Report supporting Appropriate Assessment of Aquaculture in Carlingford Shore SAC

(Site code: 02306)

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1 PREFACE

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

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

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

2 EXECUTIVE SUMMARY

2.1 THE SAC

Carlingford Shore SAC (Site code: 002306) comprises the entire southern shoreline of Carlingford Lough and continues round the tip of the Cooley Peninsula to just west of Cooley Point. The SAC is designated for two coastal habitats only: annual vegetation of drift lines (1210) and perennial vegetation of stony banks (1220). While the site is not designated for any marine habitats, it does contain intertidal sand and mudflats/gravel banks and also patches of saltmarsh, some areas of dry grassland and an area of mixed deciduous woodland. The site is flanked by Carlingford Mountain to the south-west. The underlying rock within the SAC is mainly carboniferous limestone. This outcrops in places in the form of bedrock shore or reefs.

2.2 ACTIVITIES IN THE SAC

Aquaculture activities within and adjacent to the Carlingford Shore SAC focus on the subtidal (bottom culture) of the Blue mussel, *Mytilus edulis* and the intertidal (bags and trestle) cultivation of the Pacific oyster *C. gigas*. The profile of the aquaculture industry in the SAC, used in this assessment, was prepared by BIM and is derived from the list of licence applications received by DAFM and provided to the MI for assessment in March 2018.

2.3 THE APPROPRIATE ASSESSMENT PROCESS

The function of an appropriate assessment is to determine if the ongoing and proposed aquaculture activities are consistent with the Conservation Objectives for the Natura site or if such activities will lead to deterioration in the attributes of the habitats and species over time and in relation to the scale, frequency and intensity of the activities. NPWS (2013a) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in the SAC. This guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with long term maintenance of certain sensitive habitats while other habitats can tolerate a range of activities. For the practical purpose of management of sedimentary habitats, a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance (NPWS 2013b). Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the characterizing species of the habitat (which may also indicate change in structure and function). Such disturbance may be temporary or persistent in the sense that change in characterizing species may recover to pre-disturbed state or may persist and accumulate over time.

The appropriate assessment process is divided into a number of stages consisting of a preliminary risk identification, and subsequent assessment (allied with mitigation measures, if necessary) which are covered in this report. The first stage of the process is an initial screening wherein activities are identified which are deemed not to have any impact on the conservation features, because they do not spatially overlap with a given habitat or have a clear pathway for interaction. These activities are excluded from further consideration. The next phase is the preparation of a Natura Impact Statement (NIS) where interactions (or risk of) are identified. Further to this, an assessment on the significance of the likely interactions between activities and conservation features is conducted. Mitigation measures (if necessary or possible) will be introduced in situations where the risk of significant disturbance is identified. In situations where there is no obvious mitigation to reduce the risk of

significant impact, it is advised that caution should be applied in licencing decisions. Overall the Appropriate Assessment is both the process and the assessment undertaken by the competent authority to effectively validate this report and/or the NIS. It is important to note that the screening process is considered conservative in that activities which may overlap with habitats but which may have very benign effects are retained for full assessment.

2.4 DATA SUPPORTS

Distribution of habitats and species population data are provided by NPWS[1]. Scientific reports on the potential effects of various activities on habitats and species have been compiled by the MI and provide the evidence base for the findings. The profile of aquaculture activities was provided by BIM. The data supporting the assessment of individual activities vary and provides for varying degrees of confidence in the findings.

2.5 FINDINGS

Aquaculture and Habitats/Species:

In Carlingford Lough (ROI waters) there are 12 mussel licences with a further 7 new applications (3 of which are already covered by an existing licence) and 17 fully licensed oyster production licences with an additional 5 sites licensed for oysters and clams. There are 24 oyster applications and 2 applications for oysters and mussels. Of the currently licenced mussel sites, only or 0.98% overlaps the Carlingford Shore SAC and only 3.06% of the mussel application sites. Of the currently licenced oyster sites, 35.27% overlap the Carlingford Shore SAC and 77.6% of the oyster applications. The likely interaction between aquaculture activity and conservation features (habitats and species) of the site was considered.

There 17 fully licenced sites and five entities involved in oyster farming within Carlingford Lough (4 companies and 1 sole traders) with a maximum of 10 tractors that are used in the production area. There are an to two of the five entities

An initial screening exercise resulted in all habitat features being excluded from further consideration. None of the aquaculture activities (existing and/or proposed) overlaps or likely interacts with the following features or species, and therefore the following habitats were excluded from further consideration in the assessment:

- Annual vegetation of drift lines [1210]
- Perennial vegetation of stony banks [1220]

The likely interactions between the proposed aquaculture activities and seals was assessed as there are a number of haul out sites in Carlingford Lough despite these species not being qualifying interests of the Carlingford Shore SAC.

[1] NPWS Geodatabase Ver: September 2015 - http://www.npws.ie/mapsanddata/habitatspeciesdata/

2.5.1 Species

The likely interactions between the proposed aquaculture activities and seals was assessed as there are a number of haul out sites in Carlingford Lough despite these species not being qualifying interests of the Carlingford Shore SAC. Negative interactions with seals cannot be discounted at the haul out location entitled 'Seal Rock' on the southern shore of the Lough. It is recommended that the licencing at the relevant sites be carefully considered such that potential disturbance to seal is reduced to negligible levels.

The rest of the haul out locations within the bay are considered not at risk from aquaculture practices.

2.5.2 Other considerations

Fishing activities in the Lough do not overlap annexed habitats for which the SAC is designated and as a result it is considered that fishing both alone and in-combination with aquaculture activities is non-disturbing the qualifying interests of the SAC.

On the basis of overlap of access routes with eel grass beds in the SAC, it is recommended that, if licencing is to proceed, alternative access routes be identified that specifically avoid eel grass beds and provide some buffer against accidental intrusion.

The ecological carrying capacity in Carlingford appears to be exceeded in all, bar two, aquaculture sectors and therefore, additional licencing is not recommended in these areas.

3 INTRODUCTION

This document assesses the potential ecological interactions of aquaculture activities on the Conservation Objectives of the Carlingford Shore SAC (Site code: 002306. The information upon which this assessment is based is a list of applications and extant licences for aquaculture activities administered by the Department of Agriculture Food and Marine (DAFM) and forwarded to the Marine Institute; as well as aquaculture and fishery profiling information provided on behalf of the operators by Bord Iascaigh Mara. The spatial extent of aquaculture licences is derived from a database managed by the DAFM[2].

