



**Report supporting Appropriate Assessment of
Aquaculture in Ballyteigue Burrow SAC
(Site code: 000696)**

Produced by

AQUAFAC International Services Ltd

On behalf of

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1. Preface

Articles 3 to 9 of the European Community (EC) Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (commonly known the Habitats Directive) provide the legislative means to protect habitats and species of Community interest through the conservation of an EU-wide network of protected sites known as Natura 2000 sites. Following the requirements of Article 6(3) of the Habitats Directive, implemented into national law under Regulation 31 of the Habitats Regulations SI 94/1997 and subsequently amended and consolidated in the European Communities (Birds and Natural Habitats) Regulations 2011, if a plan or project is not connected with, or necessary for the management of a protected site and is likely to have a significant effect on the features for which the site is designated either individually or in combination with other plans or projects, an Appropriate Assessment (AA) is required to assess whether a plan or project will have any adverse effect on the integrity of Natura 2000 site(s) in view of the Conservation Objectives set for the features (habitats and/ or species) for which the site(s) is designated.

Natura 2000 sites in Ireland that form part of the Natura 2000 network of protected sites include Special Areas of Conservation (SACs) designated due to their significant ecological importance for species and habitats protected under Annex I and Annex II respectively of the Habitats Directive, and Special Protection Areas (SPAs), designated for the protection of populations and habitats of bird species protected under the EU Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds). The features for which SACs and SPAs are designated are respectively called Qualifying Interests and Special Conservation Interests (also collectively referred to herein as conservation features). The NPWS are the competent authority for the management of Natura 2000 sites in Ireland.

Aquaculture operations existed in coastal areas prior to the designation of areas as SACs and/ or SPAs under the Directives. Ireland is undertaking AA of existing and proposed aquaculture activities in SACs and SPAs. This is an incremental process, as agreed with the EU Commission in 2009, and will eventually cover all aquaculture activities in all Natura 2000 sites. AA of aquaculture operations are carried out against the Conservation Objectives for the conservation features of the Natura 2000 site. The Conservation Objectives are defined by the NPWS.

Aquaculture activities are licenced by the Department of Agriculture, Food and Marine (DAFM). For aquaculture operations, DAFM receives applications to undertake such activity and submits a set of applications and existing licences, at a defined point in time, for AA. If the AA process finds that the possibility of significant adverse effect cannot be discounted or that there is a likelihood of negative consequence for the conservation features for which a site is designated then such activities will need

to be mitigated further if they are allowed to continue. The assessment reports are not always explicit on how this mitigation might be achieved but rather indicate whether mitigation is required or not and what results should be achieved.

2. Executive Summary

2.1 The SAC

The Ballyteigue Burrow Special Area of Conservation (SAC) is located on the south coast of Co. Wexford. The SAC site extends eastwards and northwards from the village of Kilmore Quay in Co. Wexford. The site consists of a long, narrow spit of coarse sand and gravel with a sand dune system, the Ballyteigue Burrow, which forms most of the seaward boundary.

Annex I marine habitats for which the site is designated include Estuaries (1130) and Mudflats and sand flats not covered by seawater at low tide (1140) each of which support soft sedimentary communities and community complexes. The site also contains, and is designated for, a range of Annex I coastal habitats including lagoons, salt meadow and marsh, sand dunes and scrub. Conservation Objectives for the conservation features of the site were identified by NPWS (2014a).

The Conservation Objectives for the Annex I marine habitats is to maintain the Favourable Conservation Condition of the habitats which is defined by attributes and targets relating to:

- 1) the extent of permanent Annex I habitat; and
- 2) the natural condition of constituent community types identified within the Annex I habitat.

2.2 Activities in the SAC

Aquaculture activity within Ballyteigue Burrow SAC focuses on the cultivation of the Pacific oyster *Crassostrea gigas* on trestles in intertidal areas of the bay. Aerial imagery indicates that oyster trestle cultivation activity has been taking place in Ballyteigue Bay since at least 1995. Prior to 2005, four operators were active, but since 2005 only a single operator has been active. Production data received indicates an increase in production from 2008 to 2013, with a slight decrease after 2015. Currently there are two aquaculture sites (namely T03/038A and T03/095A), covering a total combined area of 3.3ha at Ballyteigue Burrow SAC. These are both classified as applications, although there is current oyster cultivation activity at one of the sites (T03/038A).

2.3 *The Appropriate Assessment Process*

The function of this Appropriate Assessment (AA) is to determine if existing and proposed aquaculture activities at Ballyteigue Burrow SAC are consistent with the Conservation Objectives for the site or if such activities will lead to deterioration in the attributes of the conservation features for which the site is designated over time due to the scale, frequency and intensity of the aquaculture activities.

NPWS (2014a) is a guidance document that details the Conservation Objectives defined for Ballyteigue Burrow SAC. Specifically, the document provides guidance on interpretation of the Conservation Objectives which are, in effect, management targets for the habitats, community types and species in the SAC. This 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 sensitive habitats while other habitats can tolerate a range of activities.

For the practical purpose of management of sedimentary habitats, a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance. Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the characterising species of the habitat (which may also indicate change in structure and function). Such disturbance may be temporary or persistent in the sense that change in characterising species may recover to pre-disturbed state or may persist and accumulate over time.

The AA process is divided into two stages.

The first stage of the process is an initial Screening wherein activities that cannot have, because they do not spatially overlap with a given habitat or have a clear pathway for interaction, any impact on the features for which the site is designated and are therefore excluded from further consideration.

The next phase is the Natura Impact Statement (NIS) where interactions (or risk of) are identified and an assessment of the significance of the likely interactions between activities and conservation features is conducted. Mitigation measures (if necessary) are introduced in situations where the risk of significant disturbance is identified. In situations where there is no obvious mitigation to reduce the risk of significant impact, it is advised that caution should be applied in licensing decisions.

Overall, AA is both the process and the assessment undertaken by the competent authority to effectively validate this Screening Report and/or NIS. It is important to note that the screening process is considered conservative in that other activities which may overlap with habitats, but which may have very benign effects are retained for full assessment. In the case of risk assessments, consequence and likelihood of the consequence occurring are scored categorically as separate components of risk. Risk scores are used to indicate the requirement for mitigation.

2.4 Data Supports

Data on the distribution of habitats and species populations are provided by NPWS. Scientific reports on the potential effects of various activities on habitats and species have been compiled by the Marine Institute and provide the evidence base for assessment findings. The data supporting the assessment of activities vary and provides for varying degrees of confidence in the findings.

2.5 Findings

Aquaculture and Habitats:

Within the Annex I habitats, 2 community types have been identified namely Mixed sediment to sand with nematodes and *Tubificoides benedii* community, and Sand with crustaceans and *Nephtys hombergii* community complex.

Based upon the scale of spatial overlap of activities with the above habitats, and the relatively high tolerance levels of the habitats and species therein, the general conclusions relating to the interaction between aquaculture activities with habitats is that consideration can be given to licencing (existing and applications) in the Annex I habitats 1130 and 1140.

The site is at risk from the introduction of non-native (alien) invasive species on and among culture stock. To manage the risk of introduction of alien species into the SAC all movement of stock in and out of the bay should adhere to relevant legislation and follow best practice guidelines (e.g. <http://invasivespeciesireland.com/cops/aquaculture/>).

3. Introduction

This document assesses the potential ecological interactions of aquaculture and fisheries activities within the Ballyteigue Burrow SAC (Site code: 000696) on the Conservation Objectives of the site. The information upon which this assessment is based is a list of license applications for aquaculture activities administered by the Department of Agriculture Food and Marine (DAFM) and forwarded to the Marine Institute. The spatial extent of aquaculture licenses is derived from a database managed by the DAFM¹.

¹ Aquaculture Licence GIS <https://www.agriculture.gov.ie/seafood/engineering/publications/gisdata/> (23.12.19)

4. Conservation Objectives for the Ballyteigue Burrow SAC

The AA of aquaculture in relation to the Conservation Objectives for Ballyteigue Burrow SAC is based on:

- 1) NPWS (2014a²) Conservation Objectives: Ballyteigue Burrow SAC 000696. Version 1.
- 2) NPWS (2014b³) Conservation Objectives supporting document - Marine Habitats Ballyteigue Burrow SAC 000696 Version 1.
- 3) NPWS (2014c⁴) Conservation Objectives supporting document - Coastal Habitats. Ballyteigue Burrow SAC 000696 Version 1.
- 4) Spatial data⁵ for conservation features.

4.1 The SAC Extent

Ballyteigue Burrow SAC is a coastal site extending eastwards and northwards from the village of Kilmore Quay in Co. Wexford. A long, narrow spit of coarse sand and gravel with an impressive sand dune system (Ballyteigue Burrow) forms most of the seaward boundary of this site. Behind the spit lies a shallow, tidal sea inlet and estuary of the Duncormick River (The Cull). The eastern portion of this intertidal system was reclaimed in the 19th century by construction of the Cull Bank and is now polderland, most of which is intensively farmed grassland and arable land. The western portion of The Cull retains semi-natural habitat, including mudflats which are exposed at low tide and saltmarsh. Most of the site is designated a Nature Reserve. The extent of the SAC is shown in **Figure 4.1** below.

