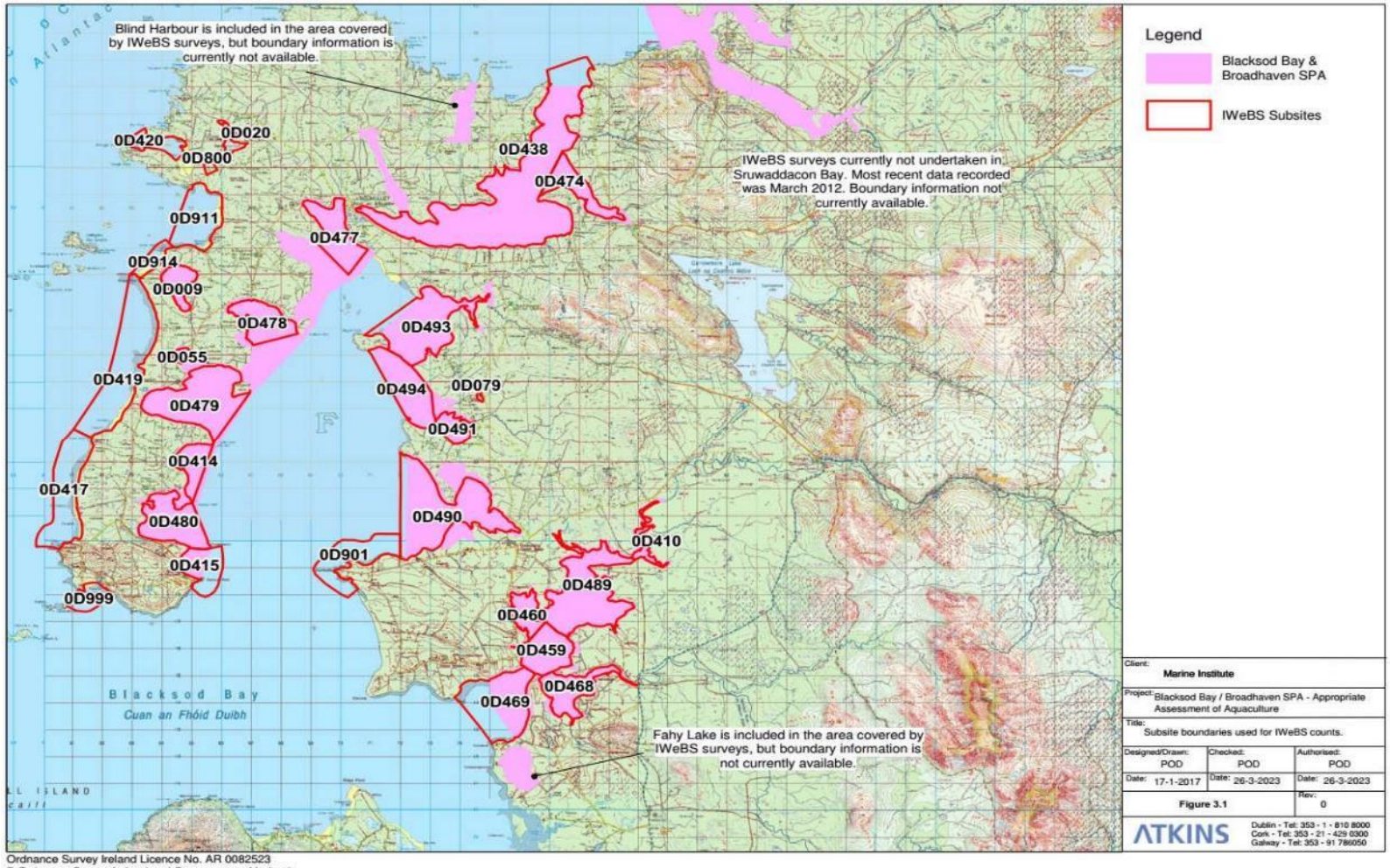
The analyses of waterbird distribution in this assessment focuses on distribution patterns of feeding, or potentially feeding birds, as the main potential impacts will be to the availability and/or quality of feeding habitat. Most waterbird species will roost at high tide in shoreline or terrestrial areas, which will not be affected by the activities being assessed. However, we have included assessment of potential impacts on roosting birds, where relevant, and in the case of breeding species such as Sandwich Tern and Dunlin (*schinzii*) we have also considered impacts on nest sites and associated foraging areas.

Waterbird distribution has been mainly analysed by reviewing count data across subsites from the IWeBS, NPWS baseline waterbird survey, other published survey data, as well as consultation with NPWS, BirdWatch Ireland etc. as appropriate. In addition, NPWS baseline waterbird survey flock map data has also been used.

3.1.3.1. Irish Wetland Bird Survey (IWeBS)

Waterbird distribution has been monitored as part of the Irish Wetland Bird Survey (IWeBS) each winter since 1994/95, apart from 2020/21. The IWeBS scheme aims to carry out monthly counts each winter between

September and March in all sites that are important for non-breeding waterbird populations. However, this level of coverage is not always possible to achieve in a volunteer-based scheme. Most counts have been carried out in the mid-winter period (December-February). The counts are carried out by a coordinated team of three volunteers, normally all on the same day around the high tide period. Count sectors are shown on Figure 3.1.



3.1.3.2. NPWS BWS

Details of the NPWS baseline waterbird survey methodology and results at Blacksod Bay / Broadhaven SPA are described in Cummins and Crowe (2010) and Lewis and Tierney (2014).

Counts

In the winter of 2009/10, waterbird counts were carried out as part of the National Parks and Wildlife Service's baseline waterbird survey. Four low tide and one high tide count were carried out. The counts were carried out by a coordinated team of five professional counters. A total of 23 count subsites were covered; the western side of the Mullet peninsula was excluded. An additional subsite (0D439) covering the subtidal part of Blacksod Bay was counted on two occasions. Lough Leam (0D055) was also counted. Count sectors are illustrated on Figure 3.2. Each count was completed in a single day and there was complete coverage on each count (Cummins and Crowe, 2010).

The NPWS baseline waterbird survey counts were carried out from land-based vantage points. This means that counts of birds in the central subtidal parts of Blacksod Bay would be strongly influenced by count conditions; however, Cummins and Crowe (2010) note that count conditions were good, though winds ranged from fresh to strong. Such conditions can present challenges for counting species such as Common Scoter.

The NPWS baseline waterbird survey counted feeding and roosting birds separately. However, we have not analysed their distribution separately. In general, birds at low tide usually roost in the same area as they feed and often the roosting birds are mainly just roosting for short periods of time before resuming feeding. Therefore, the division between feeding and roosting may be a matter of chance depending upon the exact timing of the count.

NPWS BWS flock maps

As part of the NPWS baseline waterbird survey the approximate position of the main flocks encountered were mapped. These flock map data have been used to supplement the analyses of species distribution from the IWeBS and/or NPWS baseline waterbird survey counts. In particular, the flock map data is useful in indicating relationships between species distributions and broad topographical/habitat zones, such as biotopes, edges of tidal channels, upper shore areas, etc.

There are some limitations to the interpretation of flock map data because of the difficulties of accurately mapping positions of distant flocks from shoreline vantage points and also the different observers may have varied in the extent to which they mapped flocks.

Breeding species

There are two qualifying interest species listed for their breeding populations. While the location of Sandwich Tern breeding colonies is known; there is no detailed information available on the distribution of foraging birds from the breeding colony. Therefore, this places constraints on undertaking a detailed distributional analyses for this species. In the case of nesting Dunlin (*schinzii*) it is assumed that birds are nesting and feeding young on machair habitats; consideration will, however, also be given to potential use of adjoining intertidal habitat as well as potential impacts associated with access.

In the case of Corncrake, a qualifying interest for a neighbouring SPA, potential impacts associated with access are also considered.

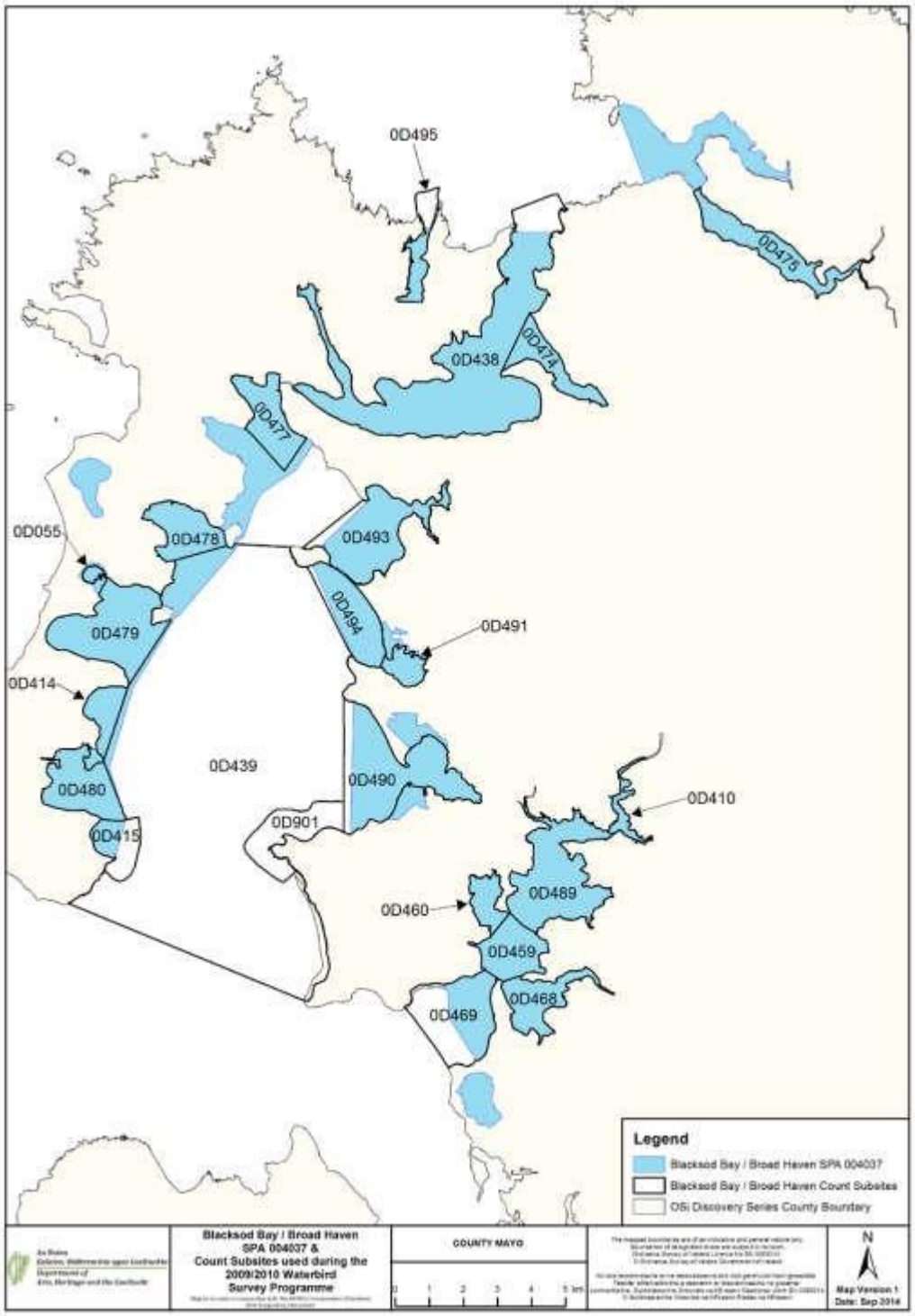


Figure 3.2 NPWS low tide count sectors (from NPWS, 2014b)

3.1.4. Assessment Methodology

3.1.4.1. Identification of potential impacts

A literature review was carried out to assess the likely main food resources of the qualifying interest species in the Blacksod Bay / Broadhaven SPA (see Appendix B). Information on the impact of the proposed aquaculture activities on intertidal and subtidal biotopes from the SAC Appropriate Assessment, and previous published research, has been used to identify potential impacts to prey resources used by the qualifying interest species.

In addition, a review of the ecology of key fish species in Blacksod Bay / Broadhaven SPA was carried out to identify potential impacts on prey resources for fish-eating qualifying interest species. Where available, previous research (Caldow *et al.*, 2003; Gittings and O'Donoghue, 2012 / 2016a; Roycroft *et al.*, 2004, 2007; Scheiffarth et al., 2007; van der Kam et al., 1999; Wehrmann, 2009) has also been used to identify the likely response (positive, neutral, or negative) of the qualifying interest species to the activities being assessed.

Potential negative impacts to qualifying interest species have been identified where the activity may cause negative impacts to prey resources, where there is evidence of a negative response to the activity by the species from previous work, and/or where a negative response is considered possible by analogy to activities that have similar types of impacts on habitat structure and/or by analogy to ecologically similar species.

With respect to cultivation of oysters on trestles, the primary source of information used for the identification of potential impacts is the oyster trestle study (Gittings and O'Donoghue, 2012; 2016a). The results of this study were used to identify consistent patterns of positive or negative association with oyster trestles across the sites studied and categorised species into the following groups: neutral/positive association, negative association, exclusion response, and variable response (response may vary between sites). The trestle study was carried out during periods with typical levels of husbandry activity. Therefore, the effects of disturbance due to husbandry activity associated with intertidal oyster cultivation are included in the categorisation of species responses and such disturbance impacts are not analysed separately in this assessment. The trestle study focused on species associated with the intertidal and/or shallow subtidal habitats. Four of the qualifying interest species (Red breasted Merganser, Common Scoter, Great Northern Diver, and Sandwich Tern) are primarily associated with deep (>0.5 m) subtidal habitats; the trestle study does not provide information on their responses to intertidal oyster cultivation. A literature review was, however, carried out to assess the likely main food resources of these qualifying interest species in the Blacksod Bay / Broadhaven SPA and to assess the potential impact of intertidal oyster cultivation on these food resources.

The pattern of impacts for oyster cultivation on trestles were taken to also represent the potential impacts of cultivating either blue mussels or winkles in oyster trestles. Subtidal native oyster cultivation has previously been assessed as part of the Lough Swilly SPA Appropriate Assessment (Marine Institute, 2013).

3.1.4.2. Assessment of impact magnitude

Where potential impacts from an activity on a qualifying interest species have been identified, the spatial overlap between the distributions of the species and the spatial extent of the activity was calculated, or qualitatively assessed when quantitative data was not available. This overlap is considered to represent the potential magnitude of the impact, as it represents the maximum potential displacement if the species has a negative response to the activity. Where appropriate, information on species habitat usage was used to refine the assessment of likely impact magnitude.

3.1.4.3. Assessment of impact significance

The methodology used for this Appropriate Assessment is focussed on the Conservation Objectives, and their attributes, that have been defined and described for the Blacksod Bay / Broadhaven SPA (NPWS, 2014a). These conservation objectives are the same for all the non-breeding qualifying interest species. The breeding qualifying interest species have different conservation objectives. However, because of lack of information about their spatial distribution we have been unable to carry out detailed assessment for these species, and they are not considered further in the following description of our assessment methodology. We have,

however, made qualitative assessments of potential impacts on these species; this will be described in detail as appropriate, below.

Conservation Objective 1 defines two types of attributes to assess conservation condition: long term population trends and numbers or range (distribution) of areas used. This assessment focuses on assessing potential impacts on the spatial distribution of the qualifying interest waterbird species within Blacksod Bay / Broadhaven.

SPA and, in particular, whether the activities will cause displacement of a significant proportion of the Blacksod Bay / Broadhaven SPA population from the affected area(s). If the activities are not predicted to cause significant displacement, then the activities are not likely to affect the long term population trends. If the activities are predicted to cause significant displacement, then the activities could affect the long term population trends (but see below). In the cases where the activities are predicted to cause significant displacement, the impacts on distribution and population size are assessed separately.

The basis for the assessments are datasets that indicate the distribution of waterbird species between different broad sectors of Blacksod Bay / Broadhaven SPA (the IWeBS and NPWS baseline waterbird survey counts; as well as other published sources of data). The datasets allow calculation of the proportion of the Blacksod Bay / Broadhaven SPA population that would be affected if aquaculture or fisheries activities cause displacement of birds from areas occupied by the activities. This approach can be considered as a very simple form of habitat association model and represents a conservative form of assessment (see Stillman and Goss-Custard, 2010): the population-level consequences of displacement will depend upon the extent to which the remaining habitat is available (i.e., whether the site is at carrying capacity). In general, this assessment method "*will be pessimistic because some of the displaced birds will be able to settle elsewhere and survive in good condition*" (Stillman and Goss-Custard, 2010).

The assessment of potential disturbance impacts is based mainly on the potential for disturbance to cause displacement of birds from areas they would otherwise occupy. However, where there is limited availability of alternative habitat, or where the energetic costs of moving to alternative habitat is high, disturbance may not cause displacement of birds but may still have population level consequences (e.g., through increased stress, or reduced food intake, leading to reduced fitness) (Gill *et al.*, 2001a/b). However, assessing these types of potential impacts would require detailed population modelling, which would require a major research effort that is beyond the scope of this assessment.

3.1.4.4. Assessment of significance

The significance of any potential impacts identified has been assessed with reference to the attributes and targets specified by NPWS (2014a) for this conservation objective. Potential negative impacts are either assessed as significant (if the assessment indicates that they will have a detectable effect on the attributes and targets) or not significant. The significance levels of potential positive impacts have not been assessed.

Attribute 1 – Long term population trends

The criteria that we have used for assessing significance with reference to attribute 1 of the conservation objectives are summarised in Table 2.1 and are described below.

If the impact is predicted to cause spatial displacement of >25% of the total Blacksod Bay / Broadhaven SPA population of a qualifying interest species, then the impact could, pessimistically, cause the long term

population trend to show a decrease of 25% or more. Therefore, the impact would be potentially significant with reference to attribute 1 of the conservation objective.

If the long-term population trend of the species is a decrease of 25% or more, and the impact is predicted to cause spatial displacement of 5% or more (see criteria under Attribute 2), then the impact could prevent the potential recovery of the population. Therefore, the impact would be potentially significant with reference to attribute 1 of the conservation objective.

If the long-term population trend of the species is a decrease of less than 25%, but the combination of the long-term population trend and the predicted spatial displacement (where the latter is assessed to be significant; see criteria under Attribute 2) would equal or exceed 25%, then the impact could cause the long term population trend to show a decrease of 25% or more. Therefore, the impact would be potentially significant with reference to attribute 1 of the conservation objective.

Table 3.1 Criteria for assessing significance with reference to attribute 1 of the conservation objectives.

Long-term population decrease (P)	Spatial displacement (S)	Additional criteria	Impact
-	≥ 25%	-	Significant
≥ 25%	≥ 5%	-	Significant
< 25%	≥ 5%	P + S ≥ 25%	Significant

Attribute 2 – Number or range (distribution) of areas used

Assessing significance with reference to attribute 2 is more difficult because the level of decrease in the numbers or range (distribution) of areas that is considered significant has not been specified by NPWS. There are two obvious ways of specifying this threshold: (i) the value above which other studies have shown that habitat loss causes decreases in estuarine waterbird populations; and (ii) the value above which a decrease in the total Blacksod Bay / Broadhaven SPA population would be detectable against background levels of annual variation.

There have been some studies that have used individual-based models (IBMs; see Stillman and Goss-Custard, 2010) to model the effect of projected intertidal habitat loss on estuarine waterbird populations. West *et al*. (2007) modelled the effect of percentage of feeding habitat of average quality that could be lost before survivorship was affected. The threshold for the most sensitive species (Black-tailed Godwit) was 40%. Durell *et al*. (2005) found that loss of 20% of mudflat area had significant effects on Oystercatcher and Dunlin mortality and body condition, but did not affect Curlew. Stillman *et al*. (2005) found that, at mean rates of prey density recorded in the study, loss of up to 50% of the total estuary area had no influence on survival rates of any species apart from Curlew. However, under a worst-case scenario (the minimum of the 99% confidence interval of prey density), habitat loss of 2-8% of the total estuary area reduced survival rates of Grey Plover, Black-tailed Godwit, Bar-tailed Godwit, Redshank and Curlew, but not of Oystercatcher, Ringed Plover, Dunlin and Knot. Therefore, the available literature indicates that generally quite high amounts of habitat loss are required to have significant impacts on estuarine waterbird populations, and that very low levels of displacement are unlikely to cause significant impacts. However, it would be difficult to specify a threshold value from the literature as these are likely to be site specific.

If a given level of displacement is assumed to cause the same level of population decrease (i.e., all the displaced birds die or leave the site), then displacement will have a negative impact on the conservation condition of the species. However, background levels of annual variation in recorded waterbird numbers are generally high, due to both annual variation in absolute population size and the inherent error rate in counting waterbirds in a large and complex site. Therefore, low levels of population decrease will not be detectable (even with a much higher monitoring intensity than is currently carried out). For example, a 1% decrease in the baseline population of Turnstone would be a decrease of two birds. The minimum error level in large-scale waterbird monitoring is considered to be around 5% (Hale, 1974; Prater, 1979; Rappoldt, 1985). Therefore, any population decrease of less than 5% is unlikely to be detectable and, for the purposes of this assessment, 5% has been taken to be the threshold value below which displacement effects are not considered to be significant. This is a conservative

threshold, as error levels combined with natural variation are likely to, in many cases; prevent detectability of higher levels of change. This threshold is also likely to be very conservative in relation to levels that would cause reduced survivorship (see above).

Summary

Impacts have been assessed as potentially having a significant negative impact on attribute 1 of the conservation objectives (the species' long-term population trend), if they are predicted to cause: -

- Displacement of 25% or more of the Blacksod Bay / Broadhaven SPA total; or
- Significant displacement levels (i.e., 5% or greater; see below) that combined with current long-term population trends, could result in a long-term population decline of 25%; or
- Significant displacement levels (i.e., 5% or greater; see below) where the current long-term population trends is already equal to or greater than 25%.

Impacts that will cause displacement of 5% or more of the total Blacksod Bay / Broadhaven SPA population of a SCI species have been assessed as potentially having a significant negative impact on attribute 2 of the conservation objectives (the species' distribution within Blacksod Bay / Broadhaven SPA). In this context, displacement may involve birds moving to other areas within the SPA or leaving the site altogether.

The 25% threshold has been derived from the NPWS conservation objectives. The 5% threshold is based on the rationale presented above.

4. Natura 2000 Sites

4.1. Blacksod Bay / Broadhaven SPA (004037)

4.1.1. Qualifying Interests

The Qualifying Interests of Blacksod Bay / Broadhaven SPA (004037) include non-breeding populations of Great Northern Diver, Light-bellied Brent Goose, Common Scoter, Red-breasted Merganser, Ringed Plover, Sanderling, Dunlin, Bar-tailed Godwit and Curlew.

Breeding populations of Sandwich Tern and Dunlin are also listed as Qualifying Interests for Blacksod Bay / Broadhaven SPA.

In addition: wetland habitats contained within Blacksod Bay / Broadhaven SPA are identified to be of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore, the wetland habitats are considered to be an additional Special Conservation Interest (NPWS, 2014a & b).

4.1.2. Conservation objectives

Qualifying Interest species

The conservation objectives for the non-breeding populations of Great Northern Diver, Light-bellied Brent Goose, Common Scoter, Red-breasted Merganser, Ringed Plover, Sanderling, Dunlin, Bar-tailed Godwit and Curlew at Blacksod Bay / Broadhaven SPA are to maintain their favourable conservation condition (NPWS, 2014a & b).

The favourable conservation conditions of these species at Blacksod Bay / Broadhaven SPA are defined by various attributes and targets, which are shown in Table 4.1.

Table 4.1 Attributes and targets for the conservation objectives of wintering Great Northern Diver, Light-bellied Brent Goose, Common Scoter, Red-breasted Merganser, Ringed Plover, Sanderling, Dunlin, Bar-tailed Godwit and Curlew at Blacksod Bay / Broadhaven SPA.

Attribute		Measure	Target	Notes
1	Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the Conservation Objectives Supporting Document
2	Distribution	Range, timing, and intensity of use of areas	There should be no significant decrease in the range, timing, and intensity of use of areas used by the 'SCI species', other than that occurring from natural patterns of variation	Waterbird distribution from the 2009/10 waterbird survey programme is discussed in Part Five of the conservation objectives supporting document

Source: NPWS (2014a). Attributes are not numbered in NPWS (2014a), but are numbered here for convenience

The conservation objectives for the breeding populations of Sandwich Tern and Dunlin at Blacksod Bay / Broadhaven SPA are to maintain their favourable conservation condition (NPWS, 2014a).