Carlingford Lough is located on the border between the Republic of Ireland to the south and Northern Ireland to the north and as a result, the Natura 2000 sites on the southern and northern shores are governed by different jurisdictions. This current assessment focuses on the impacts on the SACs on the southern Republic of Ireland shore. The Fisheries and Environment Division of the Department of Agriculture and Rural Development (DARD) commissioned AFBI to produce a cumulative impact assessment report for aquaculture activities within and adjacent to all Natura 2000 designated sites in Carlingford Lough (AFBI, 2015). Both assessments conform in their assessment of the impacts on the Carlingford Shore SAC.

4 CONSERVATION OBJECTIVES FOR CARLINGFORD SHORE SAC

The appropriate assessment of aquaculture and fisheries in relation to the Conservation Objectives for Carlingford Shore SAC is based on Version 1.0 of the objectives (NPWS 2013a – Version 1 15 July 2013) and supporting documentation (NPWS 2013b - Version 1 May 2013). The spatial data for conservation features was provided by NPWS[3].

4.1 THE SAC EXTENT

The Carlingford Shore SAC site comprises the entire southern shoreline of Carlingford Lough and continues round the tip of the Cooley Peninsula to just west of Cooley Point. While the principal conservation interests lie in the perennial vegetation of shingle banks and the annual vegetation of drift lines, the site also has intertidal sand and mudflats, patches of saltmarsh, some areas of dry grassland, and an area of mixed deciduous woodland. The site is flanked by Carlingford Mountain to the south-west. The underlying rock within the SAC is mainly carboniferous limestone. This outcrops in places in the form of bedrock shore or reefs. Granite boulders are occasionally found. Intertidal mudflats and sand/gravel banks also occur. The full extent of the SAC is shown in **Figure 4.1** below.

4.2 QUALIFYING INTERESTS (SAC)

The SAC is designated for the following habitats and species (NPWS 2013a), as listed in Annex I and Annex II of the Habitats Directive:

- Annual vegetation of drift lines [1210]

[2] DAFM Aquaculture Database version Aquaculture: May, 2015
[3] NPWS Geodatabase Ver: June 2015 - http://www.npws.ie/mapsanddata/habitatspeciesdata/

- Perennial vegetation of stony banks [1220]

There are no marine habitats that could overlap with the aquaculture activities in the Carlingford Shore SAC (NPWS 2013a).

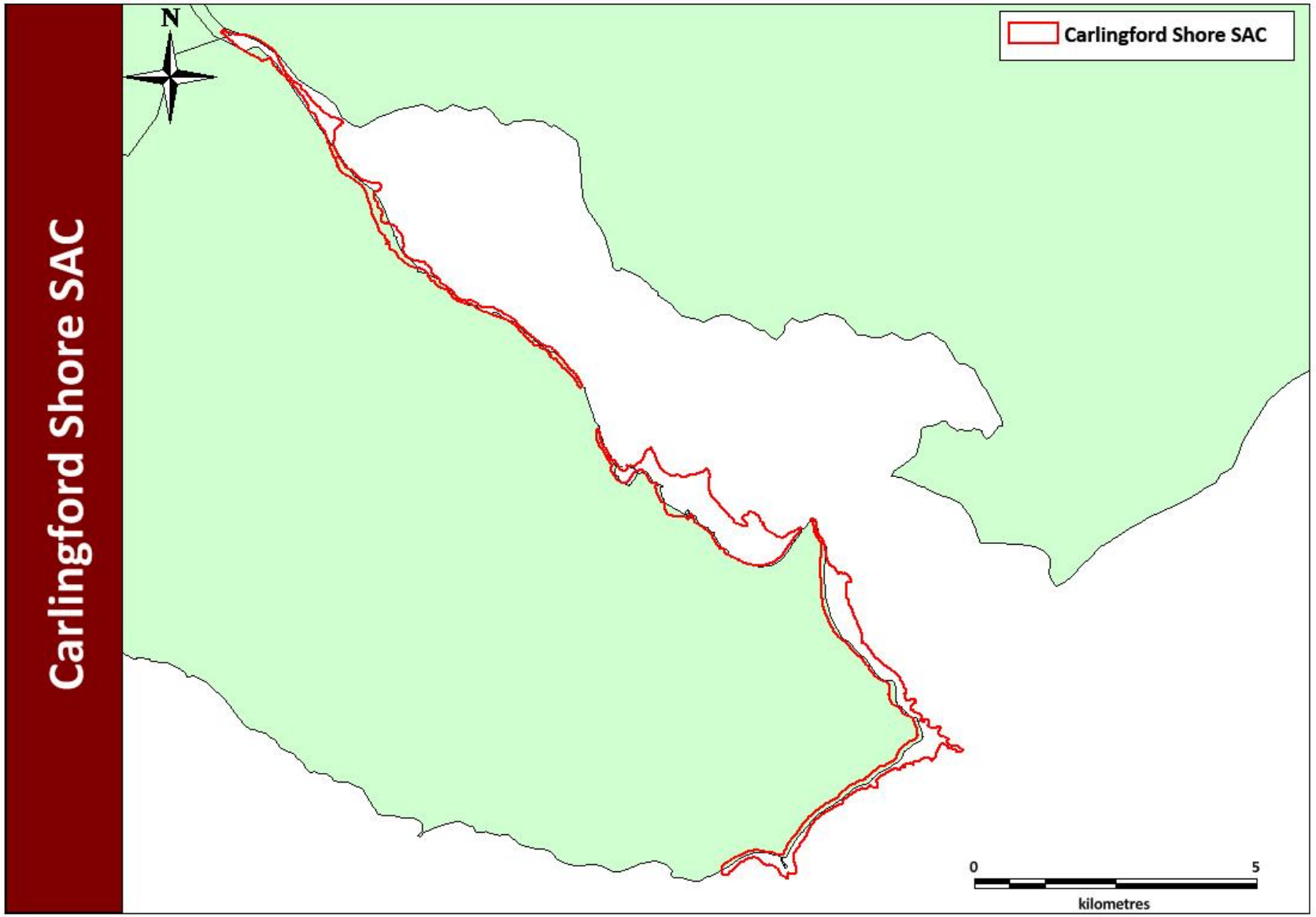

Figure 4-1- The extent of the Carlingford Shore SAC.

4.3 CONSERVATION OBJECTIVES FOR CARLINGFORD SHORE SAC

The Conservation Objectives for the Qualifying Interests for the SAC were prepared by NPWS (NPWS 2013a). The natural condition of the designated features should be preserved with respect to their area, distribution, and extent and community distribution. Habitat availability should be maintained for designated species and human disturbance should not adversely affect such species. The features, objectives and targets of each of the Qualifying Interests within the SAC are listed in **Table 4.2** below.

Table 4-1- Conservation Objectives and targets for marine habitats and species in Carlingford Shore SAC (NPWS 2013a, 2013b). Annex I and II features listed in **bold**.