4.2 Qualifying Interests

The SAC is designated for the following habitats Annex I of the Habitats Directive:

- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Coastal lagoons [1150] (*priority habitat under the Habitats Directive)
- Annual vegetation of drift lines [1210]

² https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000696.pdf

³

[https://www.npws.ie/sites/default/files/publications/pdf/Ballyteigue%20Burrow%20SAC%20\(000696\)%20Conservation%20objectives%20supporting%20document%20-%20marine%20habitats%20\[Version%201\].pdf](https://www.npws.ie/sites/default/files/publications/pdf/Ballyteigue%20Burrow%20SAC%20(000696)%20Conservation%20objectives%20supporting%20document%20-%20marine%20habitats%20[Version%201].pdf)

⁴

[https://www.npws.ie/sites/default/files/publications/pdf/Ballyteigue%20Burrow%20SAC%20\(000696\)%20Conservation%20objectives%20supporting%20document%20-%20coastal%20habitats%20\[Version%201\].pdf](https://www.npws.ie/sites/default/files/publications/pdf/Ballyteigue%20Burrow%20SAC%20(000696)%20Conservation%20objectives%20supporting%20document%20-%20coastal%20habitats%20[Version%201].pdf)

⁵ <https://www.npws.ie/maps-and-data/habitat-and-species-data>

- Perennial vegetation of stony banks [1220]
- *Salicornia* and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glaucopuccinellietalia maritimae*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) [1420]
- Embryonic shifting dunes [2110]
- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]
- Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] (*priority habitat under the Habitats Directive)
- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) [2150] (*priority habitat under the Habitats Directive)

The spatial extent of the Qualifying Interest Annex I marine habitats Estuaries (1130) and Mudflats and sandflats not covered by seawater at low tide (1140) is illustrated in **Figure 4.2** and **Figure 4.3** respectively.

Constituent communities and community complexes recorded within the Annex I habitats 1130 and 1140 are listed in NPWS (2014b) and illustrated in **Figure 4.4** and presented in **Table 4.1** below.

Table 4.1: The constituent community types recorded in Ballyteigue Burrow SAC and their occurrence in the Annex I habitats

Community Type	SAC Annex I Habitats	
	Estuaries (1130)	Mudflats and sandflats not covered at low tide (1140)
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community	✓	✓
Sand with crustaceans and <i>Nephtys hombergii</i> community complex	✓	



Figure 4.1: The extent of the Ballyteigue Burrow SAC.

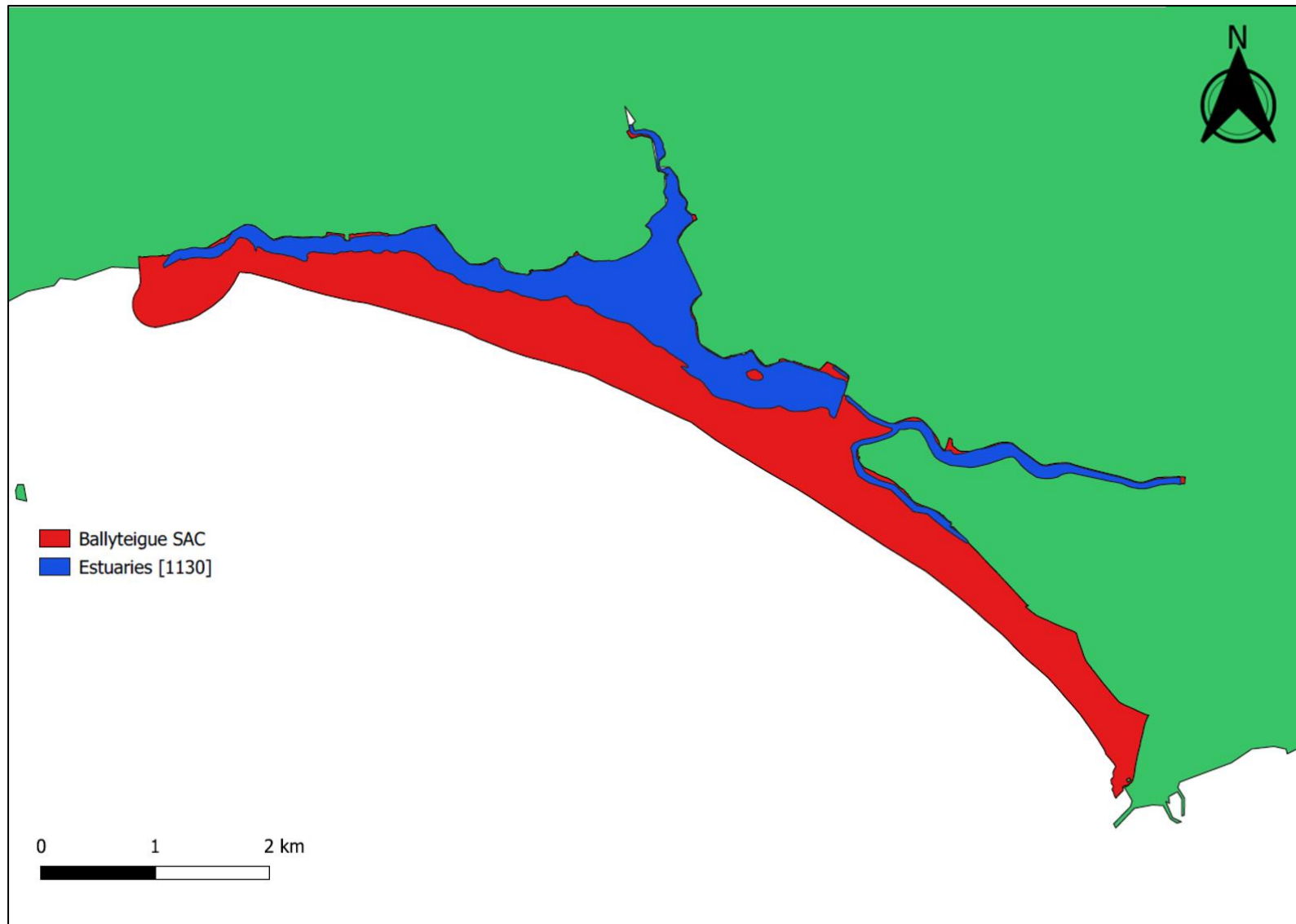


Figure 4.2: The extent of the marine Annex I Qualifying Interest of 1130 within Ballyteigue Burrow SAC.