The favourable conservation conditions of these species at Blacksod Bay / Broadhaven SPA are defined by various attributes and targets, which are shown in Table 4.2.

Table 4.2 Attributes and targets for the conservation objectives for breeding populations of Sandwich Tern and Dunlin at Blacksod Bay / Broadhaven SPA.

Attribute	Measure	Target	Notes	
			Sandwich Tern	Dunlin
1.Breeding population abundance: apparently occupied nests (AONs) (TE) apparently occupied territories (AOTs) (DN)	Number	No significant decline	Measure based on standard tern survey methods (see Walsh *et al*., 1995). Hannon *et al*. (1997) recorded 81 breeding pairs on Inishderry as part of the 1995 All Ireland Tern Survey. Recent data is lacking for this colony	Measure based on standard survey methods (see Suddaby *et al*. (2010))
2. Productivity rate: fledged young per breeding pair (both TE and DN)	Mean number	No significant decline	Measure based on standard tern survey methods (see Walsh *et al*., 1995). The Seabird Monitoring Programme (SMP) online database (JNCC, 2014) provides population data for this species	Measure based on standard survey methods (see Thompson *et al.* (2007))
3. Distribution: breeding colonies (TE)	Number; location; area (ha) (TE) Number; location (DN)	No significant decline (TE) Stable or increasing, subject to natural variation (DN)	Typical sandwich tern breeding sites are located on low-lying offshore islands or islets in bays or brackish lagoons on spits or remote mainland dunes (Cramp, 1985). Wide fluctuations between years in both breeding numbers and colony locations are known to occur for this species (Mitchell *et al*., 2004). However, a sandwich tern colony has been recorded on Inishderry in the 1990s and on several occasions in the 1980s (see Hannon *et al*., 1997 and Whilde, 1985)	The distribution of breeding dunlin has contracted since initial surveys were undertaken (Nairn and Shephard, 1985; Madden *et al.*, 1998; Suddaby *et al*., 2010)
4. Availability of suitable habitat: area and distribution (DN only)	Hectares; location	Stable or increasing, subject to natural processes	Not applicable	Ideally, suitable habitat should be at, or close to, existing breeding pairs. Factors that are negatively affecting potentially suitable habitat include fencing, drainage, inappropriate grazing regimes, fertilisation and overgrazing by rabbits (*Oryctolagus cuniculus*)

Attribute	Measure	Target	Notes	
			Sandwich Tern	Dunlin
5. Prey biomass available (TE only)	Kilogrammes	No significant decline	Key prey items: Mostly energy-rich fish, some crustaceans and occasionally insects and rag worms. Key habitats: sandwich tern forage in/over shallow marine waters such as bays, inlets and outflows, gullies, shoals, inshore waters, reefs, and sandbanks; also, more open waters nearshore and offshore, including open sea. Foraging range: max. 70km, mean max. 42.3km, mean 14.7km (BirdLife International Seabird Database (Birdlife International, 2014))	Not applicable
6. Barriers to connectivity (TE only)	Number; location; shape; area (hectares)	No significant increase	Foraging range: Max 70km, mean max 42.3km, mean 14.7km (Birdlife International Seabird Database (Birdlife International, 2013))	Not applicable
7. Disturbance at breeding site (both TE and DN)	Level of impact	Human activities should occur at levels that do not adversely affect the breeding *[SCI species]* population	Colonies are typically situated on low-lying offshore islands or islets, in bays or brackish lagoons, on spits or remote mainland dunes (Cramp, 1985). The sandwich tern colony on Inishderry has been recorded in the 1990s and on several occasions in the 1980s (see Hannon *et al*., 1997 and Whilde, 1984)	Colonies are typically situated on low-lying offshore islands or islets, in bays or brackish lagoons, on spits or remote mainland dunes (Cramp, 1985). The sandwich tern colony on Inishderry has been recorded in the 1990s and on several occasions in the 1980s (see Hannon *et al*., 1997 and Whilde, 1984) (TE) Unsuitable livestock grazing regimes can result in nest trampling and destruction of suitable nesting sites. Agri-environment schemes in Ireland specify less than 1.0 livestock units per hectare during the breeding wader nesting period (DN)

Source: NPWS (2014a) [Attributes are not numbered in NPWS (2014a), but are numbered here for convenience].

Wetlands and waterbirds

The conservation objective for wetlands and waterbirds at Blacksod Bay / Broadhaven SPA is to "*maintain the favourable conservation condition of the wetland habitat in Blacksod Bay / Broadhaven SPA as a resource for the regularly-occurring migratory waterbirds that utilise it*" (NPWS, 2014a).

The favourable conservation condition of the wetland habitat at Blacksod Bay / Broadhaven SPA is defined by a single attribute and target, which is shown in Table 4.3.

Table 4.3 Attribute and target for the conservation objective for wetlands and waterbirds at Blacksod Bay / Broadhaven SPA.

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area occupied by the wetland should be stable and not significantly less than the area of 8,539 ha other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 8,539 ha using OSi data and relevant orthophotographs. For further information see Part Three of the Conservation Objectives Supporting Document

Source: NPWS (2014a).

4.2. Carrowmore Lake SPA (004052)

4.2.1. Qualifying features

The Qualifying Interest species of Carrowmore Lake SPA is a breeding population of Sandwich Tern.

4.2.2. Conservation objectives

The conservation objective for the breeding population of Sandwich Tern is to maintain or restore its favourable conservation condition (NPWS, 2022a)[29].

NPWS have only published generic conservation objectives for the Carrowmore Lake SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.3. Doogort Machair SPA (004235)

4.3.1. Qualifying features

The Qualifying Interest species of Doogort Machair SPA is a breeding population of Dunlin (*Calidris alpina schinzii*).

4.3.2. Conservation objectives

The conservation objective for the breeding population of Dunlin is to maintain or restore its favourable conservation condition (NPWS, 2022b)[10].

[29] NPWS (2022a). Conservation objectives for Carrowmore Lake SPA [004052]. Generic Version 9.0. Department of Housing, Local Government and Heritage. [10] NPWS (2022b). Conservation objectives for Doogort Machair SPA [004235]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

NPWS have only published generic conservation objectives for the Doogort Machair SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.4. Duvillaun Islands SPA (004111)

4.4.1. Qualifying features

The Qualifying Interest species of the Duvillaun Islands SPA include non-breeding populations of Barnacle Goose.

Breeding populations of Fulmar and Storm Petrel are also listed as Qualifying Interests for Duvillaun Island SPA.

4.4.2. Conservation objectives

The conservation objective for both the breeding and non-breeding Qualifying Interest populations within Duvillaun Islands SPA is to maintain or restore their favourable conservation condition (NPWS, 2022c)[30].

NPWS have only published generic conservation objectives for the Duvillaun Islands SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.5. Illanmaster SPA (004074)

4.5.1. Qualifying features

The Qualifying Interest species for Illanmaster SPA is a breeding population of Storm Petrel.

4.5.2. Conservation objectives

The conservation objective for the breeding Strom Petrel population at Illanmaster SPA is to maintain or restore its favourable conservation condition (NPWS, 2022d)[31].

NPWS have only published generic conservation objectives for the Illanmaster SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.6. Inishkea Islands SPA (004004)

4.6.1. Qualifying features

The Qualifying Interests of the Inishkea Islands SPA include non-breeding populations of Barnacle Goose, Ringed Plover, Sanderling, Purple Sandpiper and Turnstone.

Breeding populations of Shag, Common Gull, Herring Gull, Arctic Tern, Little Tern, and Dunlin are also listed as Qualifying Interests for Inishkea Islands SPA.

4.6.2. Conservation objectives

The conservation objective for both the breeding and non-breeding Qualifying Interest species populations within Inishkea Islands SPA are to maintain or restore their favourable conservation condition (NPWS, 2022e)[32].

NPWS have only published generic conservation objectives for the Inishkea Islands SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

[30] NPWS (2022c). Conservation objectives for Duvillaun Islands SPA [004111]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

[31] NPWS (2022d). Conservation objectives for Illanmaster SPA [004074]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

[32] NPWS (2022e). Conservation objectives for Inishkea Islands SPA [004004]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

4.7. Inishglora and Inishkeeragh SPA (004084)

4.7.1. Qualifying features

The Qualifying Interest of the Inishglora and Inishkeeragh SPA include non-breeding populations of Barnacle Goose.

Breeding populations of Storm Petrel, Cormorant, Shag, Lesser Black-backed Gull, Herring Gull, and Arctic Tern are also listed as Qualifying Interests for Inishglora and Inishkeeragh SPA.

4.7.2. Conservation objectives

The conservation objective for both the breeding and non-breeding Qualifying Interest populations within Inishglora and Inishkeeragh SPA is to maintain or restore their favourable conservation condition (NPWS, 2022f)[33].

NPWS have only published generic conservation objectives for the Inishkea Islands SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.8. Mullet Peninsula SPA (004227)

4.8.1. Qualifying features

The Qualifying Interest of the Mullet Peninsula SPA is a breeding population of Corncrake.

4.8.2. Conservation objectives

The conservation objective for Corncrake populations within the Mullet Peninsula SPA are to maintain or restore their favourable conservation condition (NPWS, 2022g)[34].

NPWS have only published generic conservation objectives for the Inishkea Islands SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.9. Owenduff/Nephin Complex SPA (004098)

4.9.1. Qualifying features

The Qualifying Interests of the Owenduff/Nephin Complex SPA are breeding populations of Merlin and Golden Plover.

4.9.2. Conservation objectives

The conservation objective for Merlin and Golden Plover populations within the Owenduff/Nephin Complex SPA are to maintain or restore their favourable conservation condition (NPWS, 2022h)[35].

[33] NPWS (2022f). Conservation objectives for Inishglora and Inishkeeragh SPA [004084]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

[34] NPWS (2022g). Conservation objectives for Mullet Peninsula SPA [004227]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

[35] NPWS (2022h). Conservation objectives for Owenduff/Nephin Complex SPA [004098]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

NPWS have only published generic conservation objectives for the Inishkea Islands SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.10. Stags of Broad Haven SPA (004072)

4.10.1. Qualifying features

The Qualifying Interests of the Stags of Broadhaven SPA are breeding populations of Storm Petrel and Leach's Storm Petrel.

4.10.2. Conservation objectives

Qualifying Interest species

The conservation objective for Storm Petrel and Leach's Storm Petrel populations within the Stags of Broadhaven SPA are to maintain or restore their favourable conservation condition (NPWS, 2022i)[36].

NPWS have only published generic conservation objectives for the Inishkea Islands SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.11. Termoncarragh Lake and Annagh Machair SPA (004093)

4.11.1. Qualifying features

The Qualifying Interests of Termoncarragh Lake and Annagh Machair SPA are non-breeding populations of Whooper Swan, Barnacle Goose, Lapwing and Greenland White-fronted Goose.

Breeding populations of Corncrake, Lapwing, Chough, and Dunlin are also listed as Qualifying Interests for Termoncarragh Lake and Annagh Machair SPA.

In addition, wetland habitats contained within Termoncarragh Lake and Annagh Machair SPA are identified to be of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore, the wetland habitats are considered to be an additional Qualifying Interest (NPWS, 2022j)[37].

4.11.2. Conservation objectives

Qualifying Interest species

The conservation objective for the breeding and non-breeding Qualifying Interest species within Termoncarragh Lake and Annagh Machair SPA are to maintain or restore their favourable conservation condition (NPWS, 2022j).

In addition, a second conservation objective for the wetland and waterbirds Qualifying Interests aims to *"maintain or restore the favourable conservation condition of the wetland habitat at Termoncarragh Lake and Annagh Machair SPA as a resource for the regularly-occurring migratory waterbirds that utilise it"* (NPWS, 2022j).

[36] NPWS (2022i) Conservation objectives for Stags of Broad Haven SPA [004072]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

[37] NPWS (2022j) Conservation objectives for Termoncarragh Lake and Annagh Machair SPA [004093]. Generic Version 9.0. Department of Housing, Local Government and Heritage.

NPWS have only published generic conservation objectives for the Termoncarragh Lake and Annagh Machair SPA. Therefore, there are no site-specific attributes and targets to define the favourable conservation condition of these species.

4.12. Other Sites (>15km)

A range of other sites occur close to or beyond 15km from Blacksod Bay / Broadhaven SPA; these include: -

Table 4.4 Other SPAs at greater than 15km from Blacksod Bay / Broadhaven SPA.

Site	Number	Conservation Interests	Comment
Killala Bay / Moy Estuary SPA[38]	004036	Ringed Plover Golden Plover Grey Plover Sanderling Dunlin Bar-tailed Godwit Curlew Redshank Wetland and Waterbirds [A999]	Remote from Blacksod Bay / Broadhaven SPA. No information to suggest interchange of waders between sites. Not considered further.
Lough Conn & Lough Cullin SPA[39]	004228	Tufted Duck Common Scoter Common Gull Greenland White-fronted Goose Wetland and Waterbirds [A999]	No impact on breeding Tufted Duck and Common Scoter likely. It is not known if breeding Common scoter winter at Blacksod Bay / Broadhaven SPA. No information available to suggest interchange of Greenland White-fronted Goose between Blacksod Bay and Broadhaven SPA and Clare Island SPA. Impacts on Common scoter and Greenland White Fronted Goose are, however, discussed below.
Bill Rocks SPA[40]	004177	Storm Petrel Puffin	Seabirds. Use of Blacksod Bay / Broadhaven SPA by seabirds, including storm petrel and puffin is discussed below.
Cross Lough (Killadoon) SPA[41]	004212	Sandwich Tern	Use of Blacksod Bay / Broadhaven SPA by foraging Sandwich tern is discussed below.

[38] NPWS (2013). Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, and the Gaeltacht.

[39] NPWS (2022k) Conservation objectives for Lough Conn and Lough Cullin SPA [004228]. First Order Site-specific Conservation Objectives Version 1.0. Department of Housing, Local Government and Heritage.

[40] NPWS (2022l) Conservation objectives for Bills Rocks SPA [004177]. First Order Site-specific Conservation Objectives Version 1.0. Department of Housing, Local Government and Heritage.

[41] NPWS (2022m). Conservation objectives for Cross Lough (Killadoon) SPA [004212]. First Order Site-specific Conservation Objectives Version 1.0. Department of Housing, Local Government and Heritage. [23] NPWS (2022n). Conservation objectives for Clare Island SPA [004136]. First Order Site-specific Conservation Objectives Version 1.0. Department of Housing, Local Government and Heritage.

Clare Island SPA[23]	004136	Fulmar Shag Common Gull Kittiwake Guillemot Razorbill Chough	Seabirds. Use of Blacksod Bay / Broadhaven SPA by seabirds is discussed below. No information available to suggest interchange of Chough between Blacksod Bay / Broadhaven SPA and Clare Island SPA. Impacts on chough are discussed below.

5. Screening for Appropriate Assessment

5.1. Zone of Influence

The "Zone of Influence" of a plan or project is the area which may experience ecological effects as a result of its implementation, including any ancillary activities. The various impacts of a plan or project will each have their own characteristics, e.g., nature, extent, magnitude, duration etc. Accordingly, the area subject to each impact ("zone of impact") will vary depending on characteristics of the impact and the presence of pathways for its propagation. Ecological features within or connected to one or more zones of impact could, depending on their sensitivities, be affected by the plan or project under consideration. The area containing such features may be regarded as the Zone of Influence. As such, in establishing the Zone of Influence for a plan or project, regard must be had to the characteristics of its potential impacts, potential pathways for impacts and the sensitivities of ecological features in the receiving environment.

In its guidance on selecting which Natura 2000 sites to include in the AA Screening, *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities* (DEHLG, 2010a) recommends inclusion of sites in the following three categories: -

- Any Natura 2000 sites within or adjacent to the plan or project area,
- Any Natura 2000 sites within the Zone of Influence of the plan or project (generally within 15km for plans, to be established on a case-by-case basis for projects, having regard to the nature, scale and location of the project, the sensitivities of the ecological receptors and the potential for in-combination effects), and
- Following the precautionary principle, any other Natura 2000 sites for which the possibility of significant effects cannot be excluded, e.g., for a project with hydrological impacts, it may be necessary to check the full extent of the catchment for Natura 2000 sites with water-dependent qualifying interests.

In addition, *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC, 2021) recommends consideration of Natura 2000 sites hosting fauna which could move to the plan or project area or its zone(s) of impact, and the potential for the plan or project to sever ecological connectivity within or between Natura 2000 sites. *Appropriate Assessment Screening for Development Management* (OPR, 2021) emphasises the importance of employing the source-pathway-receptor model (rather than arbitrary distances such as 15km) when selecting Natura 2000 sites for inclusion in the AA Screening.

Based on the descriptions of the proposed and the receiving natural environment, the zones of impact of the proposed development were defined as all areas within the proposed development boundary, including any areas temporarily required, for habitat loss or fragmentation; as well as all areas where birds could potentially be disturbed by proposed activities.

As noted Chapter 4.0 presents a review of Special Protection Areas in the environs of the proposed licence applications in Blacksod Bay that could conceivably be impacted by the proposed activities. The potential for negative impacts is considered for different species groups in turn below.

5.2. Screening for Appropriate Assessment

5.2.1. Blacksod Bay / Broadhaven SPA

As noted, the qualifying interests of Blacksod Bay / Broadhaven SPA is designated for the following species:

- Red-throated Diver (*Gavia stellata*) [A001]
- Great Northern Diver (*Gavia immer*) [A003]
- Slavonian Grebe (*Podiceps auritus*) [A007]
- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]
- Common Scoter (*Melanitta nigra*) [A065]
- Red-breasted Merganser (*Mergus serrator*) [A069]
- Ringed Plover (*Charadrius hiaticula*) [A137]
- Sanderling (*Calidris alba*) [A144]
- Dunlin (*Calidris alpina*) [A149]
- Bar-tailed Godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Sandwich Tern (*Sterna sandvicensis*) [A191]
- Dunlin (*Calidris alpina schinzii*) [A466]
- Wetland and Waterbirds [A999]

These species are all within the Zone of influence and are considered further in Chapter 7.0, below.

5.3. Other SPAs

5.3.1. Terrestrial Species

Corncrake

Both the Mullet Peninsula SPA (004227) and Termoncarragh Lake and Annagh Machair SPA (004093) are designated for Corncrake. The Corncrake continues to be included on the red list of Birds of Conservation Concern (Gilbert *et al.*, 2021; Colhoun and Cummins, 2013) due to significant declines in the Irish breeding populations, due in a large part to agricultural intensification. In terms of habitat use Corncrake favour dense vegetation such as hay meadows. Proposed aquaculture activities at Blacksod Bay / Broadhaven SPA will not negatively impact on Corncrake either directly or indirectly through loss of prey / habitat or through disturbance of favoured areas.

Corncake at both Mullet Peninsula SPA (004227) and Termoncarragh Lake and Annagh Machair SPA (004093) is Screened Out from further consideration.

Barnacle Geese

Barnacle Geese are Qualifying Interest species at a number of sites; namely, Duvillaun Islands (004111), Inishkea Islands SPA (004004), Inishglora and Inishkeeragh SPA (004084) and Termoncarragh Lake and Annagh Machair SPA (004093). Barnacle Goose is not an SCI for Blacksod Bay / Broadhaven SPA.

The Greenland breeding population of Barnacle Geese that over winter in Ireland and Britain is increasing (Mitchell *et al*. 2008) with a total wintering population estimated at 80,670 birds (Mitchell and Hall, 2013). This figure is based on the results of the most recent census which found that 31 sites of 72 checked in Ireland held 17,500 in 2013 (Crowe *et al*. 2014) while in Scotland, the equivalent survey yielded 63,170 geese from 38 of 224 sites checked (Mitchell and Hall, 2013). This represents a total wintering population increase of 14.4 percent since the last survey in 2008 (Mitchell and Hall, 2013).

The results of the 2013 census suggest that Ireland holds 22 percent of the flyway population and has shown an increase of 43 percent since the last census was undertaken in 2008 (Crowe *et al*. 2014). Over the long term, census results show a population increase from 2,771 in 1959/60 to 12,232 in 2008 (Walsh and Crowe, 2008; Mitchell *et al*. 2009) to 17,500 for the most recent survey (Crowe *et al*. 2014). In March 2018 a total of 16,237 birds were recorded in Ireland (Doyle *et al*., 2018). This represented a 7% decrease from the 2013 census; this was in line with an observed flyway population decrease.

Notably, Mitchell and Hall (2013) investigated the increases in population on a site by site basis and found that prior to the 2013 survey it appeared that increases in population were due to increases at a number of key sites in Ireland and Scotland, namely Islay, Tiree, Coll, Oronsay/Colonsay, South Walls, Inishkea Islands and Ballintemple/Lissadell which held the majority of geese (75.5% of the total in 2013); with Islay alone holding 55.7% of the population total. However, the recent census results suggest that numbers at key sites have stabilised since 2008, whereas number on the outlying sites continue to rise. This suggests that the key sites may have reached their carrying capacity and so outlying sites will continue to see an increase in numbers. Internationally the population trend also shows an increasing trend (Wetland International, 2012). No sites in Northern Ireland record significant numbers of Barnacle Geese (Calbrade *et al*. 2010).

Barnacle Goose is amber listed on the Birds of Conservation Concern in Ireland (Gilbert *et al*., 2021). Although population numbers were increasing at the time for this species, it remained on the amber list of conservation concern as it has a localised wintering population, i.e., where 50 percent of the Irish population are located in 10 or fewer sites. The localised nature of the wintering groups makes them vulnerable, hence their inclusion on the amber list. In addition, the Irish population represents more than 20% of the European wintering population

and so the species is considered to be of international importance and qualifies for the amber list. In the UK, the Barnacle Goose is also listed as amber status on birds of conservation concern (Eaton *et al.* 2009) due to the localised nature of the wintering population with 50 percent of the UK population located in 10 or fewer sites.

In Ireland, the species is mainly recorded along the west and northwest coasts, often on islands or remote areas which are difficult to access. Internationally important numbers were recorded Ballintemple in Co. Sligo; Dunfanaghy New Land and Trawbreaga in Co. Donegal; as well as the Inishkea Islands, Cross Lough and Termoncarragh, Co. Mayo (Doyle *et al.*, 2018). It was also recorded at a further 11 sites in nationally important numbers.

The number of birds recorded / distribution of Barnacle Geese flocks recorded in the 2013 census are illustrated in Table 5.1 / Figure 5.1. While the area clearly supports notable numbers of Barnacle Geese, preferred feeding areas do not spatially overlap with the proposed aquaculture plots.

Barnacle Goose is Screened Out from further consideration.

Table 5.1 Summary population data for Barnacle Goose in environs of Blacksod (after Mitchell et al. 2008; Crowe *et al*., 2014; Doyle *et al*., 2018).

Site	Relevant SPA	2008	2013	2018
Duvillaun Islands	Duvillaun Islands SPA	221	0	60
Inishkea Islands	Inishkea Island SPA	2525	2,250	2330
Inishkeeragh	Inishglora & Inishkeeragh SPA	50	0	
Inishglora	Inishglora & Inishkeeragh SPA	90	0	0
Termoncarragh Lake	Termoncarragh Lake and Annagh Machair SPA	850	640	940
Cross Lough (Mullet)	Blacksod Bay / Broadhaven SPA		620	804
Annagh Head (Mullet)	n.a.		490	243
Falmore (Mullet)	n.a.		205	81
Carriglahan (Mullet)	n.a.		225	
Mullet Peninsula				340[42]
(N) All Ireland 1% importance threshold: 150 (Crowe and Holt, 2013). (I) Based on Wetlands International, 2006 for baseline period and 2012 thresholds for recent counts. High Island (0), Inishshark (454) & Davillaun (160) SPA (counts from Crowe *et al*., 2014).				

Whooper Swan & Greenland White-fronted Geese

Termoncarragh Lake and Annagh Machair SPA (004093) supports a wintering population of both Whooper Swan and Greenland white-fronted Goose (for location see Figure 1.1). The site supports up to 300 Whooper Swan;

[42] Recorded from Eachléim (142), Tiraun (184), Elly (8) and Barnagh (6) on the Mullet peninsula (Doyle *et al*., 2018).

numbers of Greenland white-fronted Goose, however, are <50 and appear to be declining (Fox *et al*., 2015). There is no overlap between proposed aquaculture activities and Termoncarragh Lake and Annagh Machair SPA; therefore, no impact to Whooper Swan or Greenland white-fronted Goose is predicted and these species at Termoncarragh Lake and Annagh Machair SPA are screened out from further consideration. In the 2020 census (Burke *et al*., 2020) the number of Whooper Swans at Termoncarragh Lake and Annagh Machair SPA were no longer noted to exceed the international (340) or national (150) threshold. Mayo recorded a decrease in birds of -275 since the 2015 census (Crowe *et al*., 2015). Overall, the population in Ireland has increased to 19,111 in Ireland (14,467 in the Republic and 4,644 in Northern Ireland) an increase of 26.5% (24.9% in ROI; 32% in NI) since the 2015 census.