Feature (Community Type)	Objective	Target(s)
Annual vegetation of drift lines [1210]	Maintain favourable conservation condition	Current area unknown, but thought to occur in a mosaic with perennial vegetation of stony banks. 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 favourable conservation condition	Current area unknown. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species

4.4 SCREENING OF ADJACENT SAC FOR EX-SITU EFFECTS

In addition to the Carlingford Shore SAC there are two other SAC site proximate to the proposed activities (**Figure 4.5**): the Dundalk Bay SAC (Site Code IE000455) located *c.* 7km east of the Carlingford Shore SAC and the Murlough SAC (UK0016612), located 18.8km east of the Carlingford Shore SAC. 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 based primarily upon the likelihood of spatial overlap.

Other Natura sites SPAs in the vicinity of Carlingford Lough are considered are considered in Carlingford Shore SPA report accompanying this report.

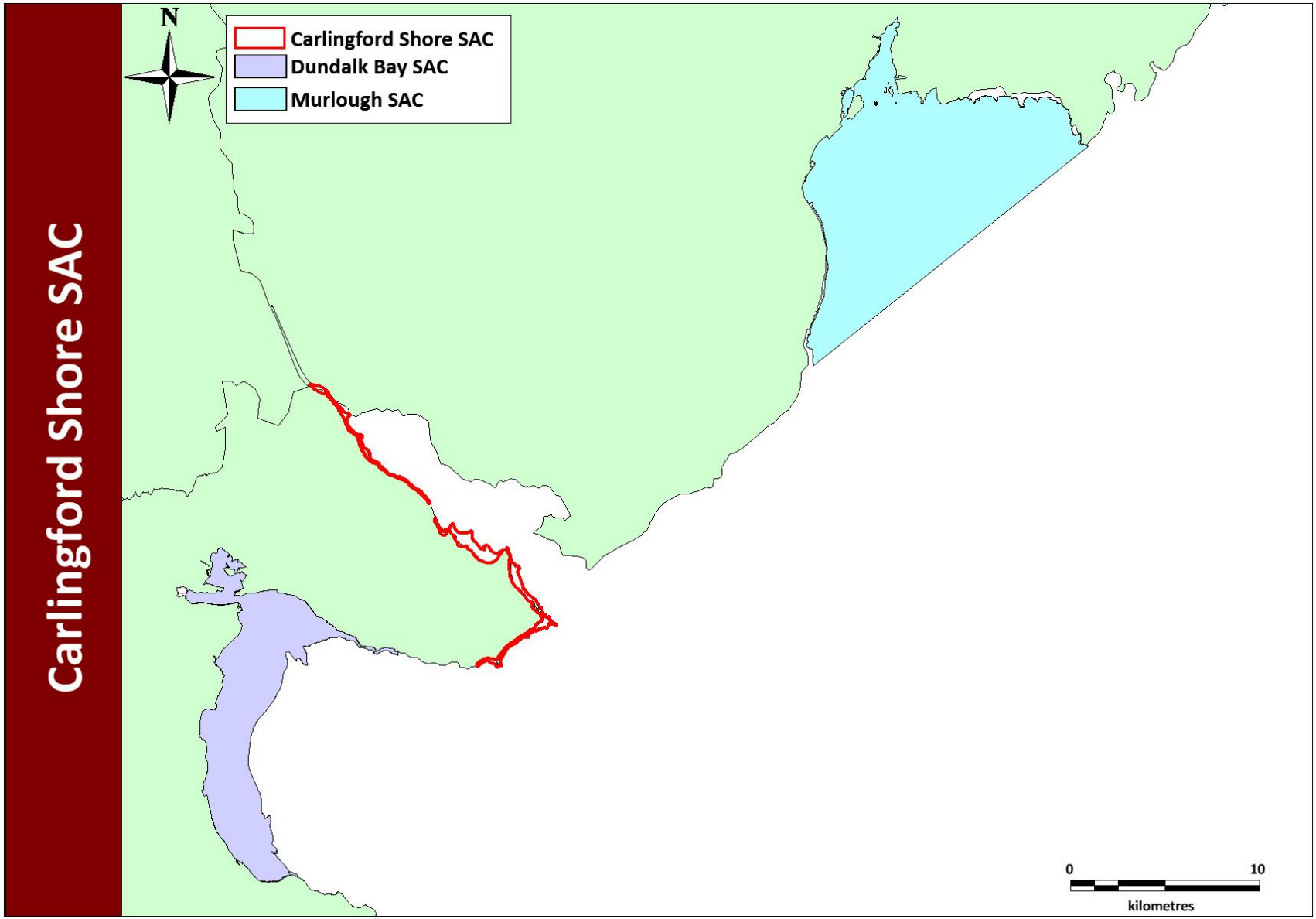

Figure 4-2 – SACs adjacent to the Carlingford Shore SAC

Table 4.3 - SAC sites adjacent to the Carlingford Shore SAC and Qualifying Features with initial screening assessment on likely interactions with aquaculture activities.

Natura site (Site code)	Qualifying features (habitat/species code)	Aquaculture initial screening
Dundalk Bay SAC (IE000455)	Estuaries [1130]	No spatial overlap or likely interactions with aquaculture activities within the Carlingford Shore SAC – excluded from further analysis.
	Mudflats and sandflats not covered by seawater at low tide [1140]	
	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]	
Murlough SAC (UK0016612)	Sandbanks which are slightly covered by sea water all the time [1110]	No spatial overlap or likely interactions with aquaculture activities within the Carlingford Shore SAC – excluded from further analysis.
	Mudflats and sandflats not covered by seawater at low tide [1140]	
	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	
	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]	
	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) [2170]	
	Marsh fritillary butterfly *Euphydryas aurinia* [1065]	
	Harbour seal *Phoca vitulina* [1365]	Harbour seals may migrate into the Carlingford Shore SAC and could interact with aquaculture activities – carry forward to Section 8.1

5 DETAILS OF THE PROPOSED PLANS AND PROJECTS

5.1 DESCRIPTION OF AQUACULTURE ACTIVITIES

Aquaculture activities within the Carlingford Shore SAC focus on the subtidal (bottom culture) of the Blue mussel, *Mytilus edulis* and the intertidal (bags and trestle) cultivation of the Pacific oyster *C. gigas*..

5.1.1 Bottom Mussel Cultivation

5.1.1.1 Current activity

5.1.1.1.1 Overview

Mussel operators are licensed to relay mussel seed on aquaculture sites in Carlingford Lough. Sites to the south of the channel are licenced by DAFM and sites to the North of the channel are licenced by DAERA. In the case of the mussel industry there are strong North-South company linkages and vessels operate on multiple sites. All operators are members of the Carlingford Lough CLAMS group.

There are 12 licensed sites and 9 entities involved in mussel cultivation within Carlingford Lough (5 companies and 4 sole traders).