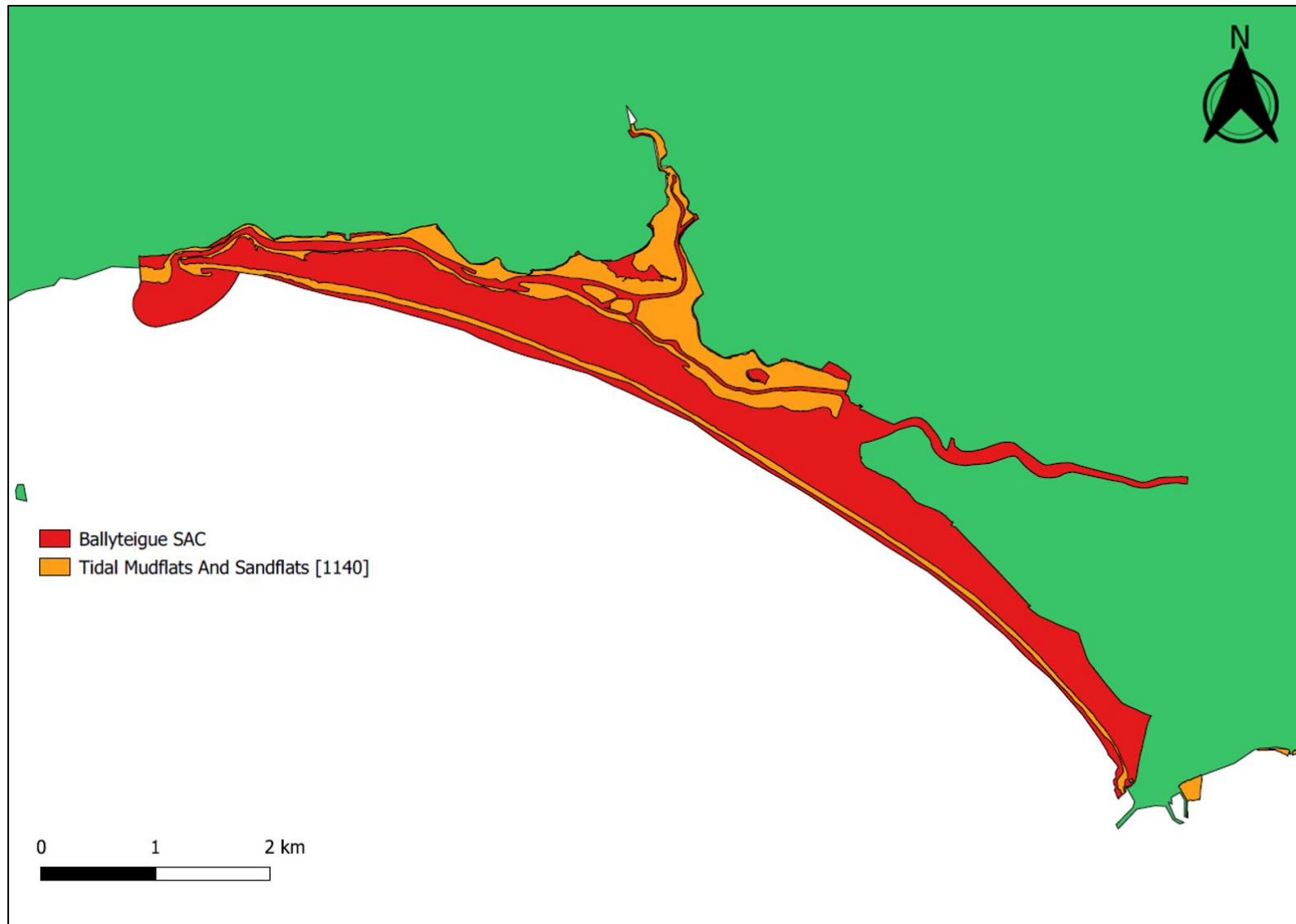


Figure 4.3: The extent of the marine Annex I Qualifying Interest 1140 within Ballyteigue Burrow SAC.

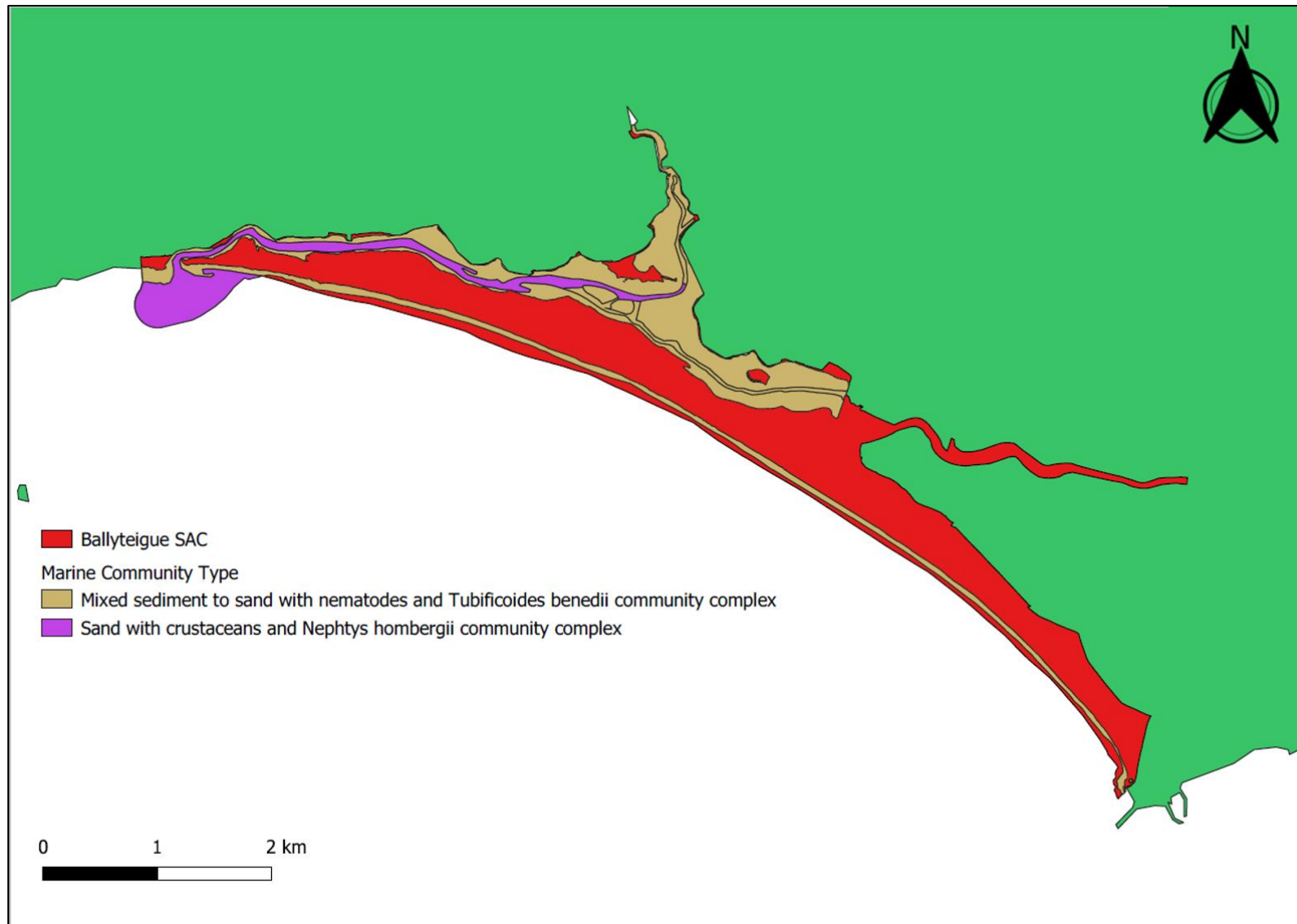


Figure 4.4: Benthic communities types recorded within the marine Annex I Qualifying Interest of 1130 and 1140 within the Ballyteigue Burrow Bay SAC.

4.3 Conservation Objectives for Ballyteigue Burrow SAC

The Conservation Objectives for the Qualifying Interests identified for the site state that the natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution (see 2014a). The Conservation Objectives, attribute and targets of the Qualifying Interests of the SAC are listed in **Table 4.2** below.

Table 4.2: The constituent community types recorded in Ballyteigue Burrow SAC and their occurrence in the Annex I habitats (NPWS 2014b).

Feature Community Type	Objective	Targets
Estuaries (1130)	Maintain Favorable Conservation Condition	237ha: The permanent habitat area is stable or increasing, subject to natural processes. 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
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex; Sand with crustaceans and <i>Nephtys hombergii</i> community complex)	Maintain Favorable Conservation Condition	164ha: Conserve community type in a natural condition
Sand with crustaceans and <i>Nephtys hombergii</i> community complex)	Maintain Favorable Conservation Condition	30ha: Conserve community type in a natural condition
Mudflats and sandflats not covered by seawater at low tide (1140)	Maintain Favorable Conservation Condition	201ha: The permanent habitat area is stable or increasing, subject to natural processes. 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
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex.	Maintain Favorable Conservation Condition	201ha: Conserve community type in a natural condition
Coastal lagoons (1150)	Maintain Favorable Conservation Condition	12.5ha: Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species

Feature Community Type	Objective	Targets
Annual vegetation of drift lines (1210)	Maintain Favorable Conservation Condition	0.66ha: 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
Perennial vegetation of stony banks (1220)	Maintain Favorable Conservation Condition	0.506ha; 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
Salicornia and other annuals colonising mud and sand (1310)	Maintain Favorable Conservation Condition	3.13ha: 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
Spartina swards (<i>Spartinion maritimae</i>) (1320)	Maintain Favorable Conservation Condition	1320 was originally listed as a qualifying Annex I habitat. However, all stands of cordgrass in Ireland are now regarded as common cordgrass (<i>Spartina anglica</i>), an alien invasive species. Thus, no Conservation Objective has been prepared for this habitat. It is therefore not necessary to assess the likely effects of plans or projects against this habitat.

4.4 Screening of Adjacent SAC or for Ex-Situ Effects

There are six SAC sites proximate the Ballyteigue Burrow SAC (**Figure 4.5**). The characteristic features of these sites are identified in **Table 4.3** where a preliminary screening is carried out on the likely interaction with aquaculture activities within Ballyteigue Burrow SAC. As it was deemed that there are no ex-situ effects and no effects on features in adjacent SACs all Qualifying Interests of the adjacent SACs sites were screened out.