Whooper Swan and Greenland white-fronted Goose are Screened Out from further consideration.

Chough

Distribution of Chough

Chough is a qualifying interest at both Termoncarragh Lake and Annagh Machair SPA (004093) and Clare Island SPA (004136). Clare supported ca. 16 pairs in 2002 / 03 (up from ca. 10 in 1992); while a pots-fledging flock of up to 30 birds occurs at Termoncarragh Lake and Annagh Machair SPA from August to October.

Status of Chough

The Atlantic and Celtic Sea coasts of Ireland support the majority of the Northwest European population of Choughs. Census counts of Chough have been undertaken in Ireland at roughly decadal intervals over the last 40 years (Cabot 1965, Bullock *et al.* 1983a, Bullock *et al.* 1983b, Berrow *et al.* 1993 all cited in Gray *et al.* 2003; Trewby *et al*., 2006). The early surveys estimated the population to number in the range of 567 to 685 pairs. Additional coverage and survey effort in the 1992 survey reported a maximum of 906 pairs of Choughs with an additional 821 birds in flocks in Ireland representing over 70% of the northwest European population (Berrow *et al* 1993 cited in Gray *et al*. 2002). The 2002/2003 survey recorded a total of 838 breeding pairs of Chough with 388 confirmed, 57 probable, and 393 possible breeding pairs. A further 756 birds were recorded in flocks. The largest numbers of birds were recorded in Cork, Kerry, and Donegal (Gray *et al*. 2003).

Chough is amber listed on the Birds of Conservation Concern in Ireland (Colhoun and Cummins, 2013). This classification is based on the fact that the species conservation status has been listed as unfavourable on the Species of European Conservation Concern (SPEC). Chough are listed as SPEC 3 where SPEC 3 species are those for which the global population is concentrated outside Europe.

Chough is listed on Annex I of the EU Birds Directive 2009/147/EC.

A repeat national census was undertaken by KRC Ecological and ALC Nature on behalf of National Parks & Wildlife Service all around the Irish coastline in 2021. The results of this census are yet to be published.

Impact Assessment - Chough

The Chough is a species of crow frequenting coastal areas from Wexford to Donegal; they are largely cliff nesting, though some birds will nest in man-made structures (Gray *et al*. 2003; Balmer *et al*. 2013). They frequent coastal habitats including areas of pasture and thus are at risk from changes in agricultural practices. In Ireland the 200711 Atlas (Balmer *et al.* 2013) indicates that there has been an overall winter range expansion of 10% since the 1981-84 Atlas (Lack, 1986); while the breeding range has increased 4% since 1968-72 (Sharrock, 1976) and 2% since 1988-91 (Gibbons *et al*, 1993). While they may feed on insects associating with rotting algae

on the upper shore, they generally do not use intertidal habitats. We are not aware of any evidence that Chough interact with oyster trestles.

Birds breeding on Clare Island would not be impacted by the proposed aquaculture. As noted, Termoncarragh Lake and Annagh Machair SPA is used by a post-fledging flock from August to October. Trewby *et al*. (2006) suggest that such sites can be important as autumn '*assembly points*' for young Choughs and birds from outside the area and these flocks may then go on to roost communally and feed as a flock in nearby habitats through the winter. A similar pattern of use was observed at Barley Cove, Co. Cork and Inch, Co. Kerry, where the flock usage of coastal dune habitat declines in the late autumn and birds chose to feed in improved and semi-improved pastures inland from the coastal roost site over the winter (Trewby *et al*. 2006).

Overall, due to the proposed scale of aquaculture activities; the lack of any significant use of intertidal habitat by Chough; and the separation of proposed oyster cultivation from known foraging, roosting or nesting sites it is unlikely that the intertidal oyster would have a negative impact on Chough breeding on Clare Island SPA or using Termoncarragh Lake and Annagh Machair SPA.

Chough is Screened Out from further consideration.

Merlin

Owenduff / Nephin Complex SPA (004098) is designated for breeding Merlin. Proposed aquaculture activities at Blacksod Bay / Broadhaven SPA will not negatively impact on Merlin breeding sites either directly or indirectly through loss of prey / habitat or through disturbance of favoured areas. Merlin tend to be much more widely distributed during the winter months, including in coastal habitats. While it is likely that Merlin nesting in Owenduff / Nephin Complex SPA may occur around Blacksod / north Mayo in the winter months; the area of suitable habitat is such that negative impacts from aquaculture are not envisaged. Merlin are therefore screened out from further consideration.

Merlin is Screened Out from further consideration.

5.3.2. Terns

Sandwich Tern

Sandwich Tern have historically bred at both Inishderry Island, within Blacksod Bay / Broadhaven SPA, and at Derreens Island, Carrowmore Lake SPA (004052). Sandwich Tern were last noted breeding at Derreens Island, Carrowmore Lake in 1984; 164 pairs (NPWS, 2015b). The island has also supported nesting Black-headed Gull, Common Gull, and Arctic Tern. Mink predation is considered a problem (NPWS, 2015b). Inishderry Island in Broadhaven Bay supported 160-170 pairs of Sandwich Tern in 1994 (81 pairs in 1995). The Inishderry colony is considered to be the same population that nested at Carrowmore Lake in the past. There is no other known Sandwich Tern colony in the wider Blacksod Bay / Broadhaven SPA. Inishderry Island was resurveyed in the summer of 2016; it supported 11 occupied Sandwich Tern nests, though there was also signs of predation with four predated Sandwich Tern noted (NPWS, *per comm*). This colony has declined by 86% since 1995 (Cummins *et al.*, 2019).

Inishderry has also supported nesting Black-headed Gull, Common Tern, and Arctic Tern; while Little Tern has also bred in small numbers in the past (NPWS, 2005). The 2016 survey recorded Lesser Black-backed Gull (2

AON[43]); Herring Gull (2 AON); Common Gull (3 AON); Great Black-backed Gull (4 AOT[44]) and Black-headed Gull (170 IND[45]). The main colony of nesting Little Tern is currently on the Inishkea Island SPA (off the west coast of the Mullet Peninsula).

Cross Lough SPA (004212) is located ca. 12 km southwest of Louisburgh, Co. Mayo. It supported 107 pairs of nesting Sandwich Tern in 1984 (70 pairs in 1995) (NPWS, 2015e). Sandwich Tern no longer breed at Cross Lough (Cummins *et al*., 2019).

Overall, however, the population of breeding Sandwich Tern is growing, in large part driven by growth in numbers at the colony at Lady's Island, Co. Wexford.

Sandwich Tern is Screened In and is considered further below.

Little Tern

The Inishkea Islands SPA supported 27 pairs of breeding Little Tern in 2000 (NPWS, 2003). Further survey work of Little Terns in 2002 recorded over 100 adults: potentially equivalent to over 50 breeding pairs. In 2016 13 occupied territories were recorded on Inishkea North and 3 nests on Inishkea South (D. Tierney *pers comm*). Overall, there are 388 nesting pairs, a +123% increase since the 1995 All Ireland Tern survey (Cummins et al., 2901).

The Seabird Wikispace gives a mean foraging range for **Little Tern** of 4 km, a mean maximum of 7 km and a maximum of 11 km from breeding colonies, but states that "*Little Terns have very short foraging ranges compared to most seabirds, with most food generally being obtained from within 5 km of the colony, and usually within 1 km of the shore*". This suggests a core foraging range centred on the Inishkea Islands, but also possibly extending eastwards to the Mullet Peninsula; and potentially along the western shores of Blacksod Bay. Little Tern, are not therefore screened out will therefore be discussed further below. Little Tern historically also nested within Inishglora and Inishkeeragh SPA.

The sandbank at the mouth of Sruwaddacon Bay supported nesting Little Tern prior to 2002 (EACS, 2010); this bank has been naturally eroded and is no longer present.

Little Tern is Screened Out from further consideration.

Arctic Tern

The Inishkea Islands SPA supported 182 pairs of breeding Arctic in 2000 (NPWS, 2015a). The site also supported 25 pairs of Common Tern in 2000 (not an SCI species). In 2016 Arctic Terns occupied a number of sites; Inishglora and Inishkeeragh SPA supported 105 pairs of breeding Arctic Tern in 1995 (Hannon *et al*., 1997). In 2016 Inishglora and Inishkeeragh SPA supported 17 apparently occupied nests (D. Tierney. *pers comm*).

Arctic Terns can feed in open marine waters preferring sheltered waters for foraging (Cramp and Simmons, 2004). The Seabird Wikispace describes its key foraging habitats as: "*open waters and shallow bays, rocky shores, tidal flats, shoals, tide rips, ocean fronts, upwellings, ice edges and faces of tidewater glaciers*". Arctic Terns feed on marine fish (e.g., sand-eels, herring, sprat, capelin, sticklebacks, pipefish, flounder, sole, hake, haddock etc.) crustaceans (e.g., isopods, amphipods, euphausiids, mysids, shore crab, shrimps, and other branchiopods and copepods) and insects. They hunt for fish predominantly by plunge diving which often follows

[43] AON – apparently occupied nests.

[44] AOT – apparently occupied territories.

[45] IND – individuals (the Black-headed Gull count was an estimate).

hovering from a height of 1-6m diving to a depth no deeper than 0.5m (Dunn, 1972a, quoted by Cramp and Simmons, 2004). Other prey items such as crustaceans and insects are caught by dipping to surface, obliqueplunge diving, or aerial pursuit (studies quoted by Cramp and Simmons, 2004) It has also been recorded scavenging fishing vessels in the Irish Sea (Watson, 1981, quoted by Cramp and Simmons, 2004) and kleptoparasitising other birds (Norrevang, 1960, Williamson, 1948, quoted by Cramp and Simmons, 2004).

The Seabird Wikispace gives a mean foraging range of 12km, a mean maximum of 12km and a maximum of 21km from breeding colonies[46], but states that due to time and energy constraints, parent Arctic Terns have to forage close to the nest, with most feeding taking place within 3 km of the colony, exceptionally up to 10 km. Newton (2012) states that Arctic Terns "*range more widely [than Little Terns] but would be expected to forage within a 5-10 km zone around their colony during the chick-rearing period*". This suggests a core foraging range centred on the Inishkea Islands, Inishglora and Inishkeeragh and along the Mullet peninsula; both Blacksod Bay and Broadhaven are potential foraging areas. Arctic Tern, is not therefore screened out will therefore be discussed further below.

Arctic Tern is Screened In and is considered further below.

5.3.3. Gulls

Herring Gull

The Inishkea Islands SPA supported 81 pairs of breeding Herring Gull in 2000 (NPWS, 2015a); while Inishglora and Inishkeeragh SPA supported 78 pairs of breeding Herring Gull in 2001.

Herring Gulls use a wide range of terrestrial, coastal, and marine habitats and regularly follow fishing boats. Cramp and Simmons (2004) state that during the breeding season they do not "*normally range beyond offshore zone, and is infrequently out of sight of land*", while habitat choice is similar outside the breeding season. However, distribution maps from the German North and Baltic Seas show that Herring Gulls can frequently occur far out to sea, even during the breeding season, although densities are higher close to land (Mendel *et al*., 2008). Cramp and Simmons (2004) quote foraging ranges from breeding colonies in various studies ranging from 2263km, while Ratcliffe *et al*. (2000, quoted by Langston, 2010) gave a foraging range of 40km from breeding colonies. Non-breeding birds may also fly considerable distances between feeding areas and roosting sites.

Herring Gulls are generalist feeders that use a wide range of habitats and are therefore not strictly tied to the marine environment; as a result, they are less likely to be sensitive to fisheries related impacts. Indeed, while Herring Gull is on the red list of Birds of Conservation Concern (Colhoun and Cummins, 2013) inland (roof) breeding colonies are on the increase, a pattern reflected to an even greater degree in the UK (Balmer *et al*., 2013).

Herring Gulls consume food through predation, scavenging and kleptoparasitism; they also follow fishing vessels where they consume discards and offal. Scavenging at dumps forms a large proportion of the Herring Gull's diet, with sometimes to 75% of food coming from this source (studies quoted by Cramp and Simmons, 2004).

[46] The literature quotes a maximum foraging range of 29km.

Herring Gull breeding on Inishkea Islands, Inishglora and Inishkeeragh could certainly forage within Blacksod Bay / Broadhaven SPA.

Herring Gull is Screened In and is discussed further below.

Common Gull

The Inishkea Islands SPA supported 47 pairs of breeding Common Gull in 2000 (NPWS, 2015a); while Clare Island SPA (004136) supported 39 breeding pairs in 1999.

Common Gull foraging ranges are not well reported in literature, but Common Gulls do frequently occur as scavengers following ships in offshore waters during winter; however, it seems to be largely limited to the coastal and littoral zone as an active forager for live prey (Cramp and Simmons, 2004). Common Gulls has a broad dietary range and use a wide range of feeding methods in a variety of habitats. In coastal and marine habitats their diet can include: benthic invertebrates in intertidal habitats; invertebrates, fish and scavenged items taken from the pelagic zone whilst swimming or from plunge dives whilst flying; and food items taken by kleptoparasitism. They regularly follow inshore fishing boats and also feed commonly in terrestrial habitats. In coastal and marine areas, molluscs, polychaetes, crustaceans, and fish can all be significant components of Common Gull diets. As for Black-headed Gulls, recent studies of Irish breeding colonies suggest that during the breeding season terrestrial habitat use and prey items dominate (Kelly *et al.*, 2012).

Clare Island SPA is just over 30km south of the southern approaches to Blacksod Bay; given the availability of suitable foraging habitat close to the island it would seem highly unlikely that birds breeding on Clare Island forage within Blacksod Bay / Broadhaven SPA. However, birds nesting on Inishkea Island SPA certainly could. Inland breeding birds, such as those on e.g., Lough Conn & Clough Cullin SPA (004228) would also appear to be too distant from Blacksod Bay / Broadhaven SPA to use it for foraging, though some dispersal to the coast in the winter months cannot be discounted.

Common Gull is Screened Out from further consideration for birds from both Inishkea Islands SPA and Lough Conn & Clough Cullin SPA. However, birds from Inishkea Islands SPA are Screened In.

Lesser Black-backed Gull

Inishglora and Inishkeeragh SPA supported 66 pairs of breeding Lesser black-backed Gull in 2001. The Lesser Black Backed Gull is omnivorous and can utilise a wide array of energy sources, consuming fish, small mammals, invertebrates, plant material, rubbish, fish discards, etc.(Cramp and Simmons, 2004). Though it is capable of obtaining food by dipping to surface, shallow plunging and aerial pursuit of prey, a large portion of its diet seems to come from kleptoparasitising food other birds (both inter- and intra-specific); it is also generally accepted that open sea fish feeding contributes more to the diet of the Lesser Black Backed Gull than scavenging compared to other large gulls (studies quoted by Cramp and Simmons, 2004). In a dietary study of an Irish breeding colony (Calf Island, Kerry) Kelly (2009) found that Lesser Black-backed Gull diet was dominated by terrestrial beetles, marine fish, and anthropogenic garbage (54.3%, 27.4% and 20.2%, respectively).

Seabird Wikispace quotes a foraging range from the nesting site of between 44 and 84km, depending on the individual. Though the mean foraging trip was 7.9±9 hours, some may last several days (Shamoun-Baranes, *et al*. 2011). It generally feeds further out from the colony than Herring Gull being better adapted for long distance flight (Verbeek, 1977b, quoted by Cramp and Simmons, 2004); however, as noted above these feeding trips may also be to terrestrial habitats targeting beetles etc. Gyimesi *et al*. (2016) also noted that a colony of Lesser Black-backed Gull breeding 30km from the coast in The Netherlands focussed entirely on a diet of terrestrial

food sources. It is noted, however, that patterns of individual behaviour can be highly variable amongst gulls (c.f. Rock *et al.*, 2016).

Lesser Black-backed Gull breeding on Inishglora and Inishkeeragh could certainly forage within Blacksod Bay / Broadhaven SPA. Lesser Black-backed Gull is not therefore screened out will therefore be discussed further below.

Lesser Black-backed Gull is Screened In and is discussed further below.

Kittiwake

Clare Island SPA (004136) supported 1,785 breeding pairs of Kittiwake in 1999 (Seabird 2000). This has declined to 840 apparently occupied nest in 2015 (Newton *et al.*, 2015). Kittiwakes feed offshore in open marine waters; they are often associated with tidal fronts or up-wellings and offshore sandbanks during the breeding season (Seabird Wikispace). They obtain prey by snatching items from the surface or splash diving and dive depths are unlikely to be more than a metre (Seabird Wikispace). Their diet is composed primarily of pelagic marine organisms eating fish (e.g., capelin, sand-eels, herring, sprat, cod, pollack, and whiting) and invertebrates (crustaceans, molluscs, annelids, and insects). They are likely to use the inshore waters of Blacksod Bay / Broadhaven SPA only occasionally.

Kittiwake is Screened Out and not considered further in this assessment.

5.3.4. Seabirds

Fulmar, Storm Petrel & Leach's Petrel

In addition to Barnacle Geese (see above), Duvillaun Islands SPA (004111), is also designated for breeding Fulmar (684 pairs in 1994) and Storm Petrel (945 apparently occupied sites on Duvillaun Beg in 2001) (NPWS, 2014a)[47]. A total 638 apparently occupied sites were noted during Seabird 2000; in 2015 there were 547 (-14%).

Ilanmaster SPA (004074) is designated for Storm Petrel; while it was not surveyed during the Seabird 2000 census, an estimate of 7,500 pairs was made prior to 1980 (NPWS, 2015a)[48]. During Seabird 2000 Inishglora supported 1,780 pairs of Storm Petrel, while Inishkeeragh supported 1,625 pairs (NPWS, 2015c).

The Stag's of Broadhaven SPA (004072), which is located about 2km north of Benwee Head is designated for both Storm Petrel and Leach's Petrel. In 2001 there were 1,905 apparently occupied Storm Petrel sites (NPWS, 2015b)[49]. The Stags is the only site in Ireland with proven recent breeding of Leach's Petrel (an estimate of 301 apparently occupied sites was made in 2001). Bills Rock SPA (004177) supports an estimated 500 pairs of Storm Petrel (in 2001) (NPWS, 2015c)[50]. Fulmar is also a qualifying interest for of Clare Island SPA (004136) to the south (4029 pairs: NPWS, 2014b)[51] as well as for Clare Island SPA (004144).

All three species are offshore foragers and would use Blacksod Bay / Broadhaven SPA little, if at all. Overall, due to the location, type and scale of proposed aquaculture activities, and the distance from both sites it is unlikely that the proposed aquaculture activities would have a negative impact on Fulmar, Storm Petrel or Leach's Petrel breeding at any of these sites.

[47] NPWS (2014a). *Duvillaun Islands SPA (004111). Site Synopsis*. NPWS, DAHG.

[48] NPWS (2015a). *Ilanmaster SPA (004074). Site Synopsis*. NPWS, DAHG.

[49] NPWS (2015b). *Stags of Broadhaven SPA (004072).* Site Synopsis. NPWS, DAHG.

[50] NPWS (2015c). *Bills Rocks SPA (004177). Site Synopsis.* NPWS, DAHG.

[51] NPWS (2014b). *Clare Island SPA (004136). Site Synopsis*. NPWS, DAHG.

Fulmar, Storm-petrel, and Leach's Petrel are Screened Out and not considered further in this assessment.

Guillemot & Razorbill

Both Guillemot and Razorbill are conservation interests of Clare Island SPA (004136). Both species were counted on Clare Island as part of the 2015 Seabird Colony Monitoring Programme (SCMP); this recorded 2,168 Guillemot and 618 Razorbill (count represents individuals; figures quoted are full site, not just the SPA). This compares to 2,280 (-9%) and 528 (+13%) during Seabird 2000.

Guillemots feed in open marine waters and can tolerate severe weather conditions. Guillemot feed primarily on fish (e.g., herring, sprat, capelin, sand-eels, cod, haddock, whiting, pollack, mackerel, three-spined stickleback etc.), though they also occasionally supplement their diet with invertebrates, primarily crustaceans (crabs, amphipods, and copepods) but also polychaete worms. The Seabird Wikispace gives a mean foraging range of 25km, a mean maximum of 61km and a maximum of 200km; though it has been noted that foraging range may vary from colony to colony (Birkhead, 1976, quoted by Cramp and Simmons, 2004). For example, in Scotland, at Fair Isle the majority of birds were observed within 6km of the colony (P Hope-Jones, quoted by Cramp and

Simmons, 2004), though they have also been recorded foraging 20-50km (Belopol'ski, 1957, quoted by Cramp and Simmons, 2004). During the pre-laying period they seem to forage much greater distances, travelling as far as 200km from the colony to feed (Birkhead, 1976, quoted by Cramp and Simmons, 2004). However, in Shetland, Monaghan *et al*. (1994, quoted by Cramp and Simmons, 2004) found that breeding adults remained within 10 km of their colony.

Guillemot is Screened Out and not considered further in this assessment.

Razorbill also feed in open marine waters and can tolerate severe weather conditions (although they are not typically pelagic; Cramp and Simmons, 2004). The diet of Razorbills is composed primarily of fish (e.g., sand-eels, sprat, herring, capelin, sardine, anchovy, three-spined stickleback etc.) but also some invertebrates, generally polychaete worms and some molluscs. The Seabird Wikispace gives a mean foraging range of 10 km, a mean maximum of 31 km and a maximum of 51 km. Cramp and Simmons (2004) quote foraging ranges in two studies of 9-13 km and 15-20 km. During breeding season recorded foraging ranges varied from 9-20km from the breeding colony (Kaftanovski, 1951; Kartashev, 1960; Lloyd, 1976a, quoted by Cramp and Simmons, 2004).

At ca. 40km from Blacksod Bay, the nesting colonies of Guillemot and Razorbill on Clare Island are sufficiently distant from proposed aquaculture sites at Blacksod Bay / Broadhaven SPA that any impact is extremely unlikely. These species are therefore screened out from further consideration.

Razorbill is Screened Out and not considered further in this assessment.

Puffin

Bills Rock SPA (004177) supports a nationally important breeding population of Puffin. The site supported ca. 1,500 pairs in 2001; though numbers were considerably higher in the past, with for example well over 5,000 pairs estimated to occur in 1939 (NPWS, 2015d).

Like Guillemot and Razorbill, Puffins feed in open marine waters and can tolerate severe weather conditions. The Seabird Wikispace describes their key foraging habitats as "*shallow waters*, *tidal fronts*". Puffins can dive to depths of up to 60m, although most prey is caught within 30m of the water surface (Seabird Wikispace). The

diet of Puffin is comprised primarily of fish (e.g., sand-eels, sprat, herring, capelin, mackerel, cod, whiting, haddock, pollack etc.), but can vary depending on location with species in arctic regions consuming more invertebrates, particularly shrimp like crustaceans and squid (Cramp and Simmons, 2004). The majority of prey is taken from near the surface of the water, with diving depths not thought to exceed 15m (Harris and Hislop, 1978, quoted by Cramp and Simmons, 2004), though they can dive deeper when feeding on crustaceans (Bird and Bird, 1935, quoted by Cramp and Simmons, 2004).

The Seabird Wikispace gives a mean foraging range of 30km, a mean maximum of 62 km and a maximum of 200 km. During the breeding season their foraging range has been reported to be between 2-10km from the colony (Harris and Heaslop, 1978; Ashcroft, 1976, quoted by Cramp and Simmons, 2004), with one study reporting 85% of the colony feeding within 3km of their breeding grounds, though individuals were also observed feeding 37km from the colony (Corkhill, 1973, quoted by Cramp and Simmons, 2004).

As for Guillemot and Razorbill, the combination of feeding at sea and distance between the nesting grounds at Bills Rock SPA and Blacksod Bay / Broadhaven SPA are such that the proposed aquaculture practices are extremely unlikely to impact Puffin breeding at Bills Rock. Puffin is therefore screened out from further consideration.

Puffin is Screened Out and not considered further in this assessment.

Cormorant & Shag

Both Cormorant and Shag are conservation interests of Inishglora and Inishkeeragh SPA (004084); while Inishkea Islands SPA (004004) is also designated for Shag. Inishglora and Inishkeeragh SPA supported 57 pairs of breeding Cormorant (in 1987) and 61 pairs of Shag (in 2001) (NPWS, 2015a); while the Inishkea Islands SPA supported 90 pairs of breeding Shag in 2000 (NPWS, 2015d)[52].