At maximum usage (seed relaying) it is estimated that 5 large mussel dredgers (>15m) would represent the total mussel fleet in the Lough. During harvesting it is estimated that 5 aquaculture vessels (4 large and 1 smaller vessel) would represent maximum activity in any 24 hour period.

Dredges typically have a ‘mouth’ width of between 2 and 4m. Mussel dredges have a flat bar at their leading edge where they interact with the seabed that is designed to skim the surface of the substrate without digging into it. This bar in effect ‘peels’ the overlying seed mussel ‘mat’ away from the underlying substrate and in doing so removes the mussel seed which is caught in a bag which follows the bar.

Depending on size, vessels may deploy two or a maximum of four dredges at a time. The iron frame of the dredge (depending on vessel size) has a maximum weight of 300 kg. The dredge is composed of a fixed bar (of between 2 and 4m in length, known as the ‘mud bar’, which is without teeth) and a frame with a net bag attached, which is 2-3m in length to retain the seed mussel catches. The bottom part of the bag is a made up of either a chain link matrix or a nylon mesh. The upper part of the bag is made of nylon mesh. In the case where a chain link matrix is used on the lower part of the bag it is common practice for a rubber mat or rope dollies (bits of chafed ropes) to be attached to the belly of the dredge to minimise disturbance of the substrate. In addition, some operators use steel bars across the mouth of the dredge to prevent large rocks or other non-target material from entering the dredge.

5.1.1.1.2 Husbandry activities

5.1.1.1.2.1 Overview

Seed mussel is fished from the sub-tidal seed areas in ROI, NI and UK waters (Only to NI sites) and transferred to licensed sub-tidal sites in Carlingford for on-growing until harvest. On-growing duration generally varies between 12- 36 months depending on the growth rates and the size of the initial seed input. During on-growing there are a range of husbandry activities undertaken in the Lough such as predator control and transfer of mussel stocks between licensed sites, these practices are necessary to maximise the ultimate return ratio.

5.1.1.1.2.2 Seed fishing

The location, timing and volume of *Mytilus edulis* seed relaying in Carlingford Lough is dictated by the available seed fishing tides, as specified in the annual seed fishing licences. The seed is relayed on licensed aquaculture sites with the dates and volume specified in the seed fishing licences and allocations issued by DAFM and DAERA and dependent on the vessel registration. The allocation system effectively sets down a maximum allowable catch for the fishery.

Current seed allocations were calculated using a range of criteria by the Seed Mussel Advisory Committee (SMAC) in 2005. SMAC was tasked with assessing industry allocation applications and making recommendations to the Department and to the Minister.

The SMAC assessed all applications by applying the criteria outlined below;

- Historical mussel fishing activity
- Percentage fished of requirement
- Average ratio return
- Average selling price per tonne
- Distance from zone to reseeding area
- Verified survey history
- Efficiency of seed operation
- Associated employment local coastal communities
- Percentage seed fished sourced from zone over last 10 years.

In addition to the criteria listed above the SMAC also considered:

- The seed tonnage applied for by the individual operators
- The capacity of the relay area (Allocations were capped on the basis of area of the site times 40 tonnes per hectare for a three year growing cycle)
- The overall capacity of the bay to support the total amount of relayed mussel. (An upper limit was placed on the allocations to each individual relay bay in order to support growth and productivity of the target and non-target species within the bays).

The capacity of the relay area in the allocation system (30-40t rule) effectively caps the stocking density which is a measure of the quantity of mussels occupying a known area of ground (both the size and number of mussels are important). Correct stocking densities are critical to the eventual production of a quality product. Too high a stocking density will result in a variable sized crop with

poor meat condition particularly from the centre of the farm. Too low a stocking density and the full potential of the area is not realised causing an increase in the cost of production. Higher stocking densities are generally preferred for bottom culture of mussels, with local variations between sites. The capping of the stocking density at 30-40t hectare is precautionary in the context of international standards[4].

Total seed allocations for Carlingford Lough – IE and NI is approximately 6000t however this is subject to seed availability and this level has not been reached in the last number of years, the average seed input to the lough from 2010-2016 is approximately 2200t with a maximum of 4468 t in 2010. Please note all figures are net tonnages.

Fishing takes place on suitable neap tides (≤7m as predicted in the Llanelli tide tables) subject to seed availability, allocation and suitable weather conditions. Carlingford Lough is managed in line with seed fisheries elsewhere on the Island of Ireland, i.e. a spring and autumn fishery subject to seed availability. Also in line with the management of other seed areas on the Island, the force majeure clause may be initiated and a seed area opened at any time if the bed is subject to high predation pressure.

Seed is relayed by pumping the seed mixed with seawater from the boat's hold onto the licensed sites. This pattern of relaying is characterised by the vessels moving across the plots during pumping in an effort to achieve an even distribution of mussel on each plot in order to maximise survival and growth.

In Carlingford relaying is generally at a density of 20-40t per hectare depending on seed size. Return rates of 1:1 are expected and the final product is harvested to order by vessels, from the licensed sites. Seed size generally varies from 1000-2000 pieces per kilo.

5.1.1.1.2.3 Grow out

Predator control and stock movements both within and between licensed sites is an integral part of the mussel production process in Carlingford Lough. Stock is moved to maximise growth rates and to prevent excessive settlement of barnacles or sea squirts on the stock which negatively affect growth rates and market value.

Predator control mainly focuses on the control of starfish and green crab. Stars are generally fished with the standard dredge or via "mops" and pots are deployed by operators to control green crab

[4] http://www.thefishsite.com/articles/894/#sthash.A51lFQDI.dpuf

Sea Fish Industry Authority (2002) Epsilon Aquaculture Limited 2002 The Seabed Cultivated Mussel Hyperbook
Dolmer et al., (2012) Area-intensive bottom culture of blue mussels Mytilus edulis in a micro-tidal estuary. Aquaculture Environment Interactions 3:81-91
Gascoigne et al., (2005) Density dependence, spatial scale and patterning in sessile biota. Oecologia 145:371-381
Kaiser et al., Seed Mussel Ecology (2006) Project Code FC1015
Beadman et al., (2004) Changes in species richness with stocking density in marine bivalves. Journal of Applied Ecology 41:464-475
BIM (2007) UISCE
Capelle et al., (2016)The role of shore crabs and mussel density in mussel losses at a commercial intertidal mussel plot after seeding
Capelle (2017) Production efficiency of mussel bottom Culture. Phd Thesis

5.1.1.1.2.4 Harvesting

All harvesting and sales activity is monitored by a variety of mechanisms; registration documents, VMS plotting, and annual returns. No waste is generated as the harvested product is placed directly into one tonne bags for export, via refrigerated truck from Warrenpoint Harbour.