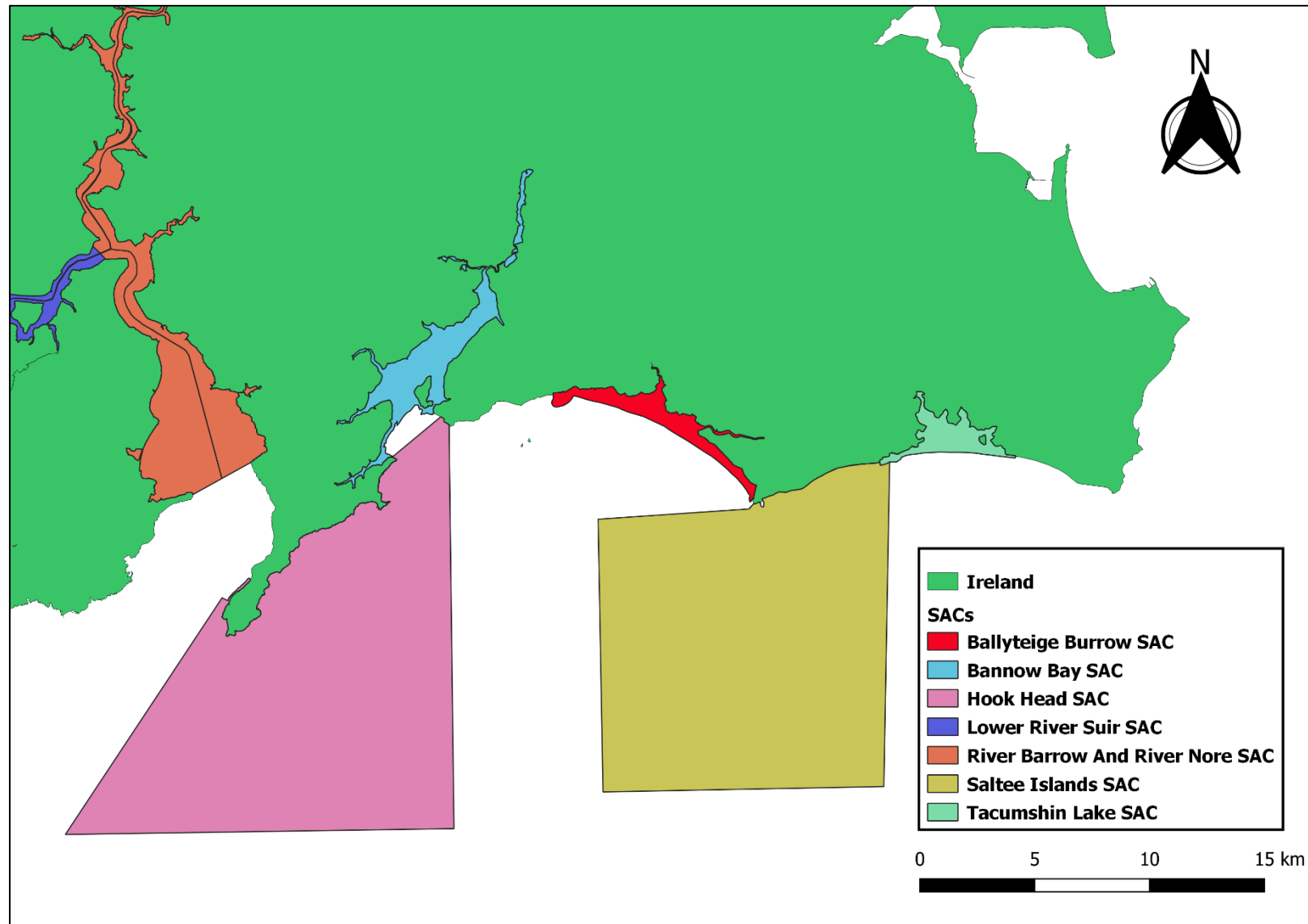


Figure 4.5: SAC adjacent to Ballyteigue Burrow Bay SAC.

Table 4.3: SAC sites adjacent to the Ballyteigue Burrow SAC and qualifying features with initial screening assessment on likely interactions with aquaculture activities.

Site (Site Code)	Qualifying Features	Aquaculture Initial Screening
Hook Head SAC (000764)	Large shallow inlets and bays [1160]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Reefs [1170]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
Saltee Island SAC (000707)	Mudflats and sandflats not covered by seawater at low tide [1140]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Large shallow inlets and bays [1160]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Reefs [1170]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Submerged or partially submerged sea caves [8330]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	<i>Halichoerus grypus</i> (Grey Seal) [1364]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
River Barrow and River Nore SAC (002162)	Estuaries [1130]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Mudflats and sandflats not covered by seawater at low tide [1140]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Reefs [1170]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.

Site (Site Code)	Qualifying Features	Aquaculture Initial Screening
	<i>Salicornia</i> and other annuals colonising mud and sand [1310]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) [1330]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	European dry heaths [4030]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	*Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis.
	*Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Vertigo moulinsiana</i> (Desmoulin's Whorl Snail) [1016]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Margaritifera margaritifera</i> (Freshwater Pearl Mussel) [1029]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Austropotamobius pallipes</i> (White-clawed Crayfish) [1092]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis

Site (Site Code)	Qualifying Features	Aquaculture Initial Screening
	<i>Lampetra planeri</i> (Brook Lamprey) [1096]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Lampetra fluviatilis</i> (River Lamprey) [1099]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Alosa fallax fallax</i> (Twaiite Shad) [1103]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Salmo salar</i> (Salmon) [1106]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Lutra lutra</i> (Otter) [1355]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Trichomanes speciosum</i> (Killarney Fern) [1421]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Margaritifera durrovensis</i> (Nore Pearl Mussel) [1990]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
Lower River Suir SAC (002137)	Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) [1330]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Old sessile oak woods with Ilex and Blechnum</i> in the British Isles [91A0]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis

Site (Site Code)	Qualifying Features	Aquaculture Initial Screening
	*Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	* <i>Taxus baccata</i> woods of the British Isles [91J0]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Margaritifera margaritifera</i> (Freshwater Pearl Mussel) [1029]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Austropotamobius pallipes</i> (White-clawed Crayfish) [1092]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Petromyzon marinus</i> (Sea Lamprey) [1095]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Lampetra fluviatilis</i> (River Lamprey) [1099]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Alosa fallax fallax</i> (Twaiite Shad) [1103]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Salmo salar</i> (Salmon) [1106]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	<i>Lutra lutra</i> (Otter) [1355]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
Bannow Bay SAC (000697)	Estuaries [1130]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Mudflats and sandflats not covered by seawater at low tide [1140]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Annual vegetation of drift lines [1210]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Perennial vegetation of stony banks [1220]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis

Site (Site Code)	Qualifying Features	Aquaculture Initial Screening
	<i>Salicornia</i> and other annuals colonising mud and sand [1310]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Atlantic salt meadows (<i>Glaucopuccinellietalia maritima</i>) [1330]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornetea fruticosi</i>) [1420]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Embryonic shifting dunes [2110]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2120]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	*Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
Tacumshin Lake SAC (000709)	*Coastal lagoons [1150]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Annual vegetation of drift lines [1210]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Perennial vegetation of stony banks [1220]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Embryonic shifting dunes [2110]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
	Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2120]	No spatial overlap or likely interactions with aquaculture activities in Ballyteigue Burrow Bay SAC – excluded from further analysis
* Indicate priority habitat under the Habitat Directive		

5. Details of the Proposed Plans and Projects

Overview

This assessment focuses on aquaculture activities which occur within the Qualifying Interest of Estuaries (1130) and Mudflats and sandflats not covered by seawater at low tide (1140) for which the Ballyteigue Burrow SAC is designated.

Aquaculture activities within the SAC focus on the cultivation of the Pacific oyster *C. gigas*. Descriptions of the spatial extent of aquaculture activities overlapping the Qualifying Interests were calculated in a GIS. The spatial extent of the cultivation sites overlapping the Qualifying Interest of 1140 and 1130 are presented in **Table 5.1** and presented graphically in **Figure 5.1** while the spatial extent of routes used by for vehicle access to the sites is presented in **Table 5.2** and **Figure 5.1**.

5.1 Description of Aquaculture Activities

There are two aquaculture sites (T03/038A [1.7ha], T03/095A [1.6ha]), covering a total area of 3.3 ha, at Ballyteigue Burrow SAC. These are both classified as applications, although there is current oyster cultivation activity at one of the sites (T03/038A). The applicants for the two sites are different indicating that aquaculture activity within the sites will be carried out by different operators.

The two aquaculture sites are located in the middle of Ballyteigue Bay on the northern side of the main tidal channel (**Figure 5.1**). The existing oyster cultivation activity in T03/038A is oyster trestle cultivation. It is our understanding that oyster trestle cultivation is the only activity proposed for both sites. No specific details have been received about the existing or proposed aquaculture activities at Ballyteigue Burrow. The following text is a general description of oyster trestle cultivation, adapted from Gittings and O'Donoghue (2012).

Oyster trestles vary in height but are typically do not exceed 0.5 m height and their height above the sediment is often less as they sink into the sediment. The trestles are usually arranged in single or paired rows with a separation of around 4 m between rows and with wider (10-20 m) access lanes. Where the trestles occur on open sandflats the rows are usually orientated more or less perpendicularly to the tideline.