While not a qualifying interest of Duvillaun Island SPA, the number of Cormorant breeding on Duvilluan Islands has decreased from 20 to 10 breeding pairs between Seabird 2000 and the current census (Cummins *et al.*, 2019). This had dropped from an earlier total of 154 in the Seabird Colony Register (SCR, 1995-1998).

Cormorant is screened in for assessment due to the potential overlap Blacksod Bay / Broadhaven SPA. Shag have seen a significant increase in breeding numbers on Inishmurray SPA (004068) off the Sligo coast (389 AON's in 2015-2018 census; + 274%; Cummins et al. 2019).

The mean foraging range of Shag from their breeding colonies is 6.5 km, with a mean maximum of 16 km and a maximum of 20 km (Seabird Wikispace; http://seabird.wikispaces.com/). Soanes *et al.* (2014) using GPS data loggers recorded a mean foraging range of 8.4±0.5km for males (range 0.5-40km) and 11.1±0.5km for females (range 0.9-58km).

It is not clear whether Shag would fly overland to forage in Blacksod Bay, though tracking studies perhaps suggest not (Soanes *et al.*, 2016); however, as this cannot be discounted Shag is screened in for assessment due to the potential overlap Blacksod Bay / Broadhaven SPA.

Cormorant and Shag are both Screened In and considered further.

5.3.5. Breeding Waders

Dunlin (schinzii)

[52] NPWS (2015d). *Inishkea Islands SPA (004004). Site Synopsis.* NPWS, DAHG.

The Inishkea Islands SPA (004004) also support a notable breeding population of Dunlin (*Calidris alpina schinzii*); the 2009 survey estimated 34 breeding pairs on Inishkea North and four breeding pairs on Inishkea South (Suddaby *et al*., 2010). While a number of different subspecies of Dunlin occur on passage or overwinter in Ireland, only *schinzii*, breeds. It is included on the red list of species of conservation concern (Colhoun and Cummins, 2013); and is noted in NPWS's Article 12 reporting (NPWS, 2015a; see also Balmer *et al*., 2013) to be declining as a breeding species. Suddaby et al. 2020 noted that while breeding *schinzii* are a qualifying interest of a number of SPAs, breeding was only confirmed recently at the Inishkea Islands SPA.

The Inishkea islands also support breeding populations of Oystercatcher, Ringed Plover, Lapwing, Snipe, Redshank and Common Sandpiper. There is no spatial overlap between the proposed aquaculture activities and any of these breeding populations of waders on the Inishkea Islands.

Termoncarragh Lake and Annagh Machair SPA (004093) has also supported breeding *schinzii* Dunlin; there is no spatial overlap between the proposed aquaculture activities and breeding populations Dunlin at this site.

Doogort Machair SPA (004235), which is also designated for breeding *schinzii* Dunlin is located on the northern shore of Achill Island. Proposed aquaculture activities will not affect dunlin nesting at this site, either directly or indirectly through e.g., disturbance. There is no evidence of breeding at this time.

Currently, Dunlin *schinzii* are only recorded breeding on Inishkea North (3 pairs), Inishkea South (1 pair) and Roonagh Lough (4 pairs), in Co. Mayo (Suddaby *et al*., 2020).

*Dunlin (*Calidris alpina schinzii*) is Screened Out and is not considered further.*

Other waders

Owenduff / Nephin Complex SPA (004098) is designated for breeding Golden Plover. Proposed aquaculture activities at Blacksod Bay / Broadhaven SPA will not negatively impact on Golden Plover breeding sites either directly or indirectly through loss of prey / habitat or through disturbance of favoured areas.

Termoncarragh Lake and Annagh Machair SPA (004093) also supports breeding Lapwing (21 pairs), Snipe (15 pairs) and Redshank (1 pair) (Suddaby *et al*., 2020); however, there is no spatial overlap between the proposed aquaculture activities and breeding wader populations at this site. Of these only Lapwing is a qualifying interest of the SPA.

Suddaby *et al*. (2010; 2020) were also reviewed for information on any other breeding wader. The proposed aquaculture sites do not conflict with these known breeding sites.

Golden Plover and Lapwing are Screened Out and are not considered further.

5.3.6. Breeding Ducks

Lough Conn and Lough Cullin SPA (004228) supports both breeding Tufted Duck and Common Scoter. Tufted Duck was Red listed as a breeding species (Colhoun and Cummins, 2013); but is now included on the Amber list (Gilbert *et al*., 2021). Common Scoter remains Red listed (Gilbert *et al*., 2021). Lough Conn and Lough Cullin SPA also supports notable populations of wintering Tufted Duck. In 2020 only a single pair of nesting Common Scoter were noted on Lough Conn and Lough Cullin SPA; the main numbers were on Lough Corrib (38 pairs), Lough Ree (7 pairs), Lough Arrow (4 pairs) (Heffernan and Hunt, 2022).

There is no spatial overlap between the proposed aquaculture activities and breeding duck populations at this site. Blacksod Bay / Broadhaven SPA is not noted for supporting notable flocks of wintering Tufted Duck. While there is a large wintering population of Common Scoter in Blacksod Bay / Broadhaven SPA, it is not known

where the small Irish breeding population winters. Thus, links between breeding scoter in Lough Conn and Lough Cullin SPA and wintering birds at Blacksod Bay / Broadhaven SPA are not known, but cannot be discounted. Common scoters are assessed in detail below.

Tufted Duck and Common Scoter are Screened Out and are not considered further.

5.3.7. Wintering Waders

The Inishkea Islands SPA (004004) are located off the west coast of the Mullet Peninsula. In addition to Barnacle Geese (see above), they support wintering populations of Ringed Plover, Sanderling, Purple Sandpiper, and Turnstone; these species use a mixture of intertidal and rocky shore habitats. There is no spatial overlap between the proposed aquaculture activities and wintering areas on the Inishkea Islands used by these species (the nearest point being 7km to the east).

5.3.8. Wetlands and Waterbirds

The Conservation Objectives define the favourable conservation condition of the wetlands and waterbird Qualifying Interest at Blacksod Bay / Broadhaven SPA purely in terms of habitat area.

None of the activities being assessed will cause any change in the permanent area occupied by wetland habitat. Therefore, the activities being assessed are not likely to have any significant impact on this Qualifying Interest and it has been screened out from any further assessment.

5.4. Screening Summary

On the basis of objective information presented in Sections 1 (description of proposed licence),Section3 and 4, the evaluation presented above has found that Blacksod Bay / Broadhaven SPA is within the zone of influence of the proposed aquaculture activities and the potential for negative impacts cannot be entirely discounted. Table 5.1 summarised those species / SPAs where the risk of ex-situ impacts is also a consideration. It summarises the finding of Section 5.3 and indicates where species from other SPAs are Screened Out, or where negative impacts cannot be entirely discounted, in which case they are Screened in for further consideration.

Table 5.2 Summary of Screening for Appropriate Assessment for SPAs other than Blacksod Bay / Broadhaven SPA.

Species	SPA	Screening Decision
Corncrake	Mullet Peninsula SPA Termoncarragh Lake and Annagh Machair SPA	Screened Out
Barnacle Geese	Duvillaun Islands Islands SPA Inishglora and Inishkeeragh SPA Termoncarragh Lake and Annagh Machair SPA	Screened Out
Species	SPA	Screening Decision
Whooper Swan	Termoncarragh Lake and Annagh Machair SPA	Screened Out
Greenland White-fronted Geese	Termoncarragh Lake and Annagh Machair SPA	Screened Out

Chough	Termoncarragh Lake and Annagh Machair SPA Clare Island SPA	Screened Out
Merlin	Owenduff / Nephin Complex SPA	Screened Out
Sandwich Tern	Blacksod Bay / Broadhaven SPA, and at Derreens Island, Carrowmore Lake SPA	Screened In
Little Tern	Inishkea Islands SPA	Screened Out
Arctic Tern	Inishkea Islands SPA	Screened In
Herring Gull	Inishkea Islands SPA Inishglora and Inishkeeragh SPA	Screened In
Common Gul	Inishkea Islands SPA Clare Island SPA Lough Conn & Clough Cullin SPA	Screened In Screened Out Screened Out
Lesser Black-backed Gull	Inishglora and Inishkeeragh SPA	Screened In
Kittiwake	Clare Island SPA	Screened Out
Fulmar	Duvillaun Islands SPA Clare Island SPA Clare Island SPA	Screened Out
Storm-petrel	Duvillaun Islands SPA Ilanmaster SPA Inishglora and Inishkeeragh SPA Stag's of Broadhaven SPA Bills Rock SPA	Screened Out
Leach's Petrel	Stag's of Broadhaven SPA	Screened Out
Guillemot	Clare Island SPA	Screened Out
Razorbill	Clare Island SPA	Screened Out
Puffin	Bills Rock SPA	Screened Out
Cormorant	Inishglora and Inishkeeragh SPA	Screened In
Shag	Inishglora and Inishkeeragh SPA Inishkea Islands SPA	Screened In
Dunlin (*Calidris alpina schinzii*)	Inishkea Islands SPA Termoncarragh Lake and Annagh Machair SPA Doogort Machair SPA	Screened Out
Golden Plover	Owenduff / Nephin Complex SPA	Screened Out
Lapwing	Termoncarragh Lake and Annagh Machair SPA	Screened Out
Tufted Duck	Lough Conn and Lough Cullin SPA	Screened Out
Common Scoter	Lough Conn and Lough Cullin SPA	Screened Out

6. Marine Biotopes & Species Status

6.1. Biotope Mapping

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) (Figure 6.1). 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. The extent of the constituent marine community types within the SAC is shown in Figure 6.2.

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.

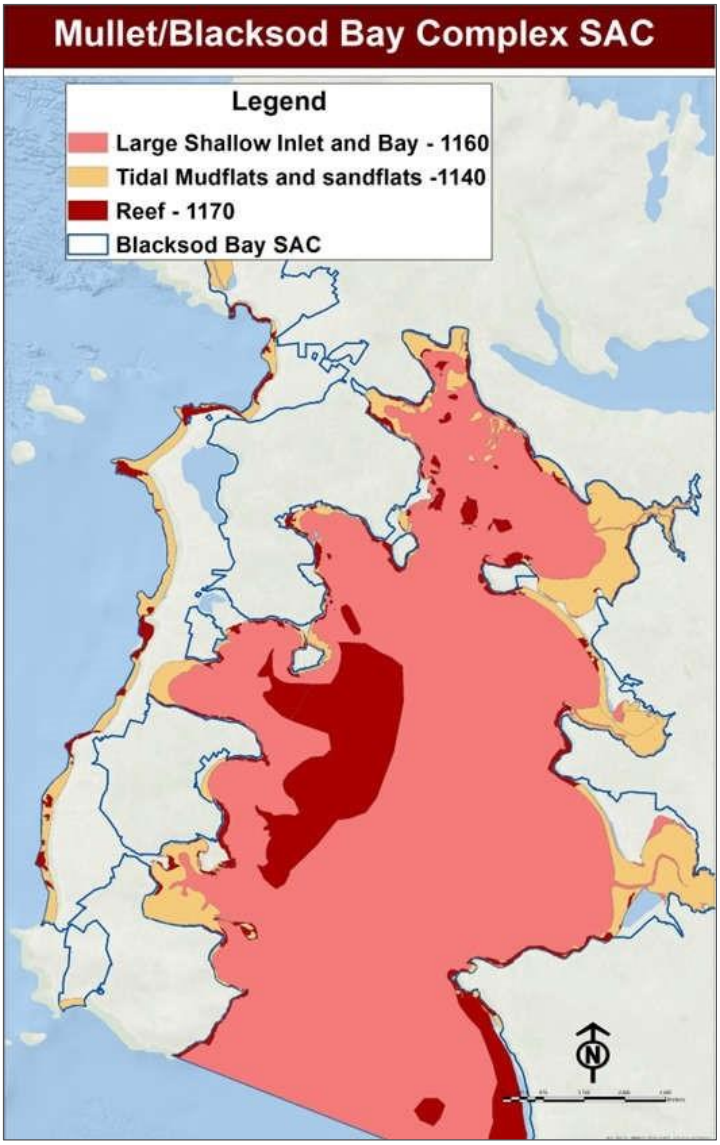


Figure 6.1 Distribution of Mullet/Blacksod Bay SAC marine qualifying interests (from NPWS, 2014a).

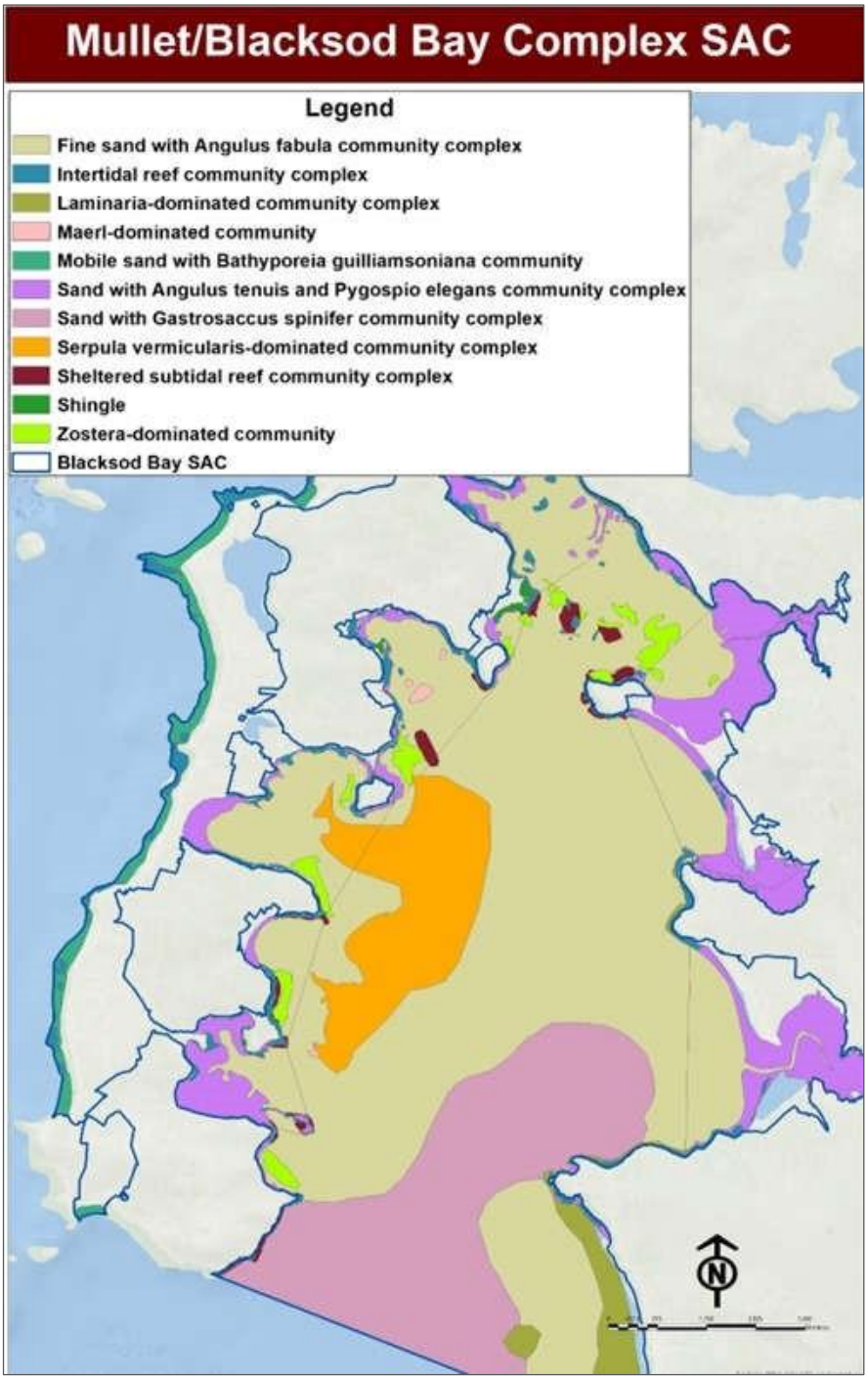


Figure 6.2 Map of Marine community types found in QI 1160 and 1170 in Mullet/Blacksod Bay Complex SAC. (NPWS 2014a).

6.1.1. Conservation Objectives for Mullet/Blacksod Bay Complex SAC

The Conservation Objectives for the Mullet/Blacksod Bay Complex SAC are communicated 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, among others, should be maintained for designated species and human disturbance should not adversely affect such species.

The QIs, conservation features, objectives, and targets for each, within the Mullet/Blacksod Bay Complex SAC are listed in Table 6.1 below.

Table 6.1 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 blue.

QIs and Conservation Features	Objective	Target(s)
Mudflats and sandflats not covered by seawater at low tide [1140]	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 *Bathyporeia guilliamsoniana* community)	Maintain favourable conservation condition	197ha; Maintained in a natural condition
(Sand with *Angulus tenuis* and *Pygospio elegans* community complex)	Maintain favourable conservation condition	1,231ha; Maintained in a natural condition
Large shallow inlets and bays [1160]	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 *Angulus tenuis* and *Pygospio elegans* community complex)	Maintain favourable conservation condition	1,182ha; Maintained in a natural condition
(Sand with *Gastrosaccus spinifer* community complex)	Maintain favourable conservation condition	1,994ha; Maintained in a natural condition
(Fine sand with *Angulus fabula* community complex)	Maintain favourable conservation condition	6,289ha; Maintained in a natural condition
(*Zostera* dominated communities)	Maintain favourable conservation condition	170ha; Maintain natural extent and high quality of *Zostera* dominated communities
(Maërl-dominated community)	Maintain favourable conservation condition	14ha; Maintain natural extent and high quality of Maërl dominated communities
(*Serpula vermicularis*-dominated community complex)	Maintain favourable conservation condition	855ha; Maintain natural extent and high quality of *Serpula* 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

(*Laminaria*-dominated community complex)	Maintain favourable conservation condition	251ha; Maintained in a natural condition
(Shingle)	Maintain favourable conservation condition	38ha; Maintained in a natural condition
Reefs [1170]	Maintain favourable conservation condition	1,531ha; The distribution and permanent area is stable or increasing, subject to natural processes.

QIs and Conservation Features	Objective	Target(s)
(*Serpula* vermicularis-dominated community complex)	Maintain favourable conservation condition	855ha; Maintain natural extent and high quality of Serpula 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
(*Laminaria*-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 *Ammophila arenaria* (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 (*Calluno Ulicetea*)	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 Magnopotamion or Hydrocharition – 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
QIs and Conservation Features	Objective	Target(s)
		favourable species and managing levels of negative species
Otter *Lutra lutra*	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 *Petalophyllum ralfsii*	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

6.2. Status and habitats and distribution of the SCI species

6.2.1. Blacksod Bay / Broadhaven SPA

Waterbird distribution around high tide has been monitored by as part of the Irish Wetland Bird Survey (IWeBS) during most winters since 2020/21. Populations of Qualifying Interest species are summarised in Table 5.1 for baseline (1999/00 to 2003/04) and for the period 1998/99 to 2012/13. Results from a recent survey – *Abundance and distribution of wintering water birds in the marine areas of Blacksod Bay, Co. Mayo* (Suddaby, 2016) are also included where relevant.

Light-bellied Brent geese, Red-breasted merganser, Ringed Plover, and Sanderling are all classed as having *Favourable* conservation status in the SPA by NPWS (NPWS, 2014b); these are species whose populations are stable or increasing at both site level and all-Ireland level.

As both Great Northern Diver and Common Scoter often occur at distances offshore they are difficult to monitor from land-based counts; as a result, trend analysis was not carried out for these species (NPWS, 2014b). That said the conservation status of Great Northern Diver was defined as *Favourable* (site population change based on two five-year – means (1999/00 – 2003/04 and 2008/09 – 2012/13) was +36%). The equivalent population change for Common scoter was given as -3%; its status was classed as *Intermediate (Unfavourable)*; i.e., it is further defined as a species whose populations are declining at both site level and all-Ireland level. Therefore, there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level. However, as noted Common Scoter they are difficult to monitor from land-based counts; this is highlighted by the peak count of 4,314 Common scoter in the winter of 2015/16 (Suddaby, 2016).

Dunlin is classed as *Highly Unfavourable* and is defined as a species whose populations are declining at both site level and all-Ireland level (site population change based on two five-year – means (1999/00 – 2003/04 and 2008/09 – 2012/13) was -64.9%). Therefore, there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level.

Curlews at Blacksod Bay / Broadhaven SPA is also classed as *Intermediate (Unfavourable)*; (site population change based on two five-year – means (1999/00 – 2003/04 and 2008/09 – 2012/13) was 19.4%); a species whose populations are declining at both site level and all-Ireland level.

Table 6.2 Conservation condition and population trends of the SCI assessment species at Blacksod Bay / Broadhaven SPA (from NPWS, 2014a).

Special Conservation Interests (SCIs)	Baseline Period (1999/00 – 2003/04) (5 year peak)	1998/99 – 2012/13 (5 year peak)		2015/16 (peak count)
		Blacksod & Tullaghan Bay	Broadhaven & Sruwaddacon Bay	Blacksod Bay (marine areas)
Light-bellied Brent Goose	279 (i)	658 (i)	41	-
Common Scoter	510 (n)	494 (n)	4	4,314
Red-breasted Merganser	83 (n)	70 (n)	58 (n)	115

Great Northern Diver	67 (i)	79 (i)	40 (n)	300
Ringed Plover	590 (n)	595 (n)	113 (n)	-
Sanderling	171 (n)	285 (n)	64 (n)	-
Dunlin	1255 (n)	687 (n)	76	-
Bar-tailed Godwit	664 (n)	627 (n)	66	-
Curlew	567 (n)	471 (n)	103	-

Table 6.3 Conservation status of the SCI assessment species at Blacksod Bay / Broadhaven SPA (from NPWS, 2014a).

Special Conservation Interests (SCIs)	Site Conservation Condition	14 year site population trend[1]	5 year site population trend[2]	Site Population change[3]	Recent all-Ireland Trend[4]	Current international trend[5]
Light-bellied Brent Goose	Favourable	+ 152.5	+ 91.1	-	Increasing	Increasing
Common Scoter	Intermediate (Unfavourable)	-	-	- 3.0	Declining	Declining
Red-breasted Merganser	Favourable	+ 23.5	+ 57.4	-	Stable	Unknown
Great Northern Diver	Favourable	-	-	+ 36.0	n/c	Stable
Ringed Plover	Favourable	+ 31.3	+ 28.6	-	Stable	Fluctuating
Sanderling	Favourable	+ 235	+ 78.9	-	Stable	Increasing?
Dunlin	Highly Unfavourable	- 64.9	- 33.5	-	Declining	Stable (*alpina*)
Bar-tailed Godwit	Favourable	+ 5.4	- 8.1	-	Stable	Increasing
Curlew	Intermediate (Unfavourable)	- 19.4	- 2.9	-	Declining	Declining

Source: Tables 4.2 and 4.2 in NPWS (2011) Footnotes: -

n/c = not calculated. [1]site population trend analysis, 12 yr = 1994–2007; [2] site population trend analysis, 5 yr = 2002–2007; [3]; Site population change based on two five-year – means (1999/00–2003/04 and 2008/09 –2012/13) [4]all-Ireland trend calculated for period 1994/95 to 2008/09; [5] international trend after Wetland International (2006).

Table 6.3 Conservation condition and population trends of the SCI assessment species at Blacksod Bay / Broadhaven SPA.

Species	1% national	1% international	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Mean
Light-bellied Brent Goose	350.00	400.00	417	1416	476*	322*	246	509	560	277	680	97	425
Common Scoter	110.00	7500.00	1076*	1189*	352*	450*	2882	517	559	611	468	473*	526
Red-breasted Merganser	25.00	860.00	99	62*	125*	87*	36*	94*	108	8	195	171*	115
Red-throated Diver	20.00	3000.00	53*	23*	31*	16*	64*	47*	24*	6	32	139*	50
Great Northern Diver	20.00	50.00	93*	196*	123*	74	34	66	102	36	124	36	73
Slavonian Grebe	n.a.	n.a.	12*	36*	20*	10	32	12*	21	6	16	6*	12
Ringed Plover	120.00	540.00	521	496	621*	594	373*	857*	558	450	357	147	474
Sanderling	85.00	2000.00	397	944	328*	331*	711*	393*	212*	243*	145*	100*	219
Dunlin	460.00	13300.00	928	776	1533	592	464	1003	764	682	614	384	689
Bar-tailed Godwit	170.00	1500.00	1040	1084	1223	740	856	953	586	670	710	807*	745
Curlew	350.00	7600.00	540	483	624*	609*	359*	545*	365	246	403	320*	376

Source: Site Summary Table for 0D499 Blacksod & Tullaghan Bays. [https://c0amf055.caspio.com/dp/f4db30005dbe20614b404564be88 – downloaded 30/03/23].