5.1.1.1.2.5 Bycatch

As part of the Marine Stewardship Council certification BIM and industry members have adopted a bycatch monitoring scheme in Carlingford Lough. Surveys in 2016 and 2017 detected no bycatch species exceeded 5% of the catch. Species detected are associated with shell fouling and those that predate on mussels – green crab and starfish. No Endangered Threatened or Protected species were detected in the samples collected on the harvest beds in Carlingford Lough.

5.1.1.1.2.6 IAS Species

The issue of IAS species is one that has been identified as a risk to the bottom grown mussel sector and thus BIM have been working with operators in Carlingford to manage the risks posed.

A number of Carlingford Lough Skippers have undertaken training in IAS species identification and a seed bed screening process was trialled in the 2017 Seed Season. It is envisioned that this will be further extended in the 2018 fishery.

5.1.1.1.3 Activity levels

The activity levels for a standard vessel is provided in Table 5.1 below

- The activity level for a standard mussel vessel is approximately 220 days per year
- Days of activity are not all within Carlingford Lough as vessels are typically involved in about 40 days seed fishing, transiting, maintenance and surveying per year.
- Subtracting activity outside the Lough provides 180 days activity per vessel per year.
- Maximum time vessels would spend on site is 6 hours per day
- Maximum activity per vessel is 1080 hrs per year
- Please note that as the operators in Carlingford are on a broadly similar production cycle, it is inappropriate to multiply 1080hrs per year by 5 vessels as there will be significant overlap in times of activity.

Table 5-1: Seasonal, daily and tidal profile of activities undertaken by standard mussel vessel in Carlingford Lough

	Tide			Time		Month											
Activity	Low	High	Slack	Day	Night	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Seed Fishing (Outside lough)			X	X						L			L	H	H	L	L
Relaying of Seed (Inside Lough)	X	X	X	X						L			L	H	H	L	L
Maintenance (General Husbandry)	X	X	X	X		L	L	H	L	L	L	H	L	L	L	L	L
Harvesting	X	X	X	X		H	H	L	L	L		H	H	H	H	H	H
Max number of working hours on water per day						6	6	6	6	6	6	6	6	6	6	6	6
Max Number of working days per month						20	20	20	15	15	10	20	20	20	20	20	20

5.1.1.2 Proposed activity

Currently there are 7 new applications areas for mussel production within the Lough, however three of these are currently licensed and therefore not double counted in the assessment. Should all bottom mussel applications be successful there would be an additional 4 entities (2 companies and 2 sole traders) would be operating.

5.1.1.3 Access

Historically vessels would access sites from Warrenpoint Harbour, Greer's Quay and Carlingford Harbour. However due to vessel size and siltation in Carlingford, all vessels now moor in Warrenpoint

5.1.2 Intertidal Oyster Cultivation

5.1.2.1 Current activity

5.1.2.1.1 Overview

Oyster farming within Carlingford Lough is a form of intensive culture which has been taking place since the early 1970s. There 17 fully licenced sites and five entities involved in oyster farming within Carlingford Lough (4 companies and 1 sole traders) with a maximum of 10 tractors that are used in the production area. There are an additional 5 sites licensed for oysters and clams to two of the five entities. Cultivation of the Pacific oyster (*Crassostrea gigas*) is carried out by growing oysters in bags placed on a variety of trestle designs. The trestle type used in the Lough varies depending on location. The most common trestle type typically measure 3m x 1m and stand 0.4 – 1.2m in height, holding 6 bags each. Bags are made of a plastic (HDPE) mesh and are fastened to trestles using rubber straps and hooks. Bags vary in mesh size depending on oyster stock grade (6mm, 9mm, and 14mm).

Higher trestles, trestles with enclosed bags (frames) and trestles with hanging baskets have been used by a number of operators for over 30 years to maximise return and to minimise man hours on the shore. On some sites these systems enhance shell shape and meat content and have allowed growers to achieve the highly rated quality classification of 'Speciales' which achieve a market price of twice that of standard quality oysters. From a sales point of view, bulk producers of 'Speciales' have huge demand for their product, whereas bulk producers of 'Standards' are competing with a large volume of this product from Ireland and internally in France and may be unable to sell all their product in a given year.

One grower has had to use the enclosed trestles (frames) to overcome the turbulence on his site which continually throws trestles over and constantly plays havoc with bags breaking loose from their bindings.

In recent years, some growers have concentrated their entire production of 'Speciales' using improved husbandry practices and a combination of the culture systems described above and have been able to reduce the growth cycle to only 2 summers thus making their operations more viable and sustainable.

5.1.2.1.2 Husbandry activities

The production cycle begins in the Lough when G4 – G6 seed (6-10mm) is introduced from UK or French hatcheries beginning in spring and/or autumn of each year. The timing of introductions has changed significantly in the last 10 years as a result of oyster mortalities not previously observed.

Hatcheries used include: SeaSalter, England; Marinoue; Grainocean; Satmar; and France Turbot, some producers have also used remote settlement and Irish hatcheries. Occasionally wild seed is also brought in from France. In response to large seed mortalities, from 2010-2015 operators purchased extra seed to ensure that production levels were maintained. This practice has now largely ceased as a result of reduced mortalities through the use of improved broodstock at the hatcheries and better husbandry practices principally the correct positioning of seed on the shore. The balance of oysters not affected by mortalities were grown to half size and sold for on-growing elsewhere, or have been gradually sold off since then. Producers are now focusing on high value markets rather than bulk sales with 2 large operators selling a portion of their stock into Asia.

Mixed stocks of Diploid and Triploid oysters are grown in Carlingford Lough and no settlement and recruitment of these oysters to the wild has ever been reported from the Lough. The operators are happy with the success of growing mixed stocks and wish to continue with this practice into the future.

Triploid stocks allow for year round harvesting. While kept separate within the operator's own traceability systems, the triploid and diploid stocks are stocked on mixed sites; triploid oysters sometimes grow very quickly on the lower inter-tidal sites and may be moved to sites further up the shore during the summer months. Mixed stocking helps spread mortality risk and minimise overall losses.

All trestle lines and blocks are labelled for traceability. As well as mixed stocking by oyster type, oyster grades are also mixed. All stocking and movement activities are recorded by date and location so that a full record of stock distribution is maintained on an ongoing basis. In general the upper shore areas are used for seed and for final hardening of stock. Some of the growers employ the use of a dedicated holding area on the upper shore close to the land base for finishing stock and to allow for ready access for grading or final harvesting during slack tides. New seed can also be placed in this area to allow for ongoing observation of its condition. Oysters are kept in the holding area for periods of up to 6 weeks.

Growth cycle, depending on seed intake size ranges from 2.5 to 3 years. Market size is approximately 100g, by which stage they are around 120 -160 shells in each bag.