Oyster spat is supplied by hatcheries and is placed in mesh bags. Generally, only a proportion of the trestles hold oyster bags at any one time. The bags are placed on top of the trestles, where they are on-grown until they are ready for harvesting. The function of the trestles is to keep the animals off the

seabed, preventing grit getting inside the oysters, providing increased water flow and allowing suitable shell growth. The mesh bags facilitate stock handling and prevent predation.

Oyster husbandry activities mainly take place during spring low tides. Workers usually access the trestles by driving tractors across the beach and will often drive through shallow water on the receding tide to make the most use of the time available. Husbandry activities involve turning the mesh bags every spring tide to rid the bags of any settled silt, stop the growth of oyster shell into the mesh and destroy fouling organisms.

At Ballyteigue Bay, the small size of the aquaculture sites means that husbandry activity is only likely to take place on a proportion of low tides, rather than on every low tide.

Cultivation sites overlap with approximately 1.41% of the Qualifying Interest 1130 Estuaries and 1.66% of 1140 Mudflats and sandflats not covered by seawater at low tide (**Table 5.2**).

5.1.1 Current Oyster Cultivation

There is very little information on the history of aquaculture activity in Ballyteigue Bay. Aerial imagery indicates that oyster trestle cultivation activity has been taking place in Ballyteigue Bay since at least 1995. We understand that, prior to 2005, four operators were active, but since 2005 only a single operator has been active (BIM). Production data received indicates an increase in production from 2008 to 2013, with a slight decrease after 2015.

5.1.2 Access Routes

There is one access route in Ballyteigue Bay (**Figure 5.1**) used by tractors and trailers to access main production areas of the Bay. Access route spatial coverage is calculated by multiplying the linear measurement of the route by 10m, which give a conservative estimate of the area covered. Access routes overlap 0.17% of the Qualifying Interest 1130 and 0.20% of 1140 (see **Table 5.2**).

Table 5.1: Spatial extent of aquaculture activities overlapping with the Qualifying Interest 1130 and 1140 in Ballyteigue Burrow SAC (Site Code 000696). Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2014b.

Estuaries (1130)		Mudflats and sandflats not covered by seawater at low tide (1140)	
Area Overlap (ha)	% Overlap	Area Overlap (ha)	% Overlap
3.3ha	1.41%	3.3ha	1.66%

Table 5.2: Spatial extent of aquaculture access routes overlapping with the Qualifying Interest 1130 and 1140 in Ballyteigue Burrow SAC (Site Code 000696). Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS 2014b.

Estuaries (1130)		Mudflats and sandflats not covered by seawater at low tide (1140)	
Area Overlap (ha)	% Overlap	Area Overlap (ha)	% Overlap
0.41ha	0.17%	0.41ha	0.20%

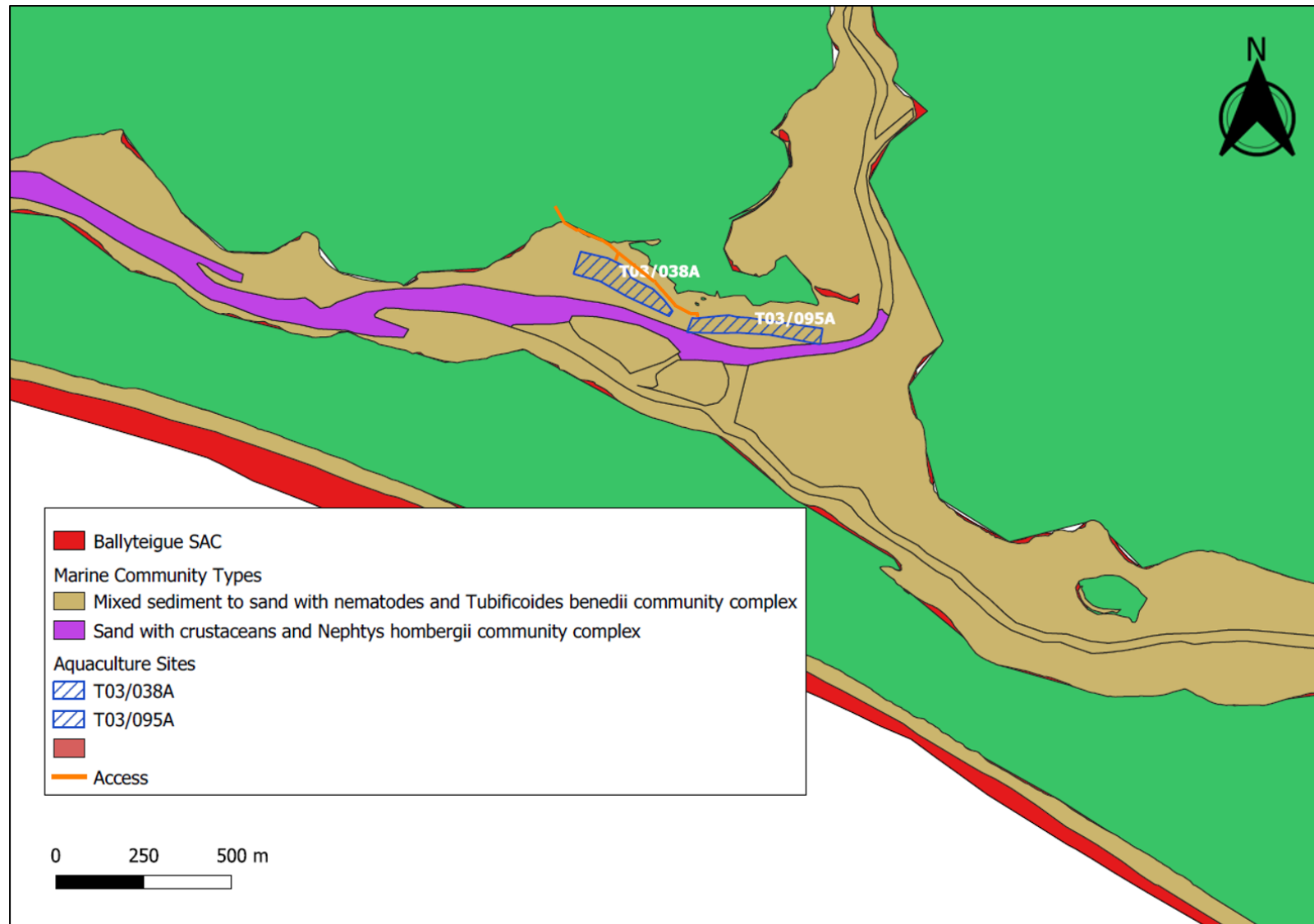


Figure 5.1: Aquaculture sites and access routes within Ballyteigue Burrow SAC

6. Natura Impact Statement for the Activities

Overview

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

Within the Qualifying Interests 1130 and 1140 of the Ballyteigue Burrow SAC the species cultured is the Pacific oyster *C. gigas* in bags and trestles in the intertidal area. Cultivation of oysters on intertidal trestle can alter the surrounding environment, both physically and biologically, not only due to the presence of the culture organisms (*e.g.* increased deposition, disease, shading, fouling, alien species) but also due to the activities associated with the culture mechanisms (*e.g.* structures resulting in current alteration, sediment compaction).

Details of the potential biological and physical effects of aquaculture activities, their sources and the mechanism by which the impact may occur are summarised in **Table 6.1** below. The predominant environmental effects of intertidal trestle cultivation are briefly discussed in **Section 6.1** to **Section 6.3**. The impact identified in the table and discussed below, are derived from published primary literature and review documents that have specifically focused upon the environmental interactions of mariculture (*e.g.* Black 2001; McKindsey *et al.*, 2007; O'Beirn *et al.*, 2012; Cranford *et al.*, 2012; ABPMer, 2013a - h).

A detailed screening assessment of potential effects identified in **Section 6.1** to **Section 6.3** is presented in **Section 7**. Where significant effects of an impact mechanism on a receptor cannot be discounted (screened out) at the screening stage, the impact mechanism and receptor combination is brought forward in the assessment (see **Section 8**).

6.1 Physico-chemical Effects

Filter feeding organisms, for the most part, feed at the lowest trophic level, usually relying primarily on the 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. Faeces and pseudofaeces can accumulate on the seafloor beneath aquaculture installations and can alter the local sedimentary habitat type in terms of organic content and particle size which has, in certain circumstances, been shown to alter the resident faunal communities.

Moderate enrichment due to deposition can lead to increased diversity due to increased food availability; however further enrichment can lead to a change in sediment biogeochemistry (e.g. oxygen levels decrease and sulphide levels increase) which can result in a reduction in species richness and abundance resulting in a community dominated by specialist species. In extreme cases of protracted organic enrichment anoxic conditions may occur where no fauna survives, and the sediment may become blanketed by bacterial mats. Changes to the sedimentary habitat due to deposition are indicated by a decrease in oxygen levels, increased sulphide reduction, decrease in REDOX depth (*i.e.* the depth of the boundary between oxic and anoxic sediments) and particle size changes.