Note: Where peak counts were recorded outside the midwinter period (Nov, Dec, Jan) these are marked with an asterisk (*). This may indicate that higher numbers occurred during passage periods, or may be due to a lack of counts in the midwinter months.

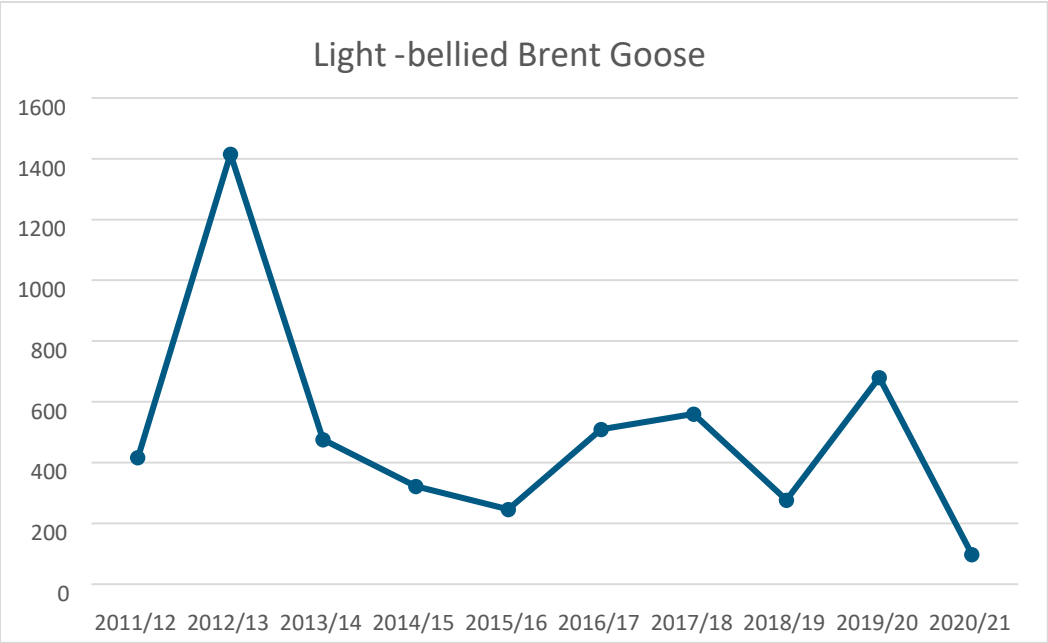


Figure 6.3 Population change in Light-bellied Brent Goose, 2011/12 to 2020/21/

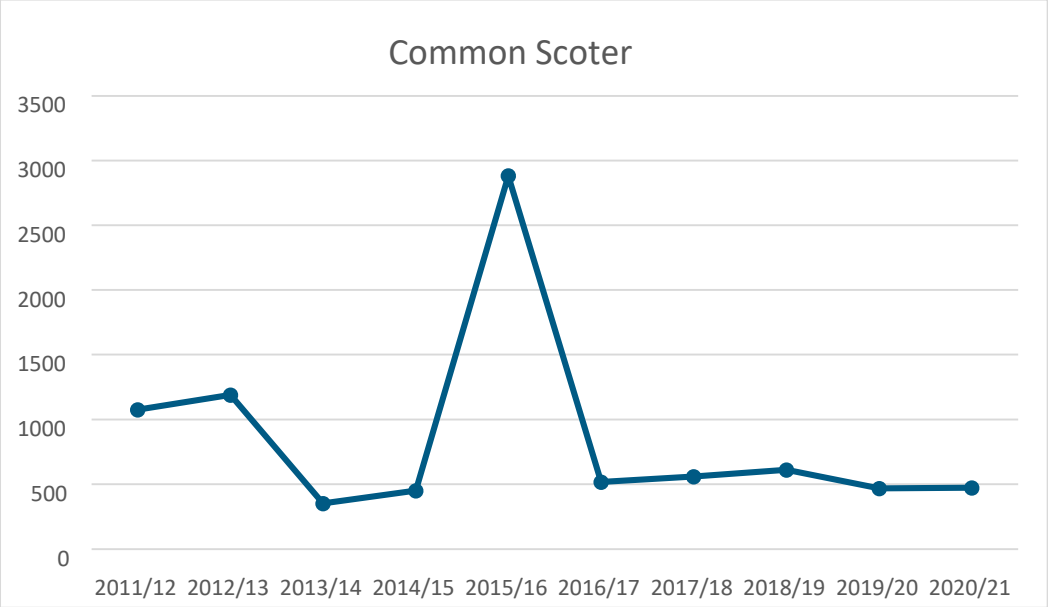


Figure 6.4 Population change in Common Scoter, 2011/12 to 2020/21/

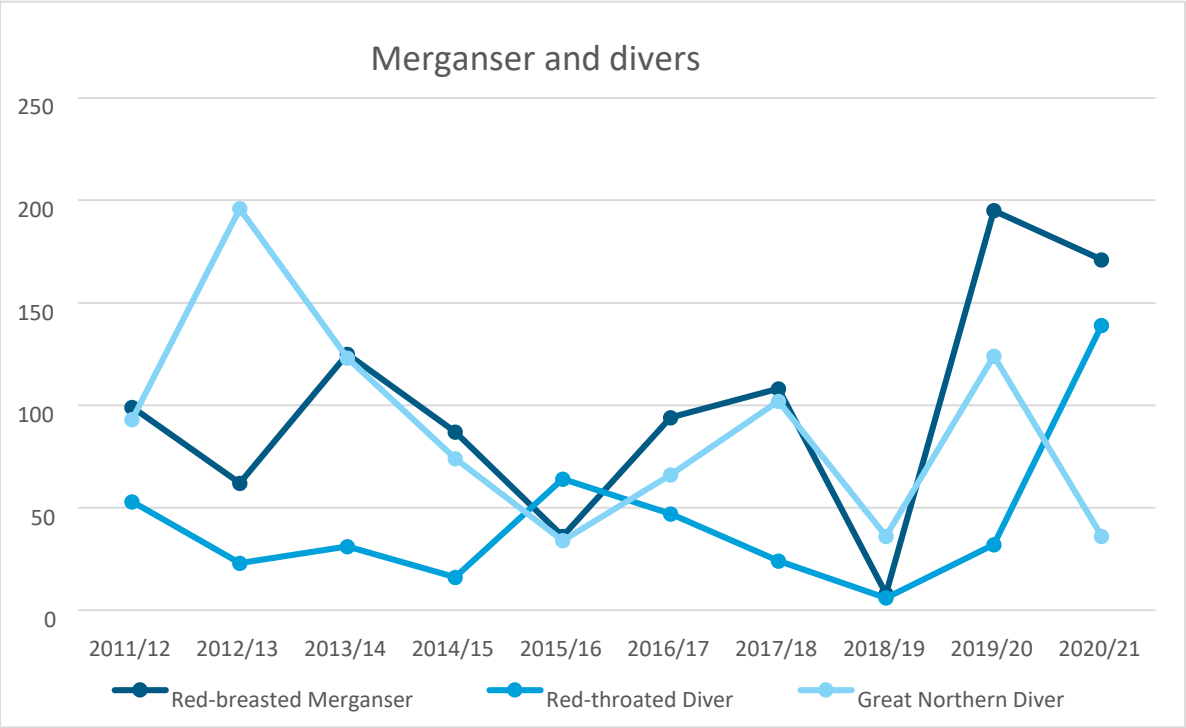


Figure 6.5 Population change in Red-breasted Merganser, Red-throated diver, and Great Northern Diver, 2011/12 to 2020/21.

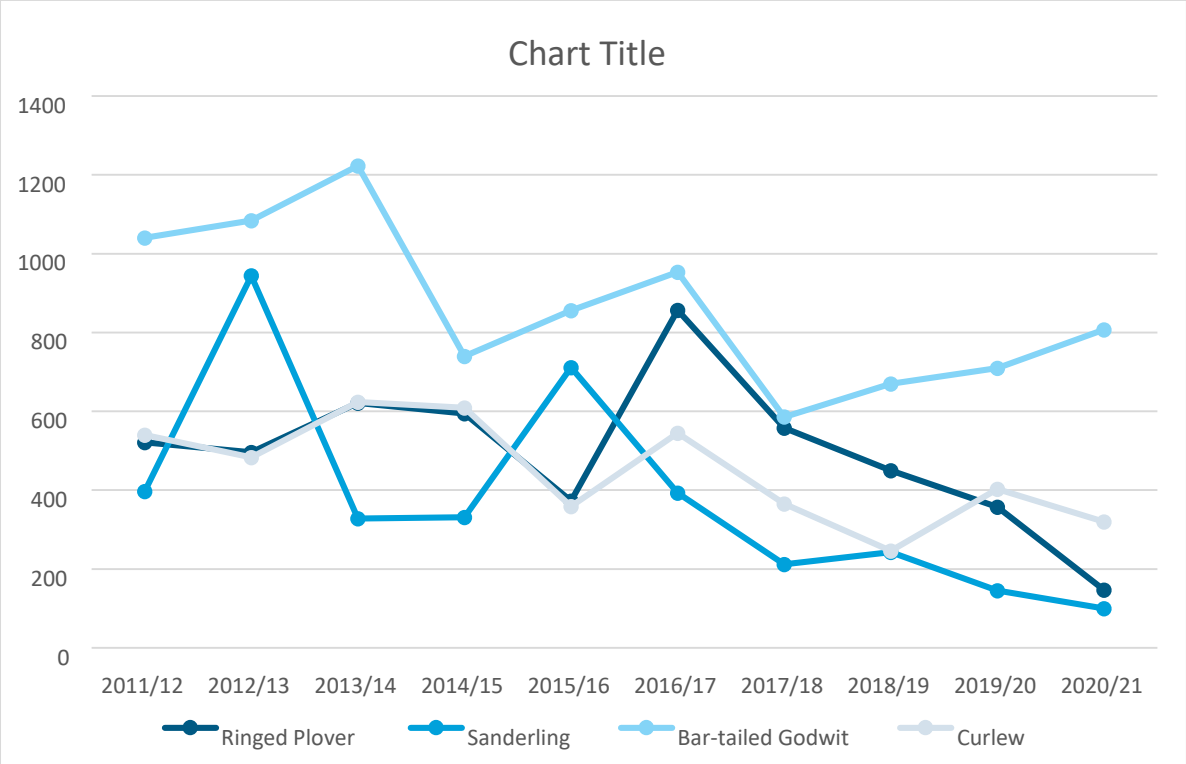


Figure 6.6 Population change in Ringed plover, Sanderling, Bar-tailed godwit, and Curlew, 2011/12 to 2020/21.

BirdWatch Ireland recently published a summary of waterbird conservation status from 2009/10 to 2015/16 (Lewis *et al.*, 2019). For those species where it is available population trends as presented in Lewis et al., 2019 are presented below. All species are showing signs of recent population declines; though in the case of Light-bellied Brent Goose, Sanderling and Bar-tailed godwit this after periods of increase.

Table 6.4 Population trends for a number of key species (from Lewis *et al*. 2019).

Species	5 year	10 year	20 year	Historical
Light-bellied Brent Goose	-15.5 (2012 census)	-10.2 (2007 census)	+96.1 (1997 census)	+75.1 (mid 80' – Sheppard, 1993)
Red-breasted Merganser	-18.4	-8.1	-28.1	+5.2
Ringed Plover	-17.9	-30.1	-6.6	+19.8
Sanderling	-14.1	-0.1	+91.8	+234.4
Dunlin (*alpina*)	-23.0	-41.7	-63.0	-52.1
Bar-tailed Godwit	-17.6	+0.2	+31.7	-26.1
Curlew	-2.4	-21.1	-41.0	-64.2

Similar data is not available for wintering Dunlin (*schinzii*), or for Common Scoter, Red-throated diver, or Great Northern Diver. (Sandwich tern is a breeding species.

6.2.2. Waterbird habitats and distribution

6.2.2.1. Tidal zones & biotope mapping

Three broad habitat zones have been defined for this assessment: intertidal, shallow subtidal (< 0.5 deep), and subtidal (moderately deep subtidal; 0.5-5 m deep & deep subtidal; > 5 m deep). The rationale for the distinction between the shallow and moderately deep subtidal zones is that Light-bellied Brent Goose (as well as other dabbling ducks, such as Wigeon, Teal and Shoveler) generally do not feed in waters greater than 0.5 m deep (Kirby *et al.*, 2000). The rationale for the distinction between the moderately deep and deep subtidal zones is that Red-breasted Merganser generally does not feed in waters greater than 5 m deep. However, as much of Blacksod Bay / Broadhaven SPA is <6m deep, with only the outer bay near Blacksod Point / Kanfinalta Point being down to 10m; this distinction is therefore less informative in this appropriate assessment, but will be referred to as appropriate. That said Suddaby (2016) did see clear difference in distribution of some species between waters close to shore (ca. <2-3m) and those further offshore (ca. 3-8m).

As noted Blacksod Bay / Broadhaven SPA is designated for wintering populations of Great Northern Diver; Light-bellied brent geese; Common Scoter; Red-breasted Merganser; Ringed Plover; Sanderling; Dunlin; Bar-tailed Godwit and Curlew.

As noted, for the purposes of this assessment three broad habitat zones have been defined for this assessment: intertidal, shallow subtidal (< 0.5 deep) and deep subtidal (> 0.5 m deep). The rationale for the distinction between the shallow and deep subtidal zones is that Shelduck and dabbling ducks

generally do not feed in waters greater than 0.5 m deep Habitat use by birds using Blacksod Bay / Broadhaven SPA are as set out in Table 6.5.

Table 6.5 Habitat zones and major prey resources likely to be used by SCI species at Blacksod Bay / Broadhaven SPA.

Species	Intertidal	Shallow subtidal (< 0.5 m)	Deep subtidal (> 0.5 m)	Major prey resources
Great Northern Diver			Feeding and roosting	Mainly flatfish & crabs
Light-bellied brent geese	Feeding and roosting	Feeding and roosting	Roosting	Marine algae; terrestrial grassland
Common Scoter			Feeding and roosting	Marine bivalves
Red-breasted Merganser		Feeding and roosting	Feeding and roosting	Benthic invertebrates; demersal and pelagic fish
Ringed Plover	Feeding and roosting			Benthic invertebrates
Sanderling	Feeding and roosting			Benthic invertebrates
Dunlin	Feeding and roosting			Benthic invertebrates
Bar-tailed Godwit				Benthic invertebrates; dominated by polychaetes & small bivalves
Curlew	Feeding and roosting			Benthic invertebrates, crabs etc.
Sandwich Tern	Roosting	Feeding	Feeding	Demersal and pelagic fish

The extent of mudflats and sandflats not covered by sea water at low tide was taken from the NPWS Mullet / Blacksod Complex SAC (site code: 470). *Conservation Objectives supporting document – Marine Habitats* (NPWS, 2014) and *Broadhaven Bay SAC (site code: 472). Conservation Objectives supporting document – Marine Habitats* (2014).These boundaries appear to have been derived from Ordnance Survey Discovery Series mapping, which in turn, appears to be based on the 1930's six inch mapping. Therefore, the details of the boundaries between the intertidal and subtidal zones are likely to have changed, particularly in areas of mobile sandflats and represents the mean low tide. Recent aerial coverage of the site from sites such as Bing Maps, Ordnance Survey Ireland and Google Earth were also consulted as were detailed marine biotope maps published by NPWS (i.e., NPWS SSCO Marine Communities – see www.npws.ie).

7. Impact Assessment

7.1. Summary of aquaculture proposals

The following information on the distribution of waterbirds in Blacksod Bay SPA is collated from the results of the NPWS baseline waterbird survey (Cummins and Crowe, 2010). The NPWS baseline waterbird survey datasets also largely informed the distribution data in the supporting document for the conservation objectives of Blacksod Bay SPA (NPWS, 2014). In addition, IWeBS datasets from Birdwatch Ireland were examined to provide additional distribution data; as were the findings of a recent study of marine areas (Suddaby, 2016).

In summary the main proposed aquaculture activities and their locations are as follows: -

1. There are 2 no. licences application for a proposed **seaweed cultivation** (T10/344A; T10/355A) – both lie in subtidal waters between Ardelly Point and outside the mouth of Doolough Point.

2. Applications T10/351A and T10/352A propose to cultivate **either shellfish or seaweed** in subtidal waters. These are located in central subtidal waters of Blacksod Bay.

3. Native Oyster cultivation is proposed at number of sites: -

    a. Licence application T10/028A (205.7ha) is located in Elly Bay; this is an extensive cultivation method with oyster grown on the seabed (subtidal waters). Apart from markers, there will be no structures on the surface.

    b. Licence application T10/028B (571.5ha) is located in the northern end of Blacksod Bay, extending from close to Belmullet, extending south-eastwards towards Trawmore Bay. Again, this is for the extensive cultivation method with oyster grown on the seabed (subtidal waters). Apart from markers, there will be no structures on the surface.

    c. Licence application T10/028C (172.97ha) is located within Saleen Harbour on the western side of inner Blacksod Bay; again, it is for the extensive cultivation method with oyster grown on the seabed (subtidal waters). Apart from markers, there will be no structures on the surface.

    d. T10-343 is located in Sruwaddacon Bay – Broadhaven (1.8 ha); this is an extensive cultivation method with oyster grown on the seabed (subtidal waters). Apart from markers, there will be no structures on the surface.

    e. The final native oyster licence applications T10/351 (24ha) and T10-352A (12ha) is a mixed application for both shellfish and seaweed cultivation. This application is for the cultivation of non-native Pacific oyster (*Magallana gigas*), as well as Native oyster (*Ostrea edulis*), mussels (*Mytilus edulis*), King scallop (*Pecten maximus*) and Queen scallop (*Aequipecten operaculris*). Unlike the other sites where shellfish are

on the sea bed, these will be grown on longlines with hanging bags, baskets, nets, lantern nets, hanging mesh and in the case of mussel – rope and mesh droppers. This is located to the east of Moyrhan Point in lower Blacksod Bay.

4. There are 2 no. licence applications for intertidal oyster cultivation, T10/343A and T10/347A.

    a. T10/343A is for the **intertidal cultivation** of non-native Pacific oyster (*Magallana gigas*), as well as Native oyster (*Ostrea edulis*), winkles (*Littorina litt*orea) and mussels (*Mytilus edulis*). The area applied for is 1.8ha. It is located on the western side of Sruwaddacon Bay, close to Carnhill.

    b. Licence application T10/347A is for the **intertidal cultivation** of Pacific oyster (*Magallana gigas*) in Trawmore Bay, Inner Blacksod Bay over an area of 11ha.

5. **Licenced Sites**

    a. T10/319A is a small seaweed cultivation site in Broadhaven Bay to the southeast of Inishderry Island[53] (within OD438).

    b. T10/296A is a small seaweed cultivation site to the west of the southern beach in Doolough on the eastern side of Blacksod Bay (within OD439).

    c. T10/344A overlaps with a small, licenced site T10/296A which is already licenced for seaweed production (within OD439).

    d. Two small intertidal oyster cultivation sites are licenced in Sruwaddacon Bay (T10/081A; T10/081B) (within OD475).

    e. T10/237A is located in Corraun Bay. It is licenced for intertidal cultivation of Pacific oyster (bag and trestle), with periwinkle and blue mussel listed as secondary species for cultivation) (within OD494).

The spatial distribution of sites relative to the NPWS low tide count sectors is summarised in Table 7.1. This also includes preliminary screening comments based on species use of intertidal versus subtidal habitats relative to the spatial distribution of licence application sites.

[53] As noted, Inishderry Island supports breeding Sandwich Ter; it was resurveyed in the summer of 2016. It supported 11 occupied Sandwich Tern nests, though there was also signs of predation with four predated Sandwich Tern noted (NPWS, per comm). This colony has declined by 86% since 1995 (Cummins *et al*., 2019).

Table 7.1 Spatial distribution of licence application sites relative to NPWS low tide count sectors and preliminary screening comments by site and species.

Licence	Tidal State	NPWS Count Sector	Location	Screening Comments
T10/028A	Subtidal	OD479	Elly Bay	These developments will predominantly interact with offshore species using subtidal waters, namely: - • Red-throated Diver (*Gavia stellata*) • Great Northern Diver (*Gavia immer*) • Slavonian Grebe (*Podiceps auritus*) • Common Scoter (*Melanitta nigra*) • Red-breasted Merganser (*Mergus serrator*) • Sandwich Tern (*Sterna sandvicensis*)
T10/28B[36]	Subtidal	OD477 OD493	Bat adjoining Belmullet Trawmore Bay	
T10/028C	Subtidal	OD478	Saleen Harbour	
T10/351A	Subtidal	OD439	Central Blacksod Bay (site is east of Moyrahan Point)	
T10/352A	Subtidal	OD439	Central Blacksod Bay (site is east of Barranagh Island)	
T10/344A[37]	Subtidal	OD439	Central Blacksod Bay (site is east of Ardelly Point)	
T10/355A	Subtidal	OD439	Central Blacksod Bay (west of Doolough)	
T10/343A	Intertidal	OD438	Broadhaven (southeast of Inishderry Island)	These developments will predominantly interact with inshore species using intertidal and shallow subtidal waters, namely: - • Light-bellied Brent Goose (*Branta bernicla hrota*) • Red-breasted Merganser (*Mergus serrator*) [A069] • Ringed Plover (*Charadrius hiaticula*) [A137] • Sanderling (*Calidris alba*) [A144] • Dunlin (*Calidris alpina*) [A149] • Bar-tailed Godwit (*Limosa lapponica*) [A157]
T10/347A	Intertidal	OD494	Trawmore Bay	

36 The central portion of waters covered by T10/28B were not counted by the NPWS low tide count survey programme.

37 This overlaps with a small Licenced site T10/296A which is already licenced for seaweed production..

Licence	Tidal State	NPWS Count Sector	Location	Screening Comments
				• Curlew (*Numenius arquata*) [A160] • Dunlin (*Calidris alpina schinzii*) [A466] To a lesser extent subtidal species such as those above may enter these waters at high tide to forage.

7.2. Review of Potential Impacts

7.2.1. Seaweed Cultivation

In recent years the harvesting of seaweed from coastal bays in Ireland has been subject to ecological assessment, stock assessment and market analysis (Kelly *et al*., 2001; Werner *et al*., 2004; McLaughlin *et al*., 2006; EHS, 2007 & Walsh *et al*. n.a.; Guiry & Morrison, 2013). More recently this has led to proposals being advanced for the harvesting of seaweeds, notably *Ascophyllum nodosum*, in a number of bays in the West of Ireland; and, where relevant, the preparation of Natura Impact Statements (e.g., Aquafact, 2013 – Trawbreaga Bay) in order to assess the potential impact of such harvesting on Natura 2000 sites. This continues "*a long tradition of sustainable seaweed harvesting in the west of Ireland, which began with kelp ash production from kelp kilns around 1700 and which continued sporadically until 1948*" (Guiry and Morrison, 2013).

The cultivation of seaweeds in Ireland is much rarer and little studied. As demand expands, international experience has found that seaweeds are initially harvested from the wild; with progressive movement initially to small scale cultivation and as is the case in East Asia to large scale cultivation.

Based on Table 7.1, the potential for impact associated with seaweed culture are considered below for species favouring subtidal waters, namely Common Scoter, Great Northern Diver, and Red-breasted Merganser.

7.2.1.1. Potential Impacts from seaweed culture

Cultivation of seaweed is an extensive system that relies on a natural nutrient supply; there is no input of food and it is not proposed to apply fertilisers at any of the proposed sites. In contrast to the culture of many animals, there is therefore no organic waste associated with seaweed farming. In fact, they are often used as part of a multi-species system to prevent water quality issues arising from the cultivation of shellfish. Furthermore, seaweed culture is more commonly regarded as being beneficial to marine ecosystems as it can remove pollution-loaded nutrients from the water, which often originate from landbased pollution sources such as agriculture (e.g., removing ammonia and phosphorous and releasing oxygen into the water; Goldburg *et al*. 2001) and in this way can provide positive ecosystem services.