5.1.2.1.3 Activity levels

The intertidal area is typically accessed during mean and spring tides. Preparatory work is always conducted in the packing areas (outside the protected areas) in the intervening periods, including grading and packing, depuration, preparation of bags and trestles and general maintenance. Sites are accessed by tractor and trailer. Each operator observes one or 2 dedicated access routes to the sites (Section 5.1.2.2).

Oysters are thinned out and graded as the oysters grow. Through the ongrowing period, they are taken to the handling / sorting facility twice per year for grading and re-packing, and subsequently returned

to the trestles. In the final stage they will be 'hardened' and stored in the upper intertidal area, before removal, grading, depurated (If required), packed and shipped for distribution.

The programme of work is continuous over all suitable low tide periods. The farms are positioned between mean Low Water Spring and mean Low Water Neap, allowing on average 3 hours exposure depending on tidal and prevailing weather conditions. Carlingford low tides are early morning and late evening.

As a general rule, growers access the growing areas 6 days per fortnight – 156 days per year. When packing, daily access is required to the hardening/storage areas further up the shore - 250-300 days per year.

Maintenance activities on-site include shaking and turning of bags, removal of fouling and seaweed by hand and movement of stocks as necessary. Three operators have land based facilities directly on the shore at the access point. A forth currently uses a nearby land base approximately 200m from the shore. As mentioned previously, some of the growers employ the use of a dedicated holding area on the upper shore close to the land base for finishing stock and to allow for ready access for grading or final harvesting during slack tides. Oysters are kept in the holding area for periods of up to 6 weeks. This system minimised the amount of time spent on the remaining sites.

Harvest periods for oysters are typically between October and April but with the culture of triploids in the Lough, year round harvesting can and does also take place. Harvesting from the half grown market takes place between March and April and again between September and October. Three of the operators have depuration facilities at their land base.

5.1.2.2 Proposed activity

There are 24 oyster applications submitted plus an additional 2 which also include mussels. A number of these applications have been submitted for winter harvesting sites - T1/102, T1/100, T01/104A, T01/101, T01/96A, T01/96B and T01/124. These sites are key to the production units in inner Carlingford due to the presence of norovirus in inner Carlingford over the winter months. Without access to winter harvesting sites the producers win inner Carlingford would be unable to provide product to their customers over the winter months which would make all their businesses unviable.

5.1.2.3 Access Routes

Access Routes have been established over many years and occur in areas where the ground is suitable to support the weight of a tractor and trailer. Between all the operators a maximum of 10 tractors (2 at Ballagan, 8 in inner Carlingford) are used to access the sites from five main access points. Figure 5.1 shows the five access points.

Of the currently licenced oyster sites (112.61ha), 39.72ha (or 35.27%) overlap the Carlingford Shore SAC.

There is an additional 117.01ha covered by oyster applications. Of this, 90.8ha (or 77.6%) overlaps the Carlingford Shore SAC.

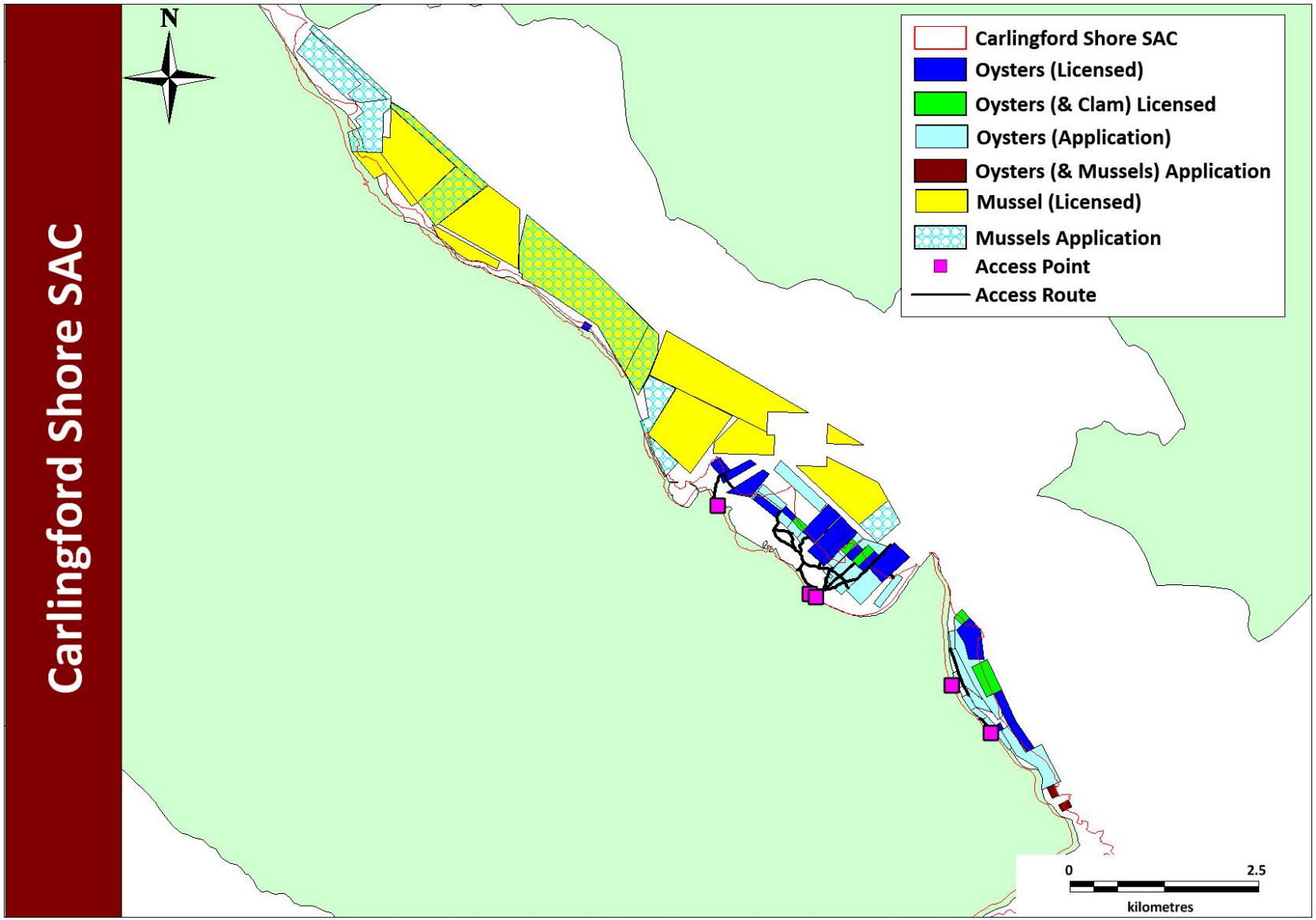

Figure 5-1 – Aquaculture activities in the vicinity of the Carlingford Shore SAC. Green background with yellow dots represents bottom mussel culture licenced sites which have applications overlapping (reviews or new applications).