Oysters are typically cultured in the intertidal zone in plastic mesh bags on 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 effect to habitats 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. The accumulation of material beneath oyster trestles is dictated by a number of factors, including:

- Hydrography – low current speeds (or small tidal range) may result in material being deposited directly beneath the trestles. If tidal height is high and large volumes of water moved through the culture area an acceleration of water flow can occur beneath the trestles and bags, resulting in a scouring effect or erosion and no accumulation of material.
- Turbidity of water – oysters have very plastic response to increasing suspended matter in the water column with a consequent increase in faecal or pseudo-faecal production. Oysters can be cultured in estuarine areas (given their polyhaline tolerance) and as a consequence can be exposed to elevated levels of suspended matter. If currents in the vicinity are generally low,

elevated suspended matter can result in increased build-up of material beneath culture structures.

- Density of culture – the density of oysters in a bag and 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 effect can be realised with resultant accumulations. Close proximity may also result in impact on shellfish performance due to competitive interactions.
- 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.

Physical disturbance caused by compaction of sediment from foot traffic and vehicular traffic. Activities associated with the culture of intertidal shellfish include the travel to and from the culture sites and within the culture sites using tractors and trailers as well as the activities of workers within the site boundaries.

6.2 Shading Effects

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

6.3 Non-native Species

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

Oyster culture poses a risk in terms of the introduction of the non-native species Pacific oyster (*C. gigas*). Wild recruitment of *C. gigas* has been documented in a number of bays on the west and north coasts of Ireland and the species appear to have become naturalised in these areas (*i.e.* establishment of a breeding population) (Kochmann et al., 2012; 2013). Naturalised population may compete with the native species for space and food. The culture of large volumes of Pacific oysters may increase the risk of successful reproduction and the establishment of 'wild' breeding populations.

Aquaculture presents a risk for the introduction of alien species as ‘hitchhikers’ on and among culture stock. There is potential that alien species may spread or proliferate to a degree that can result in environmental damage.

6.4 *Disease Risk*

As a generalisation, marine farmed organisms are affected by a range of disease, much as other domesticated agriculture stock. Due to the nature of the (high density) of shellfish culture methods there is potential for risk of transmission of disease within the cultured stock, and between the stock and wild populations.

Table 6.1: Potential indicative environmental pressures of aquaculture activities within the Qualifying Interest 1130 and 1140 of the Ballyteigue Burrow SAC.

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

7. Screening of Aquaculture Activities

Overview

A screening assessment is an initial evaluation of the possible impacts that activities may have on the Qualifying Interests. The screening is a filter, which may lead to exclusion of combinations of activities (or impact mechanisms) and Qualifying Interests from AA proper, thereby simplifying the assessments, if this can be justified unambiguously using limited and clear-cut criteria. Screening is a conservative filter that minimises the risk of false negatives.

7.1 Physico-chemical Effects

The screening of potential physico-chemical impacts of the proposed activities is based primarily on spatial overlap. Where Qualifying Interests overlap spatially with the proposed activities then significant effects due to these activities on the Conservation Objectives for the Qualifying Interests is not discounted (not screened out) except where there is absolute and clear rationale for doing so.

Where there is relevant spatial overlap full assessment is warranted. Likewise, if there is no spatial overlap and no obvious interaction is likely to occur, then the possibility of significant effect is discounted, and further assessment of possible effects is deemed not to be necessary. Where the overlap between an aquaculture activity (*i.e.* the cultivation site and the access route) and a Qualifying Interest is zero and there is no likely interaction identified; the Qualifying Interest and aquaculture activity combination is screened out and not considered further. Therefore, on this basis, the following habitats are excluded from further consideration in this assessment:

- Coastal lagoons [1150]
- Annual vegetation of drift lines [1210]
- Perennial vegetation of stony banks [1220]
- *Salicornia* and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) [1420]
- Embryonic shifting dunes [2110]
- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]
- Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]
- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) [2150]

In contrast, spatial overlap of activities with the following Annex I habitats exist:

- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]

Table 5.1 and **Table 5.2** respectively highlight the spatial overlap between aquaculture activity (*i.e.* the cultivation site and the access route) with the Qualifying Interest of 1130 and 1140.

Respectively **Table 7.1** and **Table 7.2** provide spatial overlap of aquaculture cultivation site and the access route, with the community types identified within 1130 and 1140. An assessment (see **Section 8**) was carried out on the likely interactions of aquaculture activities with the community types.

Conclusion: potential significant effects exist (see **Section 8.1** for assessment of significance of effects).

7.2 Shading Effects

Shading is considered not to be an issue as the species characterising the benthic habitats under the cultivation structures are not shade sensitive species.

Conclusion: potential significant effects are unlikely to occur - effect screened out.

7.3 Non-native Species

7.1.1 Naturalisation of *Crassostrea gigas*

As outlined above oyster culture presents a risk in terms of the establishment of breeding populations of Pacific oyster. Factors contributing to the successful establishment of oysters in Irish bays include the high-density cultivation of the species, long residence times of embayment waters and large intertidal areas.

Oyster production levels at the Ballyteigue site and the hydrography of the bay does not fulfil these criteria, therefore the risk of successful establishment of 'wild' populations of Pacific oyster in Ballyteigue Burrow SAC is considered low.

It should be noted that no one has witnessed or are aware of any successful settlement and recruitment of pacific oysters in the Bay.

Conclusion: potential significant effects are unlikely to occur - effect screened out.

7.1.2 Introduction of non-native species

The introduction of non-native species as 'hitchhikers' on and among culture stock is also considered a risk, the extent of which is dependent upon the duration of time the stock has spent outside of the Ballyteigue Burrow SAC.

Invasive species can have serious negative consequences on their environment and cause damage to ecosystem functions and services by outcompeting native species. This would be of particular concern for any aquaculture activity within SAC sites, but also any aquaculture with connectivity to a SAC sites e.g. hydrological connectivity.

Conclusion: potential significant effects (see **Section 8.2** for assessment of significance of effects).

Section 8.2 also describes the potential significance of effects and outlines the existing measures that are implemented to manage the risk of introduction of non-native species

7.4 Disease Risk

As outlined above, Kochmann *et al.* (2012; 2013) reported naturalised populations on the west and north coast of Ireland. Given that the Ballyteigue site is located on the south coast away from established populations of 'wild' *C. gigas* population, disease transmission risk is considered negligible.

Conclusion: potential significant effects are unlikely to occur - effects screened out.

Table 7.1: Spatial overlap of aquaculture sites with constituent community types within the Qualifying Interest 1130 and 1140 in Ballyteigue Burrow SAC. Spatial data based on licence database provided by DAFM. Habitat data provided in NPWS (2014a,b).

Estuaries (1130)				Mudflats and sandflats not covered by seawater at low tide (1140)	
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex		Sand with crustaceans and <i>Nephtys hombergii</i> community complex		Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex	
Area Overlap (ha)	% Overlap	Area Overlap (ha)	% Overlap	Area Overlap (ha)	% Overlap
3.3	2.04%	0.002	<0.01%	3.3	1.66%

Table 7.2: Spatial overlap of intertidal oyster cultivation site access routes with constituent community types within the Qualifying Interest 1130 and 1140 in Ballyteigue Burrow SAC. Habitat data provided in NPWS (NPWS 2014a,b).

Estuaries (1130)				Mudflats and sandflats not covered by seawater at low tide (1140)	
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex		Sand with crustaceans and <i>Nephtys hombergii</i> community complex		Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex	
Area Overlap (ha)	% Overlap	Area Overlap (ha)	% Overlap	Area Overlap (ha)	% Overlap
0.4	0.25%	No Overlap	No Overlap	0.41	0.20%

8. Assessment of Aquaculture Activities

The objective of this AA is to determine whether ongoing and proposed aquaculture activities in Ballyteigue Burrow SAC are consistent with the Conservation Objectives for the site or if such activities will lead to deterioration in the attributes of the habitats and species over time and in relation to the scale, frequency and intensity of the activities.

8.1 *Physico-chemical Effects*

8.1.3 Overview

NPWS (2014a) provides guidance on interpretation of the Conservation Objectives which are, in effect, management targets for the Qualifying Features in the SAC. This guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with long term maintenance of certain sensitive habitats while other habitats can tolerate a range of activities.

For the practical purpose of management of sedimentary habitats, a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance. Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the characterizing species of the habitat (which may also indicate change in structure and function). Such disturbance may be temporary or persistent in the sense that change in characterizing species may recover to pre-disturbed state or may persist and accumulate over time.