Site preparation (such as removal of rocks etc.) is not required nor will there be any chemicals applied to control predators, competing species and / or fouling organisms. Furthermore, no prophylactive application of chemicals to prevent disease is proposed.

As noted above on-growing of seaweed will be from ropes located along the surface. Apart from longline anchors, there will therefore be limited introduction of physical structures into the environment. While, in Asia seaweed farms can be extremely large with the potential to alter the physical characteristics and habitat surrounding them; this is not the case here. As noted, the sites in Blacksod Bay would all be considered small in scale. Furthermore, none of the four sites overlap with sensitive marine habitats such as reefs, *Zostera* beds etc.

There is very little evidence to suggest that seaweed farms of this scale would have serious consequences for the surrounding habitat. In fact, seaweeds are known to be habitat-creators,

forming refuges, and feeding grounds for a variety of fishes and invertebrates (Kelly, 2005). In this way they may in fact be a positive impact on fish eating species such as Red-breasted Merganser and Great Northern Diver.

All four sites are to be located in subtidal waters in large, open bays; furthermore, they are small in scale with respect to the overall size of the bays within which they are located. The scale of operation is not likely to result in localised nutrient depletion; alter patterns of sedimentation or alter patterns of water flow. While there may be some re-direction of nutrients to macroalgae and thus away from phytoplankton – the scale of operations proposed is such that this is unlikely to be significant and would be swamped by larger bay-wide patterns of water / nutrient exchange and circulation.

Coastal Water quality in both Blacksod and Broadhaven is recorded as unpolluted by the EPA (inner waters around licenced T10/319A are not classified (for all areas are defined as "*Strongly expected to achieve good status*" by the EPA (Source: Envision; EPA map viewer).

We are not aware of any published evidence of bird entanglement seaweed cultivation structures (see e.g., published evidence on mussel long lines).

7.2.2. Native oyster cultivation

This activity involves the bottom culture of native oysters (*Ostrea edulis*) at sites T10/028A (Elly), T10/028B (inner bay at Belmullet), T10/028C (Saleen Bay), T10/351A (central Blacksod Bay), T10/352A (central Blacksod Bay), and T10-343 (Sruwaddacon Bay – Broadhaven).

The following text is extracted from the Aquaculture Profile for the site (BIM, 2016a) and summarises activities on oyster sites.

> *"The natural flat oyster (Ostrea edulis) beds of Blacksod Bay are of both national and international importance as they are one of only nine such national native oyster beds in Ireland. The North Mayo Oyster Development Co-operative manages the naturally occurring beds of native oysters 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 circa 148 members. The Cooperative 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 bi-valve 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 degree Celsius 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. 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 picture from Blacksod Bay.

As mentioned earlier 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 Bonamiasis 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.*

Native oysters and King scallop (Pecten maximus) are also fished outside the Co-op's licensed site by licensed fishing vessels."

Generally, the culture of oysters in this way can be considered to include three main phases.

7.2.2.1. Nursery Phase

A nursery phase which can often take place in the intertidal zone. However, as noted above the Blacksod Bay fishery is dependant to a large extent on natural settlement and is also based around natural oyster beds dating back to the 19th Century. Settlement can, however, also be supplemented by the suspension of bags of mussel shells from buoys / floats in areas of good oyster spatfall; it is assumed that this would take place in subtidal waters.

No activities associated with oyster bottom culture will occur within the intertidal. As noted a number of areas of intertidal reef are located within licence areas; notably within T10/028, while *Zostera*, a favoured food of Light-bellied Brent Geese is present in both T10/028A and T10/028B. There will be no overlap in dredging activity permitted with sensitive habitats such as reef, maërl and *Zostera*.

The SAC AA describes the ongrowing of oysters in subtidal waters as follows: -

> *"It is proposed that suitably-sized oysters (> 15 g) are spread within the licensed area. Oysters will be checked periodically when the progress (growth and mortality) of the oysters will be monitored and intervention will be necessary if anomalies are discovered. For example, oysters may need turning-over if excessive fouling or siltation is noted on the animals. Such intervention, as well as harvesting (when oysters are approximately 100 g), is carried out using oyster dredges deployed from boats. The dredges are typically 1.5 m wide and have contact with the substrate via a flat blade".*

There is no information available on the current, or proposed, occupancy of subtidal habitat within licensed plots. Therefore, we have made the unrealistic assumption of an occupancy rate of 100% (as advised by the Marine Institute). It is noted, however, that this is an unrealistic assumption given the extensive beds of *Zostera* as well as other sensitive habitats within that are located in T10/028A and T10/028B (see above).

In general, it is considered that the areas used for oyster bottom culture will be below the lowest astronomical tide because the operators will not want to be constrained by the tide whilst dredging (Francis O'Beirn, Marine Institute, pers. comm.).

7.2.2.2. Potential impacts on habitat structure and prey resources

The SAC AA states that bottom culture of oysters is "*considered disturbing*" to the subtidal biotopes affected, due to the sensitivity of some of the characteristic species to organic enrichment, smothering and/or physical disturbance from dredging.

It is considered unlikely that increases in oyster density (even to 10's per m^2) would impact negatively on fishes. In fact, it is possible that fish production/abundance would increase. The oysters, along with shell 'hash', provides a low relief habitat that will increase general heterogeneity in overall structure and which has been shown to increase diversity and abundance of fish species. However, it should be noted that these conclusions relate to work conducted on a different oyster species, *Crassostrea virginica* in the US (Francis O'Beirn, Marine Institute, *pers. comm*; see also Lenhert and Allen, 2002; Scyphers, *et al.*, 2011; Tolley and Volety, 2005).

Mapped densities of oysters recorded in the subtidal zones of the licensed oyster plots during Marine Institute surveys are very low (<0.5m^2) with low overall biomass (25 Tonnes) (Tully and Clarke, 2012). If this is representative of recent years, it is reasonable to assume that the existing levels of oyster cover are not significantly affecting waterbird distribution in the subtidal zone. Therefore, waterbird distribution patterns can be used to assess the potential impact of the ongrowing of oysters in subtidal waters.

7.2.2.3. Further ongrowing of oysters in subtidal waters

The SAC AA states that oyster harvesting *"is carried out using oyster dredges deployed from boats"* and that *"the dredges are typically 1.5 m wide and have contact with the substrate via a flat blade"*.

The Aquaculture Profile notes that the number of harvesting days are restricted to a short season normally in the spring time, February to March. It is normally 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. 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. We have no detailed information on whether all licenced boats would be active across the 8 fishing days.

Oyster harvesting will result in the removal of oyster biomass that would otherwise have been available for birds to feed on. However, there are no SCI species at Blacksod Bay that are likely to feed on oysters in subtidal waters.

7.2.2.4. Other SPA / Species

As noted above adjoining SPAs support a range of species whose foraging range could theoretically overlap with the areas of oyster beds. These include e.g., Cormorant, Shag, gulls (Herring, Common and Lesser Black-backed) and terns, such as Arctic and Little.

In the case of Cormorant these are widely distributed throughout the SPA, with large numbers in the inner bay as well as Elly Bay (OD479) and off Claggan (OD494) (Suddaby, 2016). In contrast, while Shag also occur in small numbers through Blacksod Bay, the main site is off Blacksod Point. The key harvesting period is from February to March when breeding Arctic and Little Tern are absent from the site. Nesting gulls, such as Herring, Common and Lesser Black-backed, can feed on a range of terrestrial, intertidal, and subtidal prey items. After breeding they can disperse widely, with for example many Lesser Black-backed migrating as far south as Portugal for the winter.

The scale of the proposed harvesting activities and associated low risk of disturbance, relative to the distance from known breeding sites and the availability of large areas of alternated foraging grounds is such that these species are unlikely to be impacted. Furthermore, as fish eating species, the potential for the oyster beds to enhance habitat structural diversity and in this way provide greater foraging opportunities for fish eating species cannot be discounted.

7.2.2.5. Conclusions

Therefore, for most species there are no potentially significant impacts that are likely to arise from the cultivation and harvesting of oysters in subtidal waters. While the potential for impacts on Red-breasted Merganser would appear to be low, a potential mitigation measure worth considering is that harvesting does not occur within all three favoured areas on the same days; thus, if birds are displaced suitable alternate habitat does occur within which they can temporally forage. The status of Red-breasted

Merganser in Blacksod Bay should also continue to be monitored against annual fishing effort / location.

7.2.3. Intertidal oysters

7.2.3.1. Background

The following text is largely extracted from the Aquaculture Profile prepared by BIM (2016a).

Pacific oysters (*Magallana gigas*) have been grown in Blacksod Bay since the 1990's, 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 and intends to increase production once licences are approved. There is a new application in Trawmore Bay – Blacksod Bay for the cultivation of oysters and clams in generally same area as where pacific oysters and clams were successfully grown in past. At present there is no production in the Bay.

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 5 metres in length, are approximately 1 metre in width and stand between 0.5 and 0.7 metres 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 Plate 8.1.

The Pacific oyster is a bivalve mollusc that filter feeds on plankton and other nutrients from the sea when submerged. All the Blacksod Bay 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 oyster seed (G4 to G8) between 6-10 mm in size) is introduced from hatcheries. On rare occasions seed can be brought in at a smaller size of less than 4 mm; these are put into 2 and 3 mm plastic mesh pouches within 4mm oyster bags where they remain for few months until they reach 6 mm and are ready to be transferred to the 4 mm oyster bag.

All seed and larger oysters brought into the Bay will to be sourced from Irish, French or UK hatcheries. 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. Sourcing of seed is often dependent on availability. In general, it takes between 2 and 4 years to reach market size (65 gram plus), 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 ½ 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 5,000 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 1,000 oysters per bag. By the time they reach market size of 66 gram plus 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 farms sites are accessed by one tractor and trailer using one or two routes from farmer's land base facilities ashore. 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.

7.3. Impact Assessment

7.3.1. Seaweed culture

7.3.1.1. Common Scoter

During winter and when feeding, Common Scoters are generally distributed in shallow coastal waters (BWPi, 2004). They are most often distributed across areas where there is a sandy substrate, linked to the distribution of their favoured prey of bivalve molluscs. Previous research varies somewhat in the range of dive depths reported for Common Scoter, with dive depths clearly influenced by local conditions, the depth of favoured bivalve feeding beds and the energetic costs of reaching same (Kaiser *et al*. 2006). All areas of Blacksod Bay are within the published foraging depth of Common Scoter.

Most seaducks, including Common Scoter are believed to be diurnal foragers. Lewis *et al*., 2005 found no evidence for significant night-time foraging in the closely related White-Winged Scoter (*Melanitta fusca*) and Surf Scoter (*Melanitta perspicillata*). In these species, and indeed for Common Scoter, published evidence suggests that birds move further offshore and into deeper waters by night to roost (Lewis *et al*., 2005 etc.). Common Scoter is believed to be largely tactile feeders, e.g., in Liverpool Bay they feed in quiet turbid waters which would preclude visual foraging. However, we are unaware of any published evidence to suggest that Common Scoter forage by night (to compensate for shorter day length, such as at and higher latitudes, or to selectively target slacker tides and thus lower current speeds within which to forage). At the mid-latitudes where Ireland is located it is highly probable that

scoter has sufficient daylight within which to meet their energetic demands and do not need to avail of nocturnal foraging to meet their daily energy budgets.

The diet of Common Scoters has been reviewed by Fox (2003), BWPi (2004) and Kaiser *et al*. (2005). Quantitative analyses of their diet show that it is overwhelmingly dominated by bivalves (88% or greater of the diet composition in the eight studies reviewed by Kaiser *et al*., 2005). A total of 30 species of bivalve have been recorded within their diet (Kaiser *et al*., 2005). Fox (2003) concluded that: "*Common Scoter seem to prefer foraging in clean sandy substrates that support benthic communities rich in bivalve biomass. Within such sites, prey species are probably taken in proportion to their abundance*". Literature reviews do not indicate any clear patterns of size selection of prey by Common Scoter (Fox, 2003; Kaiser *et al*., 2006). Common Scoter are reported to consume prey with a shell length within a range of 5-40mm (Kube, 1996; Meissner & Brager 1990; Durink *et al*. 1993; all quoted by Kaiser, *et al*. 2006), though an upper limit of around 50 mm shell length has also been reported (Fox, 2003). However, the maximum limit may not apply to razor clams as these are likely to be ingested lengthways (Kaiser *et al*., 2006). There is also evidence of scoter nipping off the ends of exposed inhalant or exhalant siphons from buried bivalves.

Much of the habitat along the centre and eastern side of Blacksod Bay is defined as 'fine sand with *Angulus fabula* (a species of bivalve mollusc) community complex'. While Fox (2003) did not reference direct evidence of consumption of *Angulus fabula*; he does reference the presence of large aggregations of scoter over known *A. fabula* beds in the Netherlands. Leonhard and Skov (2007), however do record *Tellina* (syn. *Angulus*) *fabula* in the diet of Common Scoter in Danish waters.

The NPWS baseline waterbird survey results suggest that Common Scoter is primarily restricted to four key subsites within Blacksod Bay. These are located in the centre and along the eastern side of the bay with birds foraging and roosting in subtidal waters of Blacksod Bay (0D439), Doolough Bay & Strand (0D490), Claggan Strand (0D494) and Kanfinalta Point (0D901). Across the full survey duration, the greatest number of Common Scoter were recorded in Doolough Bay & Strand (0D490) and Claggan Strand (0D494). These areas largely coincide with the marine biotope *Fine sand with Angulus fabula*, while there is some overlap with *Sand with Gastrosaccus spinifer* off Kanfinalta Point.

In addition to these four sites, IWeBS data suggests that Trawmore Bay (0D493) is an additional subsite of importance for Common Scoter as large flocks have been counted in this subsite in the past. The outer part of Trawmore Bay is again dominated by *Fine sand with Angulus fabula*; with *Sand with Angulus tenuis and Pygospio elegans* dominating inshore waters.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are all located in the deeper subtidal waters within low tide count sector 0D439. If seaweed is cultivated on all 4 – this equates to 102ha of floating seaweed culture which may exclude Common scoter from diving for prey in these areas (though there appears to be no published evidence looking at the relationship between scoter and seaweed cultivation). However, the 4 no. blocks are widely spread in smaller elements through central Blacksod Bay. (Note that the bay is also subject to scallop dredging).

In 2015 BirdWatch Ireland were commissioned to assess the abundance and distribution of wintering water birds in the marine areas of Blacksod Bay (Suddaby, 2016). Land based counts were undertaken each month from December 2015 to April 2016 (a total of 10 counts). Counts were timed to coincide

with optimal calm sea conditions. As well as counting flooded intertidal habitats included in IWeBS count zones, neighbouring areas of subtidal habitat were also counted. By far the most important area for Common Scoter was the waters off Claggan Strand (notably south of Claggan Point) where a mean total of 2,210 (± 205.8) birds were recorded; and to a lesser degree off Doolough Point and Doolough Bay, where 1,053 (± 174.5) birds were noted (in waters generally no more than ca. 5-6.4m deep). Actively foraging birds were noted. A mean count of 3,355 (± 203.9) birds were estimated to be present during the survey period; with a peak count of 4,314 on 10th February 2016. This is significantly higher than the number usually recorded by IWeBS or noted in NPWS, 2014.

T10/352A is >3km off Claggan Strand, the Admiralty chart shows water depth close to the area varying from 5.8m to 9.4m, with habitat characterised as *Fine sand with Angulus fabula*. While these area support habitat favoured by Common scoter, the flock distributions noted in the above surveys suggest the main density of prey are likely to be in waters of less than ca. 5-6.4m deep. This area is therefore likely to be less optimal for foraging scoter, though available.

T10/355A is located to the northwest of Doolough Strand in waters of 6-7m depth; this overlaps in part with the depths noted as being favoured (i.e., ca. 5-6.4m deep) by Common Scoter and is characterised as *Fine sand with Angulus fabula*.

T10/344A on the western side of Blacksod appears to be less favoured by Common Scoter; T10/351A is located in the central deeper waters. Both areas are characterised by *Serpula vermicularis*[54]*dominated community complex*, which, based on the above comments on distribution, appears are less favoured by Common Scoter to forage over. Licences T10/344A or T10/351A or therefore not likely to negatively impact upon Common Scoter.

As noted, scoter also seem to favour Trawmore Bay, in inner Blacksod Bay. This area is also dominated by *Fine sand with Angulus fabula* in central areas. The eastern portion of T10/028A, bottom cultivation of native oyster, overlaps with the outer reaches of Trawmore Bay. Within Trawmore Bay T10/347A is for the intertidal cultivation of Pacific oyster, as is T10/343A in Sruwaddacon Bay. These site will not impact upon Common scoter.

The area of *Fine sand with Angulus fabula* (see Figure 6.2) within the SPA is 6,289ha; Maintained in a natural condition. The total percentage exclusion based on an area of 54ha (T10/352A; T10/355A) equates to <1% habitat loss (0.86%).

We do not have any site-specific data on the response of Common Scoter to marine traffic in the Blacksod Bay area. However, this species is generally considered to be highly sensitive to such disturbance. Furness *et al*. (2013) classified its sensitivity to disturbance from ship and helicopter traffic as 5 on a scale of 1 to 5, where 5 represents "*strong escape behaviour*, *at a large response distance*". Schwemmer *et al*. (2011) reported a median flush distance of 804 m during experimental disturbance work in the North Sea, with a maximum flush distance of 3.5 km, and only 0.5% of Common Scoter flocks did not flush as the boat approached. They also found a significant positive correlation between flock size and the distance at which birds flushed. Similarly, Kaiser *et al*. (2006) reported that larger flocks flushed at distances of 1-2 km, while smaller flocks flushed at distances of

[54] 38 A species of fan worm, polychaete.

less than 1 km. Both studies used medium-sized vessels (lengths of 25-40 m) and Kaiser *et al*. (2006) state that "*flush distance is likely to relate to the size (height) of vessel structure above the water-line*".

Access to all sites is by boat from Blacksod Pier. Traffic along the west side of Blacksod should be >24km from waters favoured by scoter. Access to T10/355A would pass closer to areas favoured by scoter along the eastern side of the sites; boats should be required to follow a more westerly route before turning eastwards only when level with the site.

With respect to the potential for disturbance, seaweed is deployed between October and November / December when Common Scoter is on site; whereas it is harvested between April and June when scoter are largely absent from site (though the early return of non-breeding and post-breeding birds cannot be discounted). Scoters are therefore unlikely to be impacted by harvesting operations. Following initial deployment (over a number of days) we understand that maintenance visits to the site would be in the order of one per month. It is very unlikely that this level of site attendance and associated boat traffic would result in anything other than a temporary displacement of birds away from the seaweed site. We are not aware of any published material to suggest that the site itself would displace foraging scoter other than within the ca. 10 ha footprint of the site. The risk of seaweed culturing at the scale proposed causing significant disturbance to Common Scoter is therefore considered low.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are not anticipated to negatively impact upon Common Scoter.

7.3.1.2. Great Northern Diver

Blacksod Bay is an extremely important site for Great Northern Diver. Great Northern Diver are widespread within the SPA having been recorded in 15 subsites during the baseline waterbird survey. However, seven subsites were identified as being of particular importance as Great Northern Divers were recorded on 3 or more occasions at these subsites during the duration of the survey. These subsites included Blacksod Point (0D415), Elly Bay (0D479), Saleen Harbour (0D478), Claggan Strand (0D494), Doolough Bay & Strand (0D490) and Kanfinalta Point (0D901) within Blacksod Bay as well as Broadhaven Bay (0D438). Broadhaven Bay was highlighted as an important foraging subsite as this was the only subsite in which Great Northern Diver were recorded for all survey dates (NPWS, 2014). Other notable subsites for foraging birds included Saleen Harbour (0D478), Elly Bay (0D479) and Doolough Bay & Strand (0D490).

IWeBS data indicate a similar pattern with high counts for Great Northern Diver having been recorded at subsites including Kanfinalta Point (0D901 - peak count 52), Trawmore Bay (0D493 - peak count 51), Doolough Strand (0D490 - peak count 62), Claggan Strand (0D494 - peak count 41), Saleen Harbour (0D478 - peak count 31) and Seafield Bay (0D477 - peak count 31; north of Saleen Harbour). As with the NPWS baseline waterbird survey, IWeBS data shows that Great Northern Diver have been recorded from across the site.

As noted, in 2015 BirdWatch Ireland were commissioned to assess the abundance and distribution of wintering water birds in the marine areas of Blacksod Bay (Suddaby, 2016). Average number of Great Northern Diver were 202 (± 13.9) during the winter increasing to 274 (± 12.4) during spring. While

recorded throughout the site, generally as singles or in small groups of 3-5 birds (though larger aggregations were encountered during spring), during the winter (December – February) there was a more westerly bias in number of birds recorded towards the waters off Aghleam Bay, Elly Bay and Saleen Harbour (Suddaby, 2016). A similar pattern (though with larger numbers) also occurred in spring (March – April); though at this time of the year a slight increase in numbers was also noted off Kanfinalta Point / Doolough Bay. As well as *Fine sand with Angulus fabula*, this section of the bay includes large areas of *Serpula vermicularis-dominated* reef habitat; the latter is likely to support large numbers of crab, a favoured prey item of Great Northern Diver in Ireland (*pers obs*).

The *Serpula vermicularis-dominated* reef sub-habitat community complex is recorded off the western shore of Blacksod Bay from Barranagh Island to Moyrahan Point in water depths of 3-11m. The sediment ranges from largely fine sands (59.8% to 86.3% very fine to fine sand) to coarse material (18.5% to 28.9% very coarse and coarse sand) reflecting its co-occurrence with maërl in the southern extreme of the community. This community is dominated by the reef-building polychaete *Serpula vermicularis* which forms distinct clusters of biogenic reef in otherwise soft sediment. The tubes are frequently encrusted with coralline algae and sponges and a number of species of red algae also occur on the reef. A variety of anemones are found attached to the reef including *Metridium senile*, *Sagartia elegans* and *Anemonia viridis*. It also provides a refuge for a number of crab species including *Munida* sp., *Liocarcinus depurator* and *Cancer pagurus*.

Where fine sand is the prevailing sediment type within the complex the bivalve *Thyasira flexuosa* and the amphipod *Ampelisca brevicornis* occur in moderate to low abundances and the bivalve *Abra alba* and *Angulus fabula*, the polychaetes *Euclymene* sp., *Magelona alleni*, *M. minuta* and *Spiophanes bombyx* are recorded in low abundances. In coarser sediment the polychaete *Chaetozone christiei* occurs in moderate abundances with the crustacean *Microdeutopus* sp., recorded as locally abundant.

Roycroft *et al*., (2007) found that Great Northern Diver were not adversely affected by mussel suspension aquaculture in Bantry Bay, Co. Cork, and may in fact benefit from it. Seaweed longline cultivation is likely to interact with divers in the same way.

While divers are often regarded as highly sensitive to disturbance from boat traffic (Furness *et al*., 2013), a recent study of Great Northern Divers in Galway Bay found that were not significantly disturbed by medium-sized craft (Gittings et al., 2015). While the study was of short duration (undertaken across one day) and included a small sample size (a total of 57 observations of 64 different birds), these findings are in line with observations of Great Northern Divers in other sites such as Courtmacsherry Bay (*pers obs.)*. The risk of seaweed culturing at the scale proposed causing significant disturbance to Great Northern Diver is therefore considered low.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are not anticipated to negatively impact upon Great Northern Diver.

7.3.1.3. Red Breasted Merganser

The baseline waterbird survey results show that Red-breasted Merganser was recorded foraging across a number of subsites sites (12) within Blacksod Bay SPA, but was only regularly recorded across the surveys in four subsites: Broadhaven Bay (0D438), Seafield Bay (0D477), Elly Bay (0D479) and

Doolough Strand (0D490). In particular, Broadhaven Bay was observed to be an important subsite for subtidal foraging. In addition, Trawmore Bay (0D493) supported significant proportions of foraging birds.

IWeBS data shows that high counts of Red-breasted Merganser have been recorded in most of the small sandy bays around the inner bay, notably at Saleen Harbour, Aghleam Bay, Seafield Bay, Claggan Strand, Elly Bay, Trawmore Bay and Doolough Bay & Strand.

Suddaby (2016) recorded the largest number of Red-breasted Merganser using shallow waters close to shore. Overall average numbers were 93 (± 7.8), with a slightly higher number noted during the winter; 108 (± 5.6) (i.e., December to February). Birds were generally encountered in mixed sex groups of 6-10; with larger groups of up to 25 particularly off Saleen Harbour (OD478) and Seafield Bay (OD477).