6 NATURA IMPACT STATEMENT FOR THE PROPOSED ACTIVITIES

The potential ecological effects of activities on the Conservation Objectives for the site relate to the physical and biological effects of aquaculture cultivation structures and activities and human activities on designated species, intertidal habitats and invertebrate communities, and biotopes within those broad habitat types. The overall effect on the conservation status will depend on the spatial and temporal extent of fishing and aquaculture activities during the lifetime of the proposed plans and projects and the nature of each of these activities in conjunction with the sensitivity of the receiving environment. Bottom cultivation and harvesting of shellfish can, like fishing, 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, dredging, sediment compaction), the extraction of commercial and natural populations and the physical effects of dredging.

Aquaculture activities within the SAC focus on the intertidal (bags and trestle) cultivation of the Pacific oyster, *C. gigas* (and mussels) and subtidal (bottom culture) of the Blue mussel *Mytilus edulis*. Details of the potential biological and physical effects of these aquaculture activities on the habitat features, their sources and the mechanism by which the impact may occur are discussed below and summarised in **Table 6.1** below. The impact summaries identified in the table are derived from published primary literature and review documents that have specifically focused upon the environmental interactions of mariculture (e.g. Black 2001; McKindsey et al 2007; NRC 2010; O'Beirn et al 2012; Cranford et al 2012; ABPMer 2013a-h).

6.1 BIOLOGICAL EFFECTS OF AQUACULTURE – ALL CULTURE METHODS:

Mussels and oysters, being suspension feeding bivalve molluscs, feed at the lowest trophic level feeding largely as herbivores, relying primarily on ingestion of phytoplankton. Therefore, the culture process does not rely on the input of feedstuffs into the aquatic environment. Suspension feeding bivalves filter suspended matter from the water column and the resulting faeces and pseudofaeces (non-ingested material) are then deposited onto the seafloor, this is known as biodeposition and is a component of a greater process called benthic-pelagic coupling. This deposition can accumulate on the seafloor beneath aquaculture installations (suspended and intertidal culture) 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 infaunal community therein; in the case of bottom mussel culture this deposition results in the formation of "mussel mud" directly beneath the mussels themselves.

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 a bacterial mat. Changes to the sedimentary habitat due to deposition are indicated by a decrease in oxygen levels, increased sulphide reduction, decrease in REDOX depth and particle size changes.

Several factors can affect the rate of deposition onto the seafloor; these include structure and culture density, site hydrography and site history. Oysters and mussels have a "plastic response" to increased

levels of suspended matter in the water column and can modify their filtration rate accordingly and thus increase the production of pseudofaeces which results in an increase in transfer of particles to the seafloor. The degree to which the material disperses away from the footprint of the culture system (e.g. Longlines, BST Longlines, floats, trestles & bags etc.) is governed by the density of mussels/oysters on the system, the depth of water and the water currents in the vicinity. It is likely that some overlap in effect will be realised. The duration and extent to which culture has been conducted on site may lead to cumulative impacts on the seabed, especially in areas where assimilation or dispersion of faeces/pseudofaeces is not rapid. A number of features of the site and culture practices will govern the speed at which faeces/pseudofaeces are assimilated or dispersed by the site. These relate to:

- Hydrography (residence time, tidal range, residual flow) govern how quickly the wastes disperse from the culture location and the density at which they will accumulate on the seafloor i.e. the greater the tidal range and residual flow then the greater the rate of dispersion and therefore the risk of accumulation is reduced.

- Turbidity in the water-the higher the water turbidity the greater the production of pseudo-faeces/faeces by the suspension feeding animal ("plastic response") and therefore greater the risk of accumulation on the seafloor.

- Density of structures-high density of culture structures (e.g. Longlines, floats, trestles & bags etc.) can result in the slowing of water currents/impediment of water flow (baffling effect), slow it down and cause localised deposition of material on the seafloor.

- Density of culture-the greater the density organisms the greater the risk of accumulations of material, suspended culture is considered a dense culture method with high densities of culture organisms over a small area. The density of culture organisms is a function of:

    - depth of the site (shallow sites have shorter droppers and hence fewer culture organisms),

    - husbandry practices – proper maintenance will result in optimum densities on the lines as well as ensuring a reduced risk of drop-off of culture animals to the seafloor as well as ensuring a sufficient distance among the longlines to reduce the risk of cumulative impacts in depositional areas.

Seston filtration-All culture methods

Suspension feeding bivalves such as mussels and oysters have a large filtration capacity and in confined areas, have been shown to alter the phytoplankton and zooplankton community abundance and structure and therefore potentially impact on the production an potentially the abundance and diversity of suspension and deposit feeding species in an area. This method of feeding may also reduce water turbidity hence increasing light penetration, which may increase phytoplankton production and therefore food availability. This increase in light penetration can have positive effects on light sensitive species such as maerl, seagrass and macroalgae.

Shading Suspended culture

The structures associated with suspended culture (e.g. trestles & bags etc.) can prevent light penetration to the seabed and therefore potentially impact on light sensitive species such as maerl, seagrass and macroalgae.

Fouling/Habitat creation-All culture methods

The structures associated with aquaculture, and the culture organisms themselves provide increased habitat for fouling species to colonise and therefore increase diversity; results in increased secondary production and increased nekton production.

Introduction of Non-native species- All culture methods

Movement and introduction of bivalve shellfish can be a vector for the introduction and spread of non-native/alien species. In some instances the introduced species may proliferate rapidly and compete with and in some cases replace the native species. Recruitment of *C. gigas* has been documented in a number of bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann et al 2012; 2013) and may compete with the native species for space and food.

Another means is the unintentional introduction of non-native species/diseases which are associated with the imported target culture species, and their subsequent spread and establishment. These associated species are referred to as ”hitch-hikers” and include animals and plants and/or parasites and diseases that potentially could cause outbreaks within the culture species or spread to other local species.

The introduction and establishment of non-native species can result in loss of native biodiversity due to increased competition for food and habitat and also predation and/or disease.

Disease risk-All culture methods

Due to the nature of the culture methods the risk of transmission of disease from cultured to wild stocks is high, e.g. the introduction of the parasitic protozoan *Bonamia ostreae*, which has caused the mass mortality within Irish native Oyster Beds. This risk can be limited by compiling a bio security plan, screening all introduced stock prior to transferring to on growing site and also good animal husbandry. Disease risk associated with movement of shellfish is governed by Fish health legislation on the movement of shellfish stocks into and out of culture areas and will not be considered further in this assessment.

Monoculture-Bottom culture

The relaying of mussels on the seabed also alters the infaunal community in terms of number of individuals and number of species present. As the habitat is dominated by single species this may lead to the transformation of an infaunal dominated community to an epifaunal dominated community and also cause alteration of sediment type and chemistry due to the production of mussel “mud“.