8.1.4 Determining Significance

The significance of the possible effects of the proposed activities on habitats, as outlined in **Section 6** and the subsequent screening exercise in **Section 7**, is determined here in the assessment. The significance of effects is determined on the basis of guidance for constituent habitats (NPWS 2014a) in particular the disturbance thresholds set for community types.

A schematic outlining the determination of significant effects on habitats and marine community types is presented in **Figure 8.1**.

Within the Ballyteigue Burrow SAC the Qualifying Interest habitats considered subject to potential disturbance and therefore, considered here are:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1130 Estuaries

Constituent community types within the above listed Qualifying Interests are:

- Mixed sediment to sand with nematodes and *Tubificoides benedii* community complex
- Sand with crustaceans and *Nephtys hombergii* community complex

For the Qualifying Interests and their constituent community types, potential effects are identified in relation to, first and foremost, the spatial overlap (see **Section 5** and **Section 7** respectively).

Subsequent disturbance and the persistence of disturbance are considered as follows:

- 1. The degree to which the activity will disturb the Qualifying Interest.** Disturbance is meant as a change in the characterising species, as listed in the Conservation Objective guidance (NPWS 2014a) of the constituent 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 (see **Section 8.2** below).
- 2. The persistence of the disturbance in relation to the intolerance of the community.** If the activities are persistent (high frequency, high intensity) and the receiving community has a high intolerance to the activity (*i.e.* the characterising species of the communities are sensitive and consequently impacted) then such communities could be said to be persistently disturbed.
- 3. The area of communities or proportion of populations disturbed.** In the case of community disturbance (continuous or ongoing) of more than 15% of the community area it is deemed to be significant.

For the assessment the threshold detailed in **3** above applies to the constituent community types that are overlapped by the aquaculture activity.

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

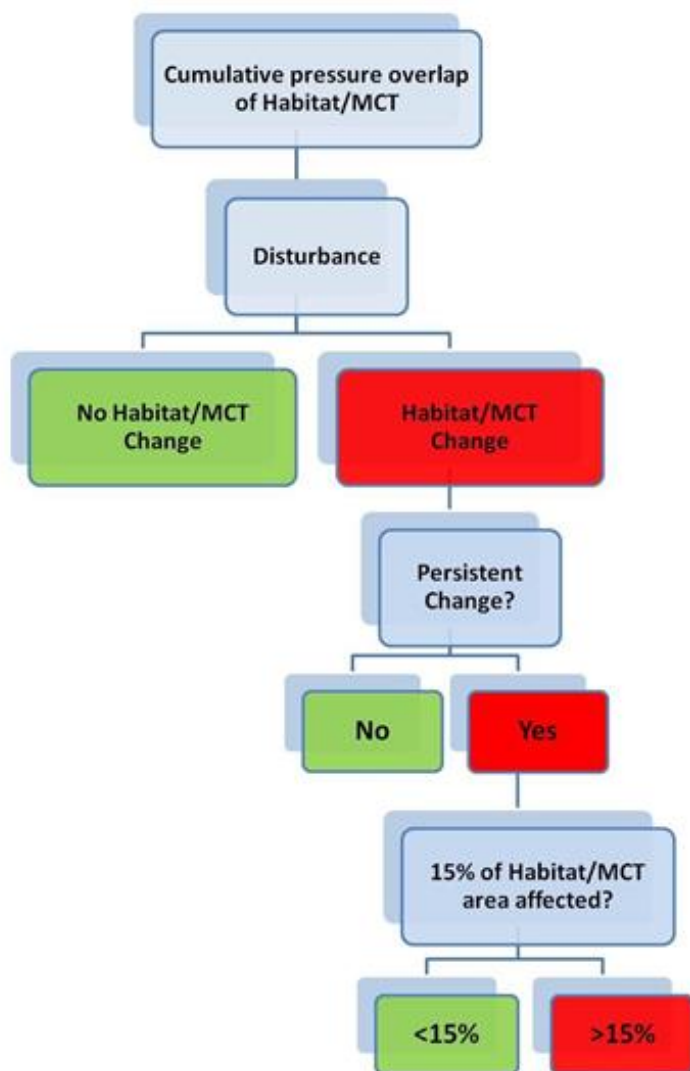


Figure 8.1: Schematic outlining the determination of significant effects on habitats and marine community types (MCT) (following NPWS 2014b).

8.1.5 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 Qualifying Interest 1130 and 1140 habitats of the Ballyteigue Burrow SAC.

One source of information is a series of reviews commissioned by the Marine Institute which identify habitat and species sensitivity to a range of pressures 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) and other primary literature.

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.* maerl and *Zostera*. Directed research investigating the effect of aquaculture on intertidal environment does provide a greater degree of confidence in conclusions; for example, the output of Forde *et al.* (2015) has provided greater confidence in terms of assessing likely interactions between intertidal oyster culture and marine habitats.

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 conservation features (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. They become significantly disturbing if more than 15% of the community is thus exposed (NPWS 2014a).
- In the case of episodic pressures (*i.e.* activities that are seasonal or discrete in time) both the intolerance and recovery components of sensitivity are relevant. If sensitivity is high but recoverability is also high relative to the frequency of application of the pressure, then the species/ habitat/ community will be in Favourable Conservation Status for at least a proportion of time.

The sensitivities of the community types found within the Ballyteigue Burrow SAC to pressures caused by aquaculture (*e.g.* smothering, organic enrichment and physical disturbance) are similar to those of the surrogate communities identified in **Table 8.1**.

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, 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 8.1: Matrix showing the sensitivity scores x pressure categories for habitats (or surrogates) in the Ballyteigue Burrow SAC (ABPMer 2013a-h) (Table 8.2 provides the codes for the various categorisation of sensitivity and confidence.)

Pressure	Physical Damage							Change in Habitats Quality									Biological Pressures					Chemical Pollution		Light		
	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 to the surface)	Changes to sediment composition- increased coarseness	Changes to sediment composition- increased fine sediment proportion	Changes to water flow	Decrease 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/pathogen	Removal of Target Species	Removal of Non-target species	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
Habitat A2.23 Polychaete/ amphipod dominated fine sand	H (*)	M (*)	M (*)	H (*)	M - H (*)	N - L (*)	L - M (*)	N - L (*)	N - L (***)	N - L (***)	L - M (*)	H (*)	H (*)	H (*)	H (*)	H - M (*)	H - M (*)	NE	H (***)	NE	H (*)	H (*)	NA	H (*)	M (*)	H (*)
Habitat A5.23 Polychaete/ bivalve dominated muddy sand shores	H (*)	M (*)	M (***)	NE	NE	N - L (*)	L - M (*)	N - L (*)	N - L (*)	N - L (*)	L - M (*)	H (*)	H (*)	H (*)	H (*)	H - M (***)	H - M (***)	NE	H (***)	NE	H (*)	H (*)	NA	H (*)	M (***)	H (*)
Habitat A5.42 Estuarine Atlantic sublittoral mixed sediment	H (*)	M (*)	M (*)	NE	NE	N - L (*)	L - M (*)	L - M (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	M (*)	M (*)	NE	H (*)	NE	H (*)	H (*)	NA	H (*)	M (*)	H (*)

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

Pressure interaction codes for Table 8.1	
NA	Not Assessed
Nev	No Evidence
NE	Not Exposed
NS	Not Sensitive
L	Low
M	Medium
H	High
VH	Very High
*	Low Confidence
**	Medium Confidence
***	High Confidence

8.1.6 Assessment of the Effects

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

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

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

As described in the Conservation Objectives document for the site (NPWS 2014a), Favourable Conservation Condition for 1130 and 1140 are defined by targets set for attributes of the Qualifying Interest. The attributes are 1) Habitat Area and 2) Community distribution. Assessment of the potential effects to the Qualifying Interest with respect to the attributes 1) and attribute 2) are presented in **Section 8.1.7** and **Section 8.1.8**.

8.1.7 Habitat Area

For Estuaries 1130 and Mudflats and sandflats not covered by seawater at low tide 1140 the target for Habitat Area is to ensure that the permanent habitat area is stable or increasing, subject to natural processes.

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.

Conclusion: no likely significant adverse effects to Habitat Area.

8.1.8 Community Distribution

Attribute 2 relates to the Distribution of communities identified within the Qualifying Interest 1130 Estuaries and 1140 Mudflats and sandflats not covered by seawater at low tide. The constituent communities in the Qualifying Interest 1130 and 1140 are:

- Mixed sediment to sand with nematodes and *Tubificoides benedii* community complex
- Sand with crustaceans and *Nephtys hombergii* community complex

The target for the attribute is; to Conserve the community types in a natural condition:

The likely interactions between aquaculture activities are outlined in **Table 8.3** and **Table 8.4**. Specifically, **Table 8.3** and **Table 8.4** focus on the spatial overlap of **a)** the cultivation sites and **b)** access routes with the constituent community types of 1130 and 1140.