As noted above, the NPWS low tide survey programme found Red-breasted Merganser to be widely recorded within Blacksod Bay / Broadhaven SPA. Merganser were recorded in a total of 14 subsites, but only four subsites supported mergansers on all four low tide counts: Broadhaven (0D438), Seafield Bay (0D477), Elly Bay (0D479) and Doolough Bay (0D490). Large numbers also occurred in Trawmore Bay (0D493) (this site recorded peak subsite numbers of 58 in October 2009 surpassing the threshold for national importance in its own right). Thereafter, Broadhaven (0D438) held the largest numbers (41, Nov. 2009; 32, Dec. 2009 & 22, Feb. 2010). These sites were also noted as important foraging sites; with key foraging sites noted as being Broadhaven, Seafield Bay and Trawmore Bay. Broadhaven Bay (0D438) supported the greatest proportion of foraging merganser within all NPWS low tide survey (between 30% and 65%). IWeBS figures also show Broadhaven Bay routinely supporting as many as 50 Red-breasted Merganser (peak count of 79 on 23rd January 2011); i.e., over the national threshold for Red-breasted Merganser in its own right.

The population trend for Red-breasted Merganser is Favourable (+23.5) at a site level, and Stable for all-Ireland NPWS, 2014a). Lewis *et al* (2019) put recent national trends for Red-breasted Merganser at -18.4 (5 year) and -8.1 (12 year).

Red-breasted Merganser feed on both fish and crustaceans. Fish species taken include sand gobies, herring and sprat, coalfish etc. They also feed on invertebrates such as small shore crabs, mysids (shrimp like crustaceans) and common shrimp. Therefore, the major prey resources for the Red breasted Merganser in subtidal waters of Blacksod Bay / Broadhaven SPA may include a mixture of benthic invertebrates and demersal and pelagic fish.

Roycroft *et al*. (2004; 2007) studied the interactions of waterbirds and seabirds (mainly divers, cormorants, gulls, and auks) with suspended mussel culture in deep subtidal habitat in Bantry Bay. This study found no evidence of adverse impacts from suspended mussel culture on waterbirds and seabirds. While Roycroft et al.'s study did not include Red-breasted Merganser, the range of species covered by their study does provide evidence that fish-eating species in general are not affected by suspended mussel culture, and suspended mussel culture may actually increase prey resources for these species (see above). As the impacts of seaweed culture are comparable (and less in terms of deposits) seaweed culturing is unlikely to cause direct impacts to Red-breasted Merganser.

T10/319A (Broadhaven Bay) and T10/320A is located just outside Doolough Bay, are both already licenced for seaweed cultivation. Normally merganser counts within the Doolough Bay are <10 (in line with Suddaby, 2016); though a count of 24 birds was recorded by IWeBS in February 2002. T10/296A is located outside Elly Bay; merganser counts here are variable, but have been as high as 29 (noted as 11-20 by Suddaby, 2016). It is probable that there is interchange of birds between subsites along the western side of the bay.

Broadhaven is a very important site for Red-breasted Merganser. As is the case for Common Scoter the placement of a ca. 10 hectare site within the inner bay will not result in a significant loss of habitat; in fact, it is possible that by acting as fish attracting devices that these might in fact have a positive impact on merganser. As noted for scoter the potential for disturbance must also be considered. In a recent study of merganser in Wexford Harbour we have found that mergansers have a high degree of behavioural sensitivity to disturbance from marine traffic (Gittings and O'Donoghue, 2016b). However, it is not clear whether this sensitivity is a general pattern, or whether it is due to some site specific factor (e.g., boat based hunting of other wildfowl in Wexford Harbour). On site works are as set out in Chapter 1.0 and paragraph 7.2.1; on this basis and given the availability of suitable alternate habitat, it is very unlikely that this level of site attendance and associated boat traffic would result in anything other than a temporary displacement of birds away from the seaweed site. The risk of seaweed culturing at the scale proposed causing significant disturbance to Red-breasted Merganser is therefore considered low.

T10/351A (seaweed, 24ha); T10/352A (native oyster / seaweed, 12ha); T10/344A (seaweed, 30ha) and T10/355A (seaweed, 24ha) are not anticipated to negatively impact upon Red-breasted Merganser.

7.3.1.4. Sandwich Tern

While Sandwich Tern also feeds in subtidal waters the main period of operation within the licence blocks is over the winter months; Sandwich Tern are absent from Blacksod Bay / Broadhaven SPA and will not be impacted during these months. The scale of operations proposed will not impact a significant proportion of the area of suitable subtidal foraging habitat used by Sandwich Tern, which can feed as far as 50km from their nesting site.

The main time where impact could occur is during the April – June harvesting window. As noted Sandwich Tern nest on Inishderry Island (along with large numbers of Black-headed Gull (170 individuals counted in 2016) and small numbers of breeding Common Gull, Herring Gull, Lesser Black-backed Gull, and Great black-backed Gulls) (note that Sandwich Tern have also bred on Carrowmore Lake to the southeast). This is close to the licence plot T10/319A (Broadhaven Bay). Association with

Black-headed gulls is a common feature of Sandwich Tern nesting sites as happens at Inishderry. Sandwich Tern are one of the earliest tern species to return from their wintering grounds; they are often back in Ireland by as early as mid-March and back on the nesting ground by mid-April. However, Sandwich Tern differ from other terns in that pre-laying activity tends to take place away from the breeding site. Most chicks hatch in late May – early June (incubation – 25 days); and fledge in late June to July (fledging – 29 days). Egg laying can be highly synchronised and is likely to be in early May on Inishderry.

This places harvesting at the same time as nest establishment and incubation on Inisherry Island (Cabot and Nisbet, 2013). T10/319A is less than 375m from Inishderry Island.

Sandwich Tern has a reputation for being easily disturbed; they are known e.g., when disturbed early in the season by a predator to abandon the site *en masse* and move to another breeding site. However, Sandwich Tern also nest on Inish Island, Lady's Island, Co. Wexford very close to an active pilgrim pathway suggesting they can readily adapt to consistent patterns of activity under certain circumstances. The concern at Inishderry relates to uncertainty as to the impact from a short, but focused, period of boat based / noisy activity coinciding with the early stages of nest establishment, egg laying and incubation; this risk cannot be entirely discounted at Inishderry due to the proximity to the nesting site.

However, as noted the numbers nesting on the island are significantly reduced – with predation seeming to be a significant issue. That said, any such risk of colony abandonment could be mitigated, however, by undertaking habitat enhancement at the nearby Carrowmore Lake site to ensure this site is managed to promote breeding by Sandwich Tern and other tern and gull species.

7.3.1.5. Other notable diving species

Large numbers of **Red-throated Diver** were recorded off Feorinyeoo Bay and Elly Bay; as well as south west of Doolough Point by Suddaby (2016). Boland and Crowe (2014) noted that Blacksod & Tullaghan Bay is no longer of significance for Red-throated diver (mean / peak 2004-2008 of 14 / 28 birds). However, the overall mean of 49 (± 8.2) and spring mean of 70 (± 11.3) noted by Suddaby (2016) are both well in excess of the national threshold of 20 birds.

Lough Swilly and Blacksod & Tullaghan Bay are the two sites from which Slavonian Grebe is most regularly recorded and in largest numbers (Boland and Crowe, 2014). The threshold for international importance is 55 birds; no national threshold has been specified.

An overall mean of 33 birds (± 4.3) and winter mean of 35 birds (± 6.0) was noted by Suddaby (2016); unlike the diver species numbers of **Slavonian Grebe** were higher in winter (December – February) than spring (March – April). Most birds occurred in the northern or inner parts of Blacksod Bay; as well as generally in count sectors closer to shore (unlike the divers and scoter). Slavonian Grebe is not likely to be negatively impacted by seaweed cultivation.

7.3.2. Bottom oyster cultivation

This component of the activity will only potentially affect Qualifying Interest species that make significant use of subtidal waters as a feeding habitat. Because the areas used for oyster bottom culture will generally be below the lowest astronomical tide, species that only feed in intertidal habitats and shallow subtidal habitat are unlikely to be affected. These species generally feed in water depths of less than 0.5m and will, therefore, only be able to utilise habitat below the lowest astronomical tide level during the lowest spring tides (< 20% of all low tides). Therefore, the species potentially affected are those that can feed in deep subtidal waters. As noted, large *Zostera* beds are present in T10/028A and T10/028B; these are an important food resource for Light-bellied Brent Geese. However, as commercial dredging over this protected habitat will not be permitted (refer to SAC AA), there will be no impact on Light-bellied Brent Geese.

In the absence of any activities in the intertidal zone and the limited impact predicted for shallow subtidal waters (<0.5m); intertidal waders (i.e., Ringed Plover, Dunlin, Bar-tailed Godwit, Curlew and Dunlin *schinzii*) and Light-bellied Brent geese are unlikely to be impacted and are not considered further. April 2023

Red-breasted Merganser, Great Northern Diver and Sandwich Tern are mainly fish-eating species. As bottom oyster culture is considered unlikely to negatively affect fish populations (and may in fact have a positive impact), potentially negative impacts from habitat alteration due to bottom oyster culture to Red-breasted Merganser, Great Northern Diver and Sandwich Tern are considered unlikely and are not discussed further. Furthermore, it should be noted that the existing oyster beds covered by licence T10/028A and T10/028B coincide with those areas favoured by Red-breasted Merganser (Suddaby, 2016; IWeBS data) in Blacksod Bay; though this may also be a result of the intertidal & subtidal reefs and *Zostera* beds acting as important fish nursery areas; thereby providing fish in the size range favoured by Red-breasted Merganser.

Common Scoter feed on molluscs and other benthic invertebrates. However, oysters do not appear to have been recorded in their diets (Fox, 2003). It is not clear whether Common Scoter target blue mussel that can attached to oyster shells. Furthermore, the areas favoured by Common scoter do not overlap to any significant extent with the bays proposed for oyster culture (though they are noted from Trawmore Bay which overlaps in part with the eastern end of T10/028B).

The harvesting of oysters will cause disturbance impacts to Qualifying Interest species that use deep subtidal waters. This will occur between February and March each year in which a harvest is permitted by the Co-op. and will normally occur over a period of 8 days. Sandwich Tern will be largely absent from the site at this time. While Common Scoter are sensitive to disturbance by boats, as noted the area covered by T10/028A and T10/028B; is at its closest ca. 2.5km from these licence blocks.

Blacksod Bay is a significant site for Great Northern Diver; numbers of Great Northern Diver in Blacksod Bay also appear to increase in spring (March – April). While Great Northern Diver does occur in the northern / inner bay (including T10/028B) they do so in smaller numbers than in the outer bay (i.e., south of Ardmore Point / Claggan Point). Good numbers of Great Northern Diver occur in Saleen Harbour and Elly Bay, though they do in general appear to favour waters further offshore, including just outside the licence blocks T10/028A and T10/028B. The area characterised by *Serpula vermicularis dominated* reef, which would support large numbers of crabs, a favoured food item, seems to be especially favoured (including off Feorinyeeo Bay OD414 to the south). As noted, Great

Northern Diver do not appear to be particularly sensitive to disturbance from small boats (see Gittings *et al*., 2015).

Unlike Great Northern Diver, Red-breasted Merganser favours shallow inshore waters. Key sites used coincide with the oyster cultivation sites. However, given that these beds have been in place since the 19th Century the possibility that the presence and management of oyster beds provides a habitat favoured by Red-breasted Merganser cannot be discounted. As noted recent work in Wexford Harbour has shown that Red-breasted Merganser are sensitive to disturbance by small boats (Gittings and O'Donoghue, 2016b); however, it is not clear whether this sensitivity is a general pattern or is due to some site-specific factor at Wexford (there is e.g., some evidence of hunting wildfowl from small boats; while Red-breasted Merganser is not a quarry species associated disturbance may have resulted in this sensitivity to small boats).

As noted harvesting would take place over no more than 8 days between February and March (spring). This would suggest that the potential for disturbance is quite limited. The fishery is a very small, but sustainable fishery. In the past fishing has been concentrated in the Belmullet Area (i.e., Seafield Bay and to the east in deeper water). This is consistent with the observed distribution of oyster as noted by Tully and Clark (2012). A fishery of this scale and duration is very unlikely to significantly impact Red breasted Merganser; and as noted the oyster beds do in fact appear to be a favoured habitat of Red breasted Merganser in Blacksod Bay. As such, its ongoing management to ensure thee oyster beds are sustainable would be the favoured option. Furthermore, it should be noted that the conservation status of Red-breasted Merganser in Blacksod Bay is Favourable (showing an increase of +23.5 over the 14 year period of 1995/96 – 2009/10).

7.3.2.1. Other SPA / Species

As noted above adjoining SPAs support a range of species whose foraging range could theoretically overlap with the areas of oyster beds. These include e.g., Cormorant, Shag, gulls (Herring, Common and Lesser Black-backed) and terns, such as Arctic and Little.

In the case of Cormorant these are widely distributed throughout the SPA, with large numbers in the inner bay as well as Elly Bay (OD479) and off Claggan (OD494) (Suddaby, 2016). In contrast, while Shag also occur in small numbers through Blacksod Bay, the main site is off Blacksod Point. The key harvesting period is from February to March when breeding Arctic and Little Tern are absent from the site. Nesting gulls, such as Herring, Common and Lesser Black-backed, can feed on a range of terrestrial, intertidal, and subtidal prey items. After breeding they can disperse widely, with for example many Lesser Black-backed migrating as far south as Portugal for the winter.

The scale of the proposed harvesting activities and associated low risk of disturbance, relative to the distance from known breeding sites and the availability of large areas of alternated foraging grounds is such that these species are unlikely to be impacted. Furthermore, as fish eating species, the potential for the oyster beds to enhance habitat structural diversity and in this way provide greater foraging opportunities for fish eating species cannot be discounted.

7.3.2.2. Conclusions

Therefore, for most species there are no potentially significant impacts that are likely to arise from the cultivation and harvesting of oysters in subtidal waters. While the potential for impacts on Red-

breasted Merganser would appear to be low, a potential mitigation measure worth considering is that harvesting does not occur within all three favoured areas on the same days; thus, if birds are displaced suitable alternate habitat does occur within which they can temporally forage. The status of Red-breasted Merganser in Blacksod Bay (as well as other diving species) should also continue to be monitored against annual fishing effort / location.

7.3.3. Intertidal Oyster cultivation (Intertidal & Shallow Subtidal Species)

As noted, there are 2 no. licence applications for intertidal oyster cultivation, T10/343A and T10/347A.

T10/343A is for the **intertidal cultivation** of non-native Pacific oyster (*Magallana gigas*), as well as Native oyster (*Ostrea edulis*), winkles (*Littorina litt*orea) and mussels (*Mytilus edulis*). The area applied for is 1.8ha. It is located on the western side of Sruwaddacon Bay, close to Carnhill.

Licence application T10/347A by Dooriel Fisheries Ltd. is for the **intertidal cultivation** of Pacific oyster (*Magallana gigas*) in Trawmore Bay, Inner Blacksod Bay over an area of 11ha.

7.3.3.1. Light Bellied Brent Goose

Results from the NPWS baseline waterbird survey show that the highest proportions of Light-bellied Brent geese were recorded at the following subsites: Claggan Strand (0D494), Seafield Bay (0D477), Blacksod Point (0D415) and Sruwaddacon Bay (0D475) for the four low tide surveys, respectively (NPWS, 2014). In addition, Doona Strand (0D469) in Tullaghan Bay was also shown to contain high numbers of foraging geese in an area of intertidal sandy and mixed substrate shoreline which had variable levels of algal growth (NPWS, 2014). In fact, during low tide surveys the majority of Light-bellied Brent geese were recorded foraging intertidally (NPWS, 2014). At, Sruwaddacon Bay, Brent Geese were mainly recorded foraging on an area of algal-covered sand and gravel, west of Glengad at the mouth of the subsite (Sruwaddacon Bay). The same foraging pattern has been documented in previous surveys in the area (EACS, 2010; FTC, 2009; EACS/WWC, 2006 cited in NPWS, 2014).

During the roost survey for the baseline waterbird survey in February 2010, the largest aggregations of roosting Brent geese were observed in Doolough Bay & Strand (0D490 – 24 birds) and Blind Harbour (0D495 – 22 birds) (NPWS, 2014).

IWeBS counts for Blacksod and Tullaghan Bay, indicate that high counts (greater than 200 birds) have been recorded in Trawmore Bay (0D493), Doolough Bay & Strand (0D490), Claggan Strand (0D494), Seafield Bay (0D477), Corraun Bay (0D491) and Blacksod Point (0D415). Furthermore, NPWS (2014b) identify that Trawboy–Cregganroe (0D468) and Birranbaun (0D459), both in Tullaghan Bay, are regular Brent goose roosts with Doolough Strand (0D490) noted as an occasional but important roost at certain times.

Light-bellied Brent geese are feeding on intertidal habitats and shallow waters to no more than 0.5m depth. As noted Light-bellied Brent geese will not be affected by subtidal aquaculture sites such as seaweed cultivation or subtidal oyster cultivation; though they are known to float in over trestles on the rising tide and feed on attached green algae.

While they do occur in Trawmore Bay, it is not one of the more favoured areas for use by Light-bellied brent geese, and they are widely distributed around Blacksod Bay. The area of the licence application is 11 ha (T10/347A), located centrally within the bay (with a length along the tidal from likely to be ca.

325m). It is not likely to significantly impact upon Light-bellied brent geese using the SPA given the habitat type upon which it is to be placed. The structures may in fact provide additional foraging opportunities in terms of green algae that grow on the bags and trestles.

As noted geese also occur in Sruwaddocon Bay, but predominantly in an area of algal-covered sand and gravel, west of Glengad at the mouth of the subsite and away from the area within which trestles are proposed. There are currently 2 no. licenced blocks in Sruwaddocon Bay; T10/081A and T10/081B – 3.785ha and 0.43ha, respectively. The new application, T10/343A is for a further 1.805ha (a 42% increase over the area of existing trestles) (total area of 6.22ha). Along ca.110m of its length of 360m T10/343A is located inshore from T10/081B. Based on its location and size; together with the fact that Light-bellied brent geese do not tend to be completely excluded by trestles and in fact can forage on algae growing on the bags and trestles; licence application T10/343A is not expected to negatively impact upon Light-bellied brent geese in Blacksod Bay / Broadhaven SPA.

T10/343A and T10/347A are not therefore anticipated to negatively impact upon Light Bellied Brent Goose populations within the Blacksod Bay / Broadhaven SPA.

7.3.3.2. Bar-tailed Godwit

Gittings and O'Donoghue (2012; 2016a) found Bar-tailed Godwits to be negatively associated with oyster trestles; with observed numbers within the oyster trestle blocks lower than the predicted numbers.

There are very little data available on the tolerance of foraging Bar-tailed Godwit to disturbance in intertidal areas. Smit and Visser (1993) reported mean flight initiation distances of 219m (range 150225m) when approached by people walking over the tidal flats on the Dutch Wadden Sea. In the Delta area this was reduced to a mean distance of 107m (range 88-127m). The behaviour of the people was also significant as bait diggers working at the same spot for longer periods (similar to workers at oyster trestles) were tolerated at shorter distances than a walking person. However, as noted above for Sanderling these studies tended to consider people walking directly at feeding flocks of birds, rather than the consistent pattern of activity within the trestles to which birds may habituate.

Townsend and O'Connor (1993) studied the effects of bait-digging at Lindisfarne, north-east England on various wader and wildfowl species. In years when bait-digging was permitted on all parts of the study bay numbers of Bar-tailed Godwit were substantially lower (76-90%) than in years when no bait digging occurred. It was assumed that the majority of the birds were prevented from feeding here by the presence of bait-diggers. Dias *et al*. (2008) studied the effects of bait-digging and traditional shellfish gathering in waders in the Tagus Estuary, Portugal. They calculated that where the disturbers were present at a density of 0.01 per 10ha of foraging area then Bar-tailed Godwit were disturbed from a mean area of 0.6% (0.2-1.4%) of their available foraging area. They concluded that traditional shell fishing has much more potential to affect waders through disturbance than through the removal of prey. Care must be taken, however, when extrapolating from these studies as bait-digging and traditional shellfish gathering often involves gatherers widely dispersed through the estuary – resulting in a disproportionately high level of disturbance (*per obs* Ballycotton Bay, Co. Cork).

Recent observations from the trestle farm in Dungarvan would suggest that habituation may also play an important role; a flock of over 400 Bar-tailed Godwits feeding along the tideline below the trestles on-site (February 2014; T. Gittings *per obs*) were not flushed by passing tractor traffic; birds

responded briefly to the presence of the tractor before resuming feeding. The above would suggest that foraging Bar-tailed Godwit can habituate to oyster maintenance activities in a specific fashion. As for Sanderling, however, dogs on site result in a significant negative impact as noted it will therefore be a condition of any licence that operators may not bring dogs onto the shore.

The peak count of Bar-tailed Godwit during the low tide counts was 910; while the peak high tide count was 1,386. The latter is of international importance. On occasion Aghleam Bay and Elly Bay have each recorded just over 70 Bar-tailed Godwit; a range of other sites do on occasion host 1-50 birds. As noted above Corraun Bay has also recently supported increased numbers (300 were recorded in November 2011 and 440 in December 2012). Trawmore Bay, however, is unequivocally the most important site for Bar-tailed Godwit in Blacksod Bay with a peak count of 1,300 birds. During the NPWS low-tide survey the site has supported 75%, 49% and 67% of the total numbers present on the 22/10/09, 03/12/09 and 18/02/10, respectively. All counts surpassed the national threshold. Flock maps from the NPWS low tide survey were also examined; these show Bar-tailed Godwit flocks in the southern part of the bay (off Srah) and north of the tidal channel; however, given the limited number of observations these data on spatial data should be interpreted cautiously.

Assuming a peak count of 1,386 birds; and a maximum occupation rate of up to 75% of the total number of foraging birds (see above) we must assume that Trawmore Bay can support routinely support up to and over 1,000 Bar-tailed Godwit (the current threshold for international importance is 1,500 birds; Lewis *et al.*, 2019)

The baseline waterbird survey also observed that Trawmore Bay was an important high tide roosting location with additional roosting birds at Elly Bay, Saleen Harbour and Doolough Bay & Strand (NPWS, 2014b). During the dedicated roost survey, the majority of Bar-tailed Godwits were observed roosting intertidally along the tide line (NPWS, 2014b).

Bar-tailed Godwit do not favour the site proposed in Sruwaddacon Bay.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. 3.4% of available habitat with Tramore Bay. Based upon a peak percentage occurrence (of the SPA population) of 75% within Trawmore Bay (0D393) this would equate to potential displacement of no more than 2.55% of Bar-tailed Godwit within the SPA. Furthermore, the length of the tideline as it passes T10/347A is 3.075km in length; approximately 325m or 10.5% of the tideline will be unavailable to Bar-tailed Godwit as it passes through the application site in Trawmore Bay. Like many waders, Bar-tailed Godwit are notable for following the tideline when foraging.

T10/343A and T10/347A are not therefore anticipated to negatively impact upon Bar-tailed Godwit populations within the Blacksod Bay / Broadhaven SPA.

7.3.3.3. Dunlin

Unlike Bar-tailed Godwit, Dunlin is typically associated with a muddier substrate. Like Bar-tailed Godwit, Dunlin is also negatively associated with oyster trestles (Gittings and O'Donoghue, 2012; 2016a). Trawmore Bay supported peak numbers of Dunlin on two of the NPWS low tide counts (NPWS, 2014b); (66 and 337 birds on 5/11/09 and 3/12/09, respectively).

Other notable sites included Tullaghan Bay (OD489; peak count of 269, February 2010), Trawkirtan (OD474; peak count of 127 in February 2010) and Mullet / Leam Lough (OD050; peak count of 407 in February 2010). As a percentage Trawmore Bay has supported as much as 31.75% and 49.6% of the Dunlin counted during the NPWS low tide surveys in Blacksod Bay / Broadhaven SPA.

The area in Sruwaddacon Bay in which T10/343A is to be located does not support notable numbers of Dunlin. It placement at this site will not negatively impact upon Dunlin within Blacksod Bay / Broadhaven SPA.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with Tramore Bay. Focusing just on the Mullet / Blacksod Bay Complex SAC the area of available sandflat and mudflat not covered at high tide (1140) is 1427.82ha. The area occupied by trestles at Trawmore amounts to 0.8% of such habitat (though based on preference for muddier substrate all this habitat will not be available to Dunlin). Based upon a peak percentage occurrence (of the SPA population) of 49.6% this would equate to potential displacement of no more than 1.7% of Dunlin within the SPA.

Thus, licencing of T10/343A and T10/347A is not predicted to negatively impact upon Dunlin within Blacksod Bay / Broadhaven SPA.

Dunlin (*schinzii*) are not breeding near any of the proposed aquaculture operation and will not be negatively impacted by the proposed licence applications.

7.3.3.4. Curlew

The NPWS baseline waterbird survey results show that Curlew are the most widely distributed SCI species across the Blacksod/Tullaghan Bay/Broadhaven Bay complex, with birds recorded on most areas of exposed intertidal sediment during surveys (a total of 22 subsites). However, while four subsites were identified to hold the greatest proportions of Curlew, the proportions were still relatively low, further supporting the view that the species were widespread across the site and did not readily form large aggregations (NPWS, 2014b) (the four site were Broadhaven Bay (0D438), Trawkirtan (0D474), Sruwaddacon Bay (0D475) and Trawmore Bay (0D493)). This is supported by IWeBS data where Curlew are recorded in a large number of subsites across counts. IWeBS data also identifies Aghleam Bay, Trawmore Bay and Elly Bay as regular roosting sites (NPWS, 2014b).

During the roost survey for the baseline waterbird survey, relatively large roosting flocks were identified in Sruwaddacon Bay and Saleen Harbour, using both the intertidal and supratidal zones. The high tide survey also showed that significant numbers of roosting birds were recorded in Elly Bay, Broadhaven Bay and Aghleam Bay (NPWS, 2014b).

The relationship between Curlew and oyster trestles varied from positive to neutral across sites in a study of the impact of oyster trestles on waterbird distribution (Gittings and O'Donoghue, 2012; 2016a).

The peak percentage occurrence of Curlew within Trawmore Bay was 19.15% of the birds counted on the 5/11/2011 NPWS low tide count. Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or

ca. 3.4% of available habitat with Tramore Bay. Focusing just on the Mullet / Blacksod Bay Complex SAC the area of available sandflat and mudflat not covered at high tide (1140) is 1427.82ha. The area occupied by trestles at Trawmore amounts to 0.8% of such habitat (though based on preference for muddier substrate all this habitat will not be available to Curlew). Based upon a peak percentage occurrence (of the SPA population) of 19.15% this would equate to potential displacement of no more than 0.62% of Dunlin within the within the Trawmore Bay (0D393), and substantially less within the SPA.

In Sruwaddacon Curlew would also be displaced in small number from along the shoreline occupied by the proposed trestles (T10/343A). However, nowhere near the level of displacement would occur on order to raise the overall SPA displacement to over 5% which would indicate a significant negative impact.

T10/343A and T10/347A are not therefore anticipated to negatively impact upon Curlew populations within the Blacksod Bay / Broadhaven SPA.

7.3.3.5. Ringed Plover

Spatial Distribution

Ringed Plover were consistently recorded in six subsites on all four baseline waterbird surveys. These subsites were Blacksod Point (OD415), Aghleam Bay (OD480 &. Feorinyeeo Bay; OD414), Elly Bay (OD479), Broadhaven Bay (OD438), Trawkirtaun Estuary (OD474) and Blind Harbour (n.a.). Based on flock numbers alone, three subsites recorded the greatest proportions of Ringed Plover during the four low tide surveys; namely were Tullaghaunnashammer (0D410), Trawboy-Cregganroe (0D468) and Trawkirtaun (0D474). Trawkirtaun estuary supported the greatest proportion of Ringed Plover on two of the low tide counts and during the high tide count. This subsite was identified as the most important subsite for foraging Ringed Plover during the baseline waterbird survey (NPWS, 2014b). As noted there are no aquaculture sites in Trawkirtaun; or in Tullaghaunnashammer.

IWeBS data for the Blacksod and Tullaghan Bay site shows that the largest flocks of Ringed Plover have been recorded in the subsites of Trawmore Bay (OD493), Birranbaun (0D459) and Elly Bay (OD479). However, Ringed Plover are most consistently recorded in the subsites of Aghleam Bay (OD480), Elly Bay (OD479), Feorinyeeo Bay (OD414), Seafield Bay (OD477) and Leam Lough (off Elly Bay).

Overall, Elly Bay (OD479) has been identified as the most important roosting subsite for Ringed Plover where they roost in mixed flocks in the upper shore (NPWS, 2014b). The main source of potential conflict is again at Trawmore Bay (i.e., application T10/347A) though potential for land based activities to impact on e.g., roosting at other sites is also considered below.

Ringed Plover do not favour the site proposed in Sruwaddacon Bay.

Trawmore Bay is not noted to be one of the main sites for Ringed Plover. The peak count is generally less than 30 birds; however, on 5th November 2009 76 Ringed Plover were counted, representing 9.1% of the SPA population on that day.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with

Tramore Bay. Focusing just on the Mullet / Blacksod Bay Complex SAC the area of available sandflat and mudflat not covered at high tide (1140) is 1427.82ha. The area occupied by trestles at Trawmore amounts to 0.8% of such habitat (though based on preference for muddier substrate all this habitat will not be available to Curlew). Based upon a peak percentage occurrence (of the SPA population) of 19.15% this would equate to potential displacement of no more than 0.62% of Dunlin within the SPA.

T10/343A and T10/347A are not therefore anticipated to negatively impact upon Ringed Plover populations within the Blacksod Bay / Broadhaven SPA.

7.3.3.6. Sanderling

The NPWS baseline waterbird survey shows that foraging Sanderling were recorded consistently at five subsites Blacksod Point (0D415), Aghleam Bay (0D480), Doolough Bay & Strand (0D490), Trawmore Bay (0D493) and Blind Harbour (0D495). Interestingly, the peak count for Sanderling during any given count was not within one of these five regular used subsites, with the exception of Blacksod Point; peak numbers were variously recorded in Trawboy-Cregganroe (OD468; in Tullaghan Bay), Feorinyeeo Bay (OD414), Blind Harbour (0D495) and Blacksod Point (0D415) for four of the counts, respectively (NPWS, 2014b).

During the high tide survey, the main Sanderling roost was recorded in Elly Bay (OD479). Furthermore, during the roost survey, addition roost locations were observed at Doona Strand (OD469) and Blacksod Point (0D415) (NPWS, 2014b).

Further studies quoted by NPWS (2014a) indicates that regular roosts have been recorded at Aghleam Bay and Leam Lough (off Elly Bay). Other roost locations have been noted at Doona Strand (OD469), Kanfinalta Point (OD901), Blind Harbour (n.a.) and at Termoncarragh Lake (OD020) (NPWS, 2014b).

IWeBS data shows that many of the largest flocks recorded have been observed in the Tullaghan Bay subsites, Aghleam Bay (0D480) and at Doolough Bay & Strand (OD490).

The main areas favoured coincide with *Fine sand with Angulus fabula* and *Sand to coarse sediment with crustaceans and Polyophthalmus*; a habitat also favoured by Dunlin, Bar-tailed Godwit and to a lesser degree Ringed Plover.

While sites along the western side of Blacksod Bay have been noted as being important for Sanderling there are no proposals for intertidal aquaculture in these areas.

There are no proposals for aquaculture at Trawboy–Cregganroe (0D468), Doona Strand (OD469), Kanfinalta Point (OD901), Blind Harbour (n.a.) or at Termoncarragh Lake (OD020). The main area of potential impact, as noted above for other species, is therefore at Trawmore Bay (0D493).

Sanderling do not favour the site proposed in Sruwaddacon Bay.

Sanderling does not generally occur though in Trawmore Bay in very large numbers. The peak count only coming to 10 birds on the 18/10/2010. Trawmore Bay represented 5.68% of the Sanderling SPA population on this count; however, as the overall count on this day was low, this may have inflated the percentage value. Sanderlings are notoriously difficult to count, however, and on other days during the NPWS low tide survey, when larger and more representative counts were noted the percentage importance of Trawmore Bay (by count) declined to 2.52%. Like Bar-tailed Godwit, Sanderling are

believed to show a negative response to trestles (Gittings and O'Donoghue, 2016a), though the dataset was small for this species.

Within Trawmore Bay there is approximately 324ha of potentially available intertidal / shallow subtidal habitat (depending upon tidal state). Assuming complete exclusion, the proposed 11ha plot at T10/347A would occupy ca. along a tidal length of ca. 325m; or ca. 3.4% of available habitat with Tramore Bay. Based upon a peak percentage occurrence (of the SPA population) of % this would equate to potential displacement of no more than 0.62% of Sanderling within the SPA.

T10/343A and T10/347A are not therefore anticipated to negatively impact upon Sanderling populations within the Blacksod Bay / Broadhaven SPA.

7.4. Assessment

7.4.1. Wetlands and Waterbirds [A999]

The wetland habitats within Blacksod Bay / Broadhaven SPA and the waterbirds that utilise this resource are an additional SCI (the wetlands and water birds SCI). The conservation objective for this SCI is to maintain its favourable conservation condition, which is defined by there being no significant decrease in the permanent area occupied by subtidal, intertidal, supratidal and lagoon and associated habitats. None of the activities being assessed will cause any change in the extents of subtidal, intertidal, supratidal and lagoon habitats. All structure ae temporary and can be removed from site. Therefore, the activities being assessed are not likely to have any significant impact on this SCI and it has been screened out from any further assessment.

8. Other Plans, Projects & Activities

This section presents an assessment of potential cumulative impacts from intertidal oyster cultivation in combination with other activities.

8.1. Abalone & Sea urchin

In the past, abalone and sea urchin have been commercially grown on the eastern shore of inner Broadhaven Bay at Muings. This facility was a pump ashore land based aquaculture licence which in not currently in operation (BIM, 2016b). Should this site commence operation again it will need to be subject to appropriate assessment. As it is land based the main area of concern is likely be indirect impacts on water quality in the adjoining bay.

8.2. Scallops

While the scallop fishery is mostly outside the SPA, there is the potential for dredging into bays which are within the SPA (e.g., at Doolough and Claggan); even where outside the SPA, however, the potential for impacts on species for which Blacksod Bay / Broadhaven SPA (and indeed other SPAs) has been designated must be considered. Dredging for scallops in subtidal waters is most likely to impact upon subtidal species such as Common Scoter, Great Northern Diver, and Red-breasted Merganser; as well as breeding Sandwich Tern; there is also the potential to impact upon subtidal foraging species from other SPAs, such as Cormorant, Shag, gulls, and terns. The location of dredging is such that there would be no impacts on Broadhaven Bay or Sruwaddacon Bay, though movement of birds between these bays and Blacksod cannot be discounted. However, as the fishery is subtidal there should be no negative impacts on intertidal and shallow subtidal species such as wintering waders and Light-bellied brent geese; other than perhaps disturbance from boats working close to shore.

None of the above species feed directly on scallop, so there would be no loss of food resources. Great Northern Diver feed largely on fish and crab; Red-breasted Merganser and Sandwich Tern on fish and crustaceans and Common Scoter on bivalves (other than scallop). Impacts on these species are therefore going to be due to impacts from dredging on marine communities having a knock on impact on prey availability or through direct disturbance to birds during harvesting.

There appears to be little published literature dealing directly with the risk scallop dredging poses to birds (RSPB, n.a.). There appears to be no evidence of bycatch from scallop dredges. Habitats which support scallop are known to provide refuge for juvenile fish (Løkkeborg, 2005; Craven *et al*. 2012); both Løkkeborg (2005) and Johnsen and Harbitz (2013) report dredge related mortality of sandeel an important prey species for many seabirds. However, sandeel favours sandy substrates whereas slightly coarser habitats favoured by scallop tend to be avoided (Holland *et al.*, 2005) thus reducing the risk of negatively impacting birds such as Sandwich Tern and Shag which prey on them.

As previously noted Red-breasted Merganser favour inshore waters (Suddaby, 2016); available evidence would suggest that they do not occur in large numbers in the deep waters within which the majority of scallop dredging occurs. Scallop dredging will not occur in the subtidal oyster beds; these bays support significant numbers of merganser. Inshore dredging can occur in other bays; and as noted

Red-breasted Merganser have shown a sensitivity to small boat disturbance in Wexford Harbour (Gittings and O'Donoghue, 2016b); though whether this sensitivity is universal or unique to Wexford is not known.

As no data is available from before the fishery, we have no information on whether Red-breasted Merganser would frequent deeper offshore waters in greater numbers in the absence of a scallop fishery; however, the depth of water relative to their preference for shallow, sheltered bays, would suggest that the area dredged for scallop in the central bay is less likely to have been a key habitat for Red-breasted Merganser in the past.

While distributed throughout Blacksod Bay (Suddaby, 2016) Great Northern Diver do occur in large numbers along the western side of Blacksod; in an area coinciding with subtidal reef; a habitat which is not to be fished. There is, however, considerable overlap between the fishery and other areas of the bay which also support Great Northern Diver, though in lower numbers / densities. It is not clear to what degree the scallop dredge would damage fish and or crab stocks that are preyed on by divers.

There is significant overlap with the dredge fishery and the distribution of Common Scoter. It is not clear to what degree the scallop dredge would damage bivalves such as *Angulus* in communities such as fine sand with *Angulus fabula*.

Furthermore, as noted both Common Scoter and Red-breasted Merganser are sensitive to disturbance by boats; the fishery would operate between 1st October and 28th February each year; directly overlapping with the occurrence on site of these wintering birds. As noted, while we understand that 12 vessels were involved in the fishery in the spring of 2015; there is currently no data on landings or distribution and duration of dredging effort. In the absence of detailed information on the fishery and equivalent spatial data it is not possible to determine if scallop fishing has influenced the current numbers and distribution of birds.

The conservation status of Great Northern Diver and Red-breasted Merganser are, however, both Favourable (+36 & +23.5, respectively; over the 14 year period from 1995/96 to 2009/10). In contrast the conservations status of Common Scoter is Intermediate (Unfavourable) (-3); though see discussion above which indicates that the counts undertaken in calm count conditions by Suddaby (2016) recorded significantly higher counts were recorded than by IWeBS or NPWS (Cummins and Crowe, 2010; 2014b).

While there is some uncertainty as to the impact of scallop dredging on birds in Blacksod Bay; it is noted that each vessel is now required to carry VMS. When this data becomes available it should be assessed against the known spatial distribution of species for which Blacksod Bay / Broadhaven SPA has been designated in order to ensure that birds are not being displaced by dredging activity and the current population trends are not impacted negatively. Furthermore, behavioural observations should be undertaken to determine whether species such as Common Scoter and Red-breasted Merganser are being negatively impacted by the scallop fishery; while further calm weather counts of subtidal species should be undertaken to build on the data presented by Suddaby (2016). This data will allow for the potential for negative impacts from scallop fishing on birds to be monitored and the fishery managed accordingly. The potential for dredging to damage bivalves upon which Common Scoter forage should also be considered further.

8.3. Fishing

Shrimp fishing occurs in Blacksod Bay (see SAC AA prepared by the Marine Institute). This fishery is fished by 4 vessels using 200 pots between October and February for ca. 30 days per year. There is also a whelk fishery. Hook and line fishing is also undertaken in Blacksod (vessels ca. 15m; summer and autumn); though there is some confusion as to whether vessels in Blacksod are sheltering from adverse weather or actively fishing.

Pots may cause localised abrasion. There is no evidence of bycatch of birds with these fisheries. By definition these are extraction industries, with e.g., removal of shrimp, whelk, and fish from the food chain.

8.4. Other Activities

8.4.1. Beach recreation

Beaches in Blacksod and Broadhaven are popular for walking. Elly Bay (OD479), Mullaghoe (i.e., Feorinyeoo Bay; OD414) and Tramore Bay (OD493) are three of the most popular beaches in Co. Mayo (NPWS, 2014b). These beaches, tend to be most popular during the summer months when wintering waterbirds are largely absent from the SPA; while Sandwich Tern are present throughout the summer they tend not to be disturbed by beach based activities (per sobs). That said, walking (often with dogs) can be a popular winter activity. NPWS (2014b) noted disturbance from walkers with dogs at Feorinyeoo Bay, Aghleam Bay, Claggan Strand and Blind Harbour. Feorinyeoo Bay in particular received a high disturbance score from walkers (including with dogs).

Elly Beach is backed by an extensive dune system and machair; while this habitat is often used by breeding waders, there is no evidence of recent breeding waders from around Elly (Suddaby et al., 2010). Horse riding was also frequently encountered during the course of the NPWS low tide surveys (in a total of seven subsites).

Disturbance from motorised vehicles was noted by NPWS (2014b) at Blacksod Point, Broadhaven Bay, Saleen Harbour, Aghleam Harbour, Tramore Bay and Blind Harbour.

The Geesala Festival runs from 13th to 20th August each year. This festival includes horse and greyhound racing on Doolough Beech as well as boat racing, angling competitions and an increase to water sports and clay pigeon shooting. However, this occurs outside the season when most of the qualifying interests are on site. There may be some temporary disturbance / displacement to Common Scoter arriving back on site early. Sandwich Tern should not be adversely impacted; in the event that there is localised displacement there is sufficient alternate feeding areas that this should not be significant.

Other sources of disturbance quotes included winkle pickers, aquaculture machinery, other vehicles, and cattle encroaching on the foreshore (NPWS, 2014b).

8.4.2. Water-based recreation

Several angling clubs and tourist businesses exist in the area and are active in both Blacksod and Broadhaven bays. These operate onshore and offshore. Sea angling festivals, which occur in July, may also add to the disturbance factor of water based activity in the area, in conjunction with increased

chartered boat activity from the numerous chartered boat businesses on the Mullet Peninsula during peak tourist season; most of these charters, however, tend to head into open waters off the Mullet and not into Blacksod or Broadhaven. Equally sea-angling generally tends to take place in the outer bays and not to any large extent into inner Blacksod and Broadhaven (see e.g., http://www.sea-anglingireland.org/shore%20-%20mayo%202.htm).

A popular educational adventure centre situated in Elly Bay (http://uisce.ie/activities/) operates from April to September (largely outside the season when subtidal species such as Great Northern Diver, Common Scoter and Red-breasted Merganser are on site) and includes a number of water based sports, including wind surfing, sailing, and canoeing. These sports may, however, be practiced by members of the public throughout the year. A marine training centre operates in Broadhaven Bay, which involves the use of powerboats, jets skies and other water activities year round (http://www.marinetraining.ie/).

8.4.3. Hunting & Shooting

While shooting does occur on site we have no information as to its frequency or scale. Mayo shooting grounds (clay pigeons) is located east of Doolough Strand, approximately 250m from the bay. It is not known if noise from clay pigeon shooting causes any localised disturbance to waterbirds using Doolough Bay.

8.4.4. Hand collection of shellfish & bait digging

Hand collection of shellfish occurs on a number of beaches in the Blacksod area, e.g., Aughleam beach for mussels and cockles and Doolough beach for cockles; (from http://www.mayo.me/where-to-pickcockles-and-mussels-in-mayo). Cummins *et al*., (2002) in a *An Assessment of the Potential for the Sustainable Development of the Edible Periwinkle*, Littorina littorea, *Industry in Ireland* did sample a number of sites in Blacksod; however, we are not aware of any information on whether periwinkle picking is actively undertaken within the SPA. NPWS (2014b) recorded hand picking of molluscs in Elly Bay (OD479) and Doolough Bay & Strand (OD490).

While there is reference to bait digging for e.g., lugworm this appear to largely be along shorelines outside the SPA.

8.4.5. Water Treatment

There is one listed urban waste water treatment centre in the area, located south east of Belmullet and discharging into Trawmore Bay (gis.epa.ie/Envision). This UWWT plant had a failed status in 2014. Plans for a new Belmullet Sewerage Scheme are underway; construction commenced on site in July 2016. There are a significant number of individual houses located throughout the peninsula which all presumably have some form of on-site effluent treatment system.

8.5. Potential impacts

There is an extensive and complex literature on the impacts of disturbance from human activities on waterbirds in intertidal and shallow subtidal habitats. It is difficult to use this literature to make specific predictions about the nature and extent of potential disturbance impacts as the effects of disturbance vary between species and, within species, vary between sites and within sites. However, in general,

with beach walks and/or when access is mainly along the shoreline (i.e., in with little activity in the intertidal or shallow subtidal zone), disturbance impacts, while causing local (a few hundred metres) displacement of birds, does not appear to affect the large-scale distribution of birds across sites (e.g., Colwell and Sundeen, 2000; Lafferty, 2001; Gill *et al.*, 2001a/b; Neumann *et al.*, 2008; Trulio and Sokale, 2008; Yasué, 2006; but see Burton *et al.*, 2002) or survivorship (Durell *et al.*, 2007; but see Stillman *et al.*, 2012). Disturbance in the intertidal zone will generally have greater impacts (Stillman *et al.*, 2012) and, where disturbance rates are high and/or concentrated areas of species food resources are affected, may cause significant impacts to large-scale distribution (Mathers *et al.*, 2002) and/or survivorship (Durell *et al.*, 2008; Goss-Custard *et al.*, 2005; Stillman *et al.*, 2012; West *et al.*, 2008). However, some studies of shellfish gathering in the intertidal zone have concluded that it does not affect waterbird populations (Dias *et al.*, 2008; Navedo and Masero (2007).

Boat activity will generally not affect waterbirds in intertidal and shallow subtidal activity. However, some types of recreational watersports activities can occur in very shallow waters and have been observed to cause disturbance to waterbirds. For example, jet skiers can on occasion travel up tidal channels and across shallowly flooded areas in some sites causing disturbance to important feeding and roosting areas. In some site, kayakers and windsurfers can come close into the shoreline causing disturbance to high tide roosts. These activities will mainly take place around the high tide period but may cause disturbance to feeding waterbirds in intertidal and shallow subtidal habitat on ebb/flood tides. We have insufficient information on the frequency and distribution of these pressures in Blacksod Bay to comment further.

8.5.1. Activities affecting waterbird food resources

8.5.1.1. Bait digging and shellfish collecting

Bait digging and shellfish collecting will remove food resources that would otherwise be available for consumption by waterbirds and may also cause mortality to not-target species (Masero *et al.*, 2006). Therefore, if these activities are extensive and/or affect concentrated food resources they could cause waterbird distribution (by causing displacement from depleted areas) and/or survivorship (by reducing the overall carrying capacity of the system).

In Blacksod Bay / Broadhaven SPA, bait digging appears to be a low intensity activity; this compares to bait digger numbers of 46-544 throughout the year in the Masero *et al.* (2006) study. Therefore, it seems unlikely that bait digging is having measurable impacts in terms of resource depletion or physical habitat disturbance in Blacksod Bay / Broadhaven SPA.

8.5.1.2. Effluent discharge

Organic and nutrient inputs to estuaries increase productivity and may increase food resources for waterbirds. Therefore, adverse impacts to waterbirds might be expected to be caused by declines in organic and nutrient inputs associated with improvements in wastewater treatment There are a number of studies that document the effects of organic and nutrient loading from effluent discharges on the benthic fauna and typically the zones affected by individual discharges are restricted to within a few hundred metres of the outfall (Burton *et al.*, 2002). The available evidence on the effects of nutrient reductions on estuarine waterbird populations is limited but, to date, no significant impacts have been reported (Burton *et al.*, 2002, 2003). One study (Alves *et al.*, 2012) has reported localised

(within 100 m) association between wastewater inputs and bird distribution; in this study the outfalls discharged in the intertidal zone and streams of sewage ran across the intertidal habitat. As noted, a new waste water treatment plant is currently under construction at Belmullet. It is not likely that improvements to water quality associated with the new plant outfall will cause a significant reduction in food supply for any of the Qualifying Interest species.

9. Conclusions

This report supporting Appropriate Assessment of Aquaculture in Blacksod Bay SPA provides the competent authority with supporting information to undertake the Appropriate Assessment, individually and in combination with other plans and projects, and its potential for direct, and indirect and incombination effects on European sites including Blacksod Bay / Broadhaven SPA.

The Report has examined the potential impacts of the proposed project on the integrity of the SPA, alone and in combination with other plans and projects, considering the site's structure, function, and conservation objectives. It is concluded that the proposed licence applications, as outlined in Section 1.4, are not likely to negatively impact on European sites including Blacksod Bay / Broadhaven SPA.

9.1. Recommendations

As noted, this assessment draws heavily on NPWS low tide data from 2010/11. We would recommend that this survey be update in order to inform ongoing management / development of aquaculture in Blacksod Bay / Broadhaven SPA.

As subtidal diving species tend not to be comprehensively covered as part of IWeBS counts, we would also recommend that subtidal diving species, i.e., divers, Red-breasted Merganser, Common Scoter, and Slavonian Grebe be surveyed again to inform ongoing management / development of aquaculture in Blacksod Bay / Broadhaven SPA.

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