Short summaries of the assessments together with broad conclusions and justifications on whether the activities are considered disturbing are provided below.

a) Cultivation sites

Significant adverse effects are unlikely to occur as the spatial overlap of the oyster cultivation sites with constituent community types of 1130 and 1140 is below the 15% disturbance threshold identified in the site Conservation Objectives (see NPWS 2014a) (see **Table 8.3**).

In addition, published literature (Forde *et al.*, 2015; O'Carroll *et al.*, 2016) indicates that, with the exception of heavy vehicle movement along access routes, intertidal oyster cultivation is non-disturbing to intertidal habitats.

b) Access Routes

Published literature has reported significant impacts to intertidal communities at routes used to access oyster cultivations (De Grave *et al.*, 1998; Forde *et al.*, 2015; O'Carroll *et al.*, 2016). The

impact is attributed to the persistent compaction of the sedimentary habitats by heavy vehicles accessing the sites.

Significant adverse effects are unlikely to occur as the spatial overlap of the access routes is below the 15% disturbance threshold identified for constituent community types in the site Conservation Objectives (see NPWS 2014a) **Table 8.4**).

Conclusion: Significant adverse effects are unlikely to occur as the spatial overlap of the cultivation sites and access routes is below the 15% disturbance threshold.

8.1.9 Conclusion Summary

Based upon the spatial overlap and sensitivity analysis, it is concluded that aquaculture activities at trestle sites and along access routes do not pose a risk of significant disturbance to the conservation of the habitat features of Estuaries (1130) and Mudflats and sandflats not covered by seawater at low tide (1140) or their associated constituent community types.

Table 8.3: Interactions between the relevant aquaculture activities and constituent communities of 1130 and 1140.

Estuaries (1130): 237ha		Mudflats and sandflats not covered by seawater at low tide (1140); 201ha
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex	Sand with crustaceans and <i>Nephtys hombergii</i> community complex	Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex
Disturbing: No Justification: The activity overlaps 3.3ha or 2.04% of this community type.	Disturbing: No Justification: The activity overlaps <0.01ha or <0.01%% of this community type.	Disturbing: No Justification: The activity overlaps 3.3ha or 1.66% of this community type.
Justification:		
<ol style="list-style-type: none"> 1) Overlap below Given that this value is less than 15% threshold, significant adverse impacts of activities on the community type can be discounted 2) Published literature (Forde <i>et al.</i>, 2015, O'Carroll <i>et al.</i>, 2016) indicate that activities occurring at trestle culture sites are not disturbing. 		

Table 8.4: Interactions between access routes used for oyster aquaculture activities and constituent communities of 1130 and 1140.

Estuaries (1130): 237ha		Mudflats and sandflats not covered by seawater at low tide (1140); 201ha
Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex	Sand with crustaceans and <i>Nephtys hombergii</i> community complex	Mixed sediment to sand with nematodes and <i>Tubificoides benedii</i> community complex
Disturbing: No Justification: The activity overlaps 0.41ha or 0.25% of this community type.	No overlap	Disturbing: No Justification: The activity overlaps 0.41ha or 0.20%% of this community type.
Justification:		
<ol style="list-style-type: none"> 1) Overlap below Given that this value is less than 15% threshold, significant adverse impacts of activities on the community type can be discounted 2) Published literature (Forde <i>et al.</i>, 2015, O'Carroll <i>et al.</i>, 2016) indicate that activities occurring at trestle culture sites are not disturbing. 		

8.2 Non-native Species

8.2.1 Overview

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

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

8.2.2 Determination of Significance

As outlined in **Table 8.1** intertidal and subtidal sand and mixed habitats⁶ are sensitive to the introduction of non-native species. Aquaculture has been identified as a vector for the introduction and/ or spread of a number of non-native species in Irish waters that have the potential to impact Qualifying Interest habitats and species of designated SACs.

Non-native species accidentally introduced/ spread to bays include the slipper-limpet *Crepidula fornicata*⁷ and the leathery (or club) sea squirt *Styela clava*⁸ and the carpet squirt *Didemnum vexillum*⁹. While these non-native species have not been recorded at the Ballyteigue Burrow SAC, their potential introduction presents a risk of the Qualifying Interest 1130 and 1140 for which the SAC is designated. Specifically, there is potential that the invasive species may alter community structure thus impacting the attributes defined for habitats in the Conservation Objective. *C. fornicata* can effect change in community structure by out-competing resident benthic species for food and space (JNCC 2002). Slipper limpet can also act to alter sediment characteristics through the removal of huge volumes of suspended organic material from the water column, and depositing filtered material on the bottom as pseudofaeces (Thieltges *et al.*, 2003).

⁶ Habitat A5.42 proxy for *Mixed sediment to sand with nematodes and Tubificoides benedii* community complex. Habitat A2.23 and Habitat A5.23; proxy habitats for *Sand with crustaceans and Nephtys hombergii* community complex.

⁷ Global Invasive Species Database <http://www.iucngisd.org/gisd/species.php?sc=600>

⁸ Global Invasive Species Database <http://www.iucngisd.org/gisd/species.php?sc=951>

⁹ Global Invasive Species Database <http://www.iucngisd.org/gisd/species.php?sc=951>

Similar to slipper limpet effects on the microbenthic communities, the tunicate species *S. clava* and *D. vexillum* can impact resident benthic communities by out-competing resident flora and fauna. At high densities these species can significantly impact on native and aquaculture species through competition for space and food, as well as predation of larvae from the water column. The species form large colonies significant over rocks and gravels, aquaculture equipment (trestle, bags, ropes, netting *etc.*) and vessel hulls. The tunicate species can smother benthic organisms and change community structure.

8.2.3 Management Measure

To manage potential risk of introduction of alien species into the SAC as a result of aquaculture activities all movement of stock in and out of the bay should adhere to relevant legislation and follow best practice guidelines (*e.g.* <http://invasivespeciesireland.com/cops/aquaculture/>).

Conclusion: with strict adherence to relevant legislation and best practice guidelines, there will be no likely significant adverse effects.

8.2.4 Conclusion Summary

The site is at risk from the introduction of non-native species on and among culture stock. To manage the risk of introduction of alien species to the habitat features of Estuaries (1130) and Mudflats and sandflats not covered by seawater at low tide (1140) and their associated constituent community types, all stock movement in the bay follow should strictly adhere to relevant legislation and follow best practice guidelines.

9. In-Combination Effects of Aquaculture, Fisheries and other Activities

9.1 Fisheries

There are no known applications for a fishery or proposed fishery plans for the Ballyteigue Burrow SAC. On this basis, there are not likely to be any in-combination impacts between fishery and aquaculture activities.

9.2 Pollution Pressures

There are a number of activities which are terrestrial in origin that might result in impacts on the conservation features of the Ballyteigue Burrow SAC. Primary among these are point source discharges from domestic sewage outfalls located adjacent to the SAC. The pressure derived from these point

sources may have very localised impacts upon dissolved nutrients, suspended solids and some elemental components.

9.3 Conclusion Summary

Pressures resulting from aquaculture activities are the localised compaction of sediment along access routes and the potential introduction of non-native species. Pressures resulting from point discharge location would not significantly impact chemical parameters in the water column, any in-combination effects with aquaculture activities are considered to be minimal or negligible.

10. SAC Aquaculture Appropriate Assessment Concluding Statement and Recommendations

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

An initial screening exercise resulted in the following features being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur: Coastal lagoons [1150], Annual vegetation of drift lines [1210], Perennial vegetation of stony banks [1220], *Salicornia* and other annuals colonising mud and sand [1310], Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330], Mediterranean salt meadows (*Juncetalia maritimi*) [1410], Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) [1420], Embryonic shifting dunes [2110], Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120, Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] and Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) [2150].

A full assessment was carried out on the likely interactions between existing and proposed aquaculture operations and the features of the Annex I habitats 1140 (Mudflats and sandflats not covered by seawater at low tide) and 1130 Estuaries. The likely effects of the aquaculture activities (species, structures, access routes) were considered in light of the sensitivity of two constituent community types and species of the Annex I habitats 1140 and 1130. The constituent communities are: Mixed sediment to sand with nematodes and *Tubificoides benedii* community complex, and Sand with crustaceans and *Nephtys hombergii* community complex. Based upon the scale of spatial overlap of current and proposed aquaculture activities and the relatively high tolerance levels of the habitats and

associated species, the general conclusion is that current and proposed activities are considered non-disturbing to the habitat Qualifying Interests and their constituent communities. It is recommended that there be strict adherence to the access routes identified and that density of culture structures within the sites be maintained at current levels.

The site is at risk from the introduction of non-native species on and among culture stock (*e.g.* slipper limpet, leathery sea squirt and carpet sea squirt). To manage the risk of introduction of alien species into the SAC all movement of stock in and out of the bay should adhere to relevant legislation and follow best practice guidelines¹⁰.

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¹⁰ <http://invasivespeciesireland.com/cops/aquaculture/>.

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