By-catch mortality-Bottom culture

Mortality of organisms captured or disturbed during the harvest and damage to structural fauna or reefs.

Nutrient Exchange - All culture methods

By their suspension feeding nature, removing particulate matter from the water column and releasing nutrients in solid and dissolved forms, bivalves influence benthic-pelagic coupling of organic matter and nutrients. Intensive bivalve culture can cause changes in ammonium and dissolved inorganic nitrogen resulting in increased primary production. The removal of nitrogen from the system is caused by both removal via harvest or denitrification at sediment surface.

6.2 PHYSICAL EFFECTS OF AQUACULTURE

Current alteration-Suspended culture

The structures used in aquaculture (e.g. Longlines, floats, trestles & bags etc.) can alter the hydrodynamics of an area i.e. increase/decrease water flow. In some instances the water flow is retarded and sediment will fall out of the water column and accumulate in the vicinity of the structures, this is known as the "Baffling effect". An increase in water flow may result in scouring of the seafloor leading to an increase in coarse sediment. Both result in a change in the sedimentary habitat structure and therefore can lead to change in the composition of the benthic infaunal community. In other instances, current speeds are such that very fine sediments and/or flocculent material (faeces and pseudofaeces) will be removed and no measurable impact is apparent on the benthic infuanal communities.

Surface disturbance-All culture methods

All aquaculture activities physically alter the receiving habitat, but the level of this disturbance depends on the culture method employed. The culture of bivalves on the seabed (on-bottom) in an uncontained fashion involves the dredging of the seafloor at various stages in the culture process i.e. the collection of seed mussels and relaying of spat, routine maintenance, removal of predators ("mopping"), stock movements and finally harvesting. The frequency of dredging activity depends on site management and how often stock is moved to new ongrowing areas to maximise growth and minimise predation prior to harvest. This dredging activity physically disturbs the seafloor and the organisms therein, and has been demonstrated to cause habitat and community changes.

The intertidal culture of bivalves (e.g. Longlines, Bags & trestles) does not require dredging and therefore is less damaging (physically) to the seafloor than the bottom culture method. However, the intertidal habitat can be affected by ancillary activities on-site i.e. servicing, vehicles on shore; human traffic and boat access lanes, causing an increased risk of sediment compaction resulting in sediment changes and associated community (infaunal and epifaunal) changes. Such activities can result in shallow and/or deep physical disturbance causing burrows to collapse, deeply burrowed organisms to die due to smothering and/or preventing siphon connection to the sediment surface or by directly crushing the animal.

Shading-Suspended culture

The structure associated with suspended culture (e.g. Longlines, floats, trestles & bags etc.) have the potential to prevent light penetration to the seabed and therefore potentially impact on light sensitive species such as maerl, seagrass and macroalgae.

Table 6-1 - Potential indicative environmental pressures of aquaculture activities within the Carlingford Shore SAC.

Activity	Pressure category	Pressure	Potential effects	Equipment / Gear	Duration (days)	Time of year	Factors constraining the activity
Intertidal Oyster Culture	Physical	Current alteration	Structures may alter the current regime and resulting increased deposition of fines or scouring.	Trestles and bags and service equipment	365	All year	At low tide only
		Surface disturbance	Ancillary activities at sites, e.g. servicing, transport increase the risk of sediment compaction resulting in sediment changes and associated community changes.				
		Shading	Prevention of light penetration to seabed potentially impacting light sensitive species				
	Biological	Non-native species introduction	Potential for non-native species (*C. gigas*) to reproduce and proliferate in SAC. Potential for alien species to be included with culture stock (hitch-hikers).				
		Disease risk	In event of epizootic the ability to manage disease in uncontained subtidal oyster populations is compromised.				
		Organic enrichment	Faecal and pseudofaecal deposition on seabed potentially altering community composition				
	Physical	Current alteration	Structures may alter the current regime and resulting increased deposition of fines or scouring.				
Subtidal Shellfish culture	Physical	Surface disturbance	Abrasion at the sediment surface and redistribution of sediment	Dredge	220	All year	Weather for site access. Size of shellfish and
		Shallow disturbance	Sub-surface disturbance to 25mm				

Activity	Pressure category	Pressure	Potential effects	Equipment / Gear	Duration (days)	Time of year	Factors constraining the activity
	Biological	Monoculture	Habitat dominated by single species and transformation of infaunal dominated community to epifaunal dominated community.				market constraints
		By-catch mortality	Mortality of organisms captured or disturbed during the harvest or process, damage to structural fauna of reefs				
		Non-native species introduction	Potential for alien species to be included with culture stock (hitch-hikers)				
		Disease risk	In event of an epizootic the ability to manage disease in uncontained subtidal shellfish populations would likely be compromised. The risk introduction of disease causing organisms by introducing seed originating from the 'wild' in other jurisdictions				
		Nutrient exchange	Increased primary production. N_2 removal at harvest or denitrification at sediment surface.				

7 SCREENING OF AQUACULTURE ACTIVITIES

A screening assessment is an initial evaluation of the possible impacts that activities may have on the Qualifying Interests. The screening process is a filter, which may lead to exclusion of certain activities or Qualifying Interests from further assessment, thereby simplifying the process. Screening is a conservative filter that minimises the risk of false negatives.

In this report, screening of the Qualifying Interests against the proposed activities is based primarily on spatial overlap i.e. if the Qualifying Interests overlap spatially with the proposed activities then impacts due to these activities on the Conservation Objectives for the Qualifying Interests is not discounted (not screened out) except where there is absolute and clear rationale for doing so. Conversely, if there is no spatial overlap and no obvious interaction is likely to occur, then the possibility of significant impact is discounted and further assessment of possible effects is not deemed necessary.

7.1 AQUACULTURE ACTIVITY SCREENING

Where the overlap between intertidal oyster or subtidal mussel aquaculture activities, and a feature is zero and there is no likely interaction of risk identified, it is screened out and not considered further.

Annual vegetation of drift lines [1210] habitat occurs primarily on deposits of shingle found lying at or above mean high-water spring tides (JNCC, 2007). Intertidal shellfish aquaculture occurs on the lower intertidal zone and there therefore will not be any spatial overlap between aquaculture and this feature of the SAC.

Perennial vegetation of stony banks [1220] habitat is found at the limit of high tide (JNCC 2007). As Intertidal shellfish aquaculture occurs on the lower intertidal zone there will therefore not be any spatial overlap between aquaculture and this feature of the SAC.

In addition, the 5 established access points to the shore (and multiple access routes on the shore) do not overlap either of these habitat types.

Therefore, the following habitats (and only qualifying interests of the Carlingford Shore SAC) are excluded from further consideration in this assessment:

- Annual vegetation of drift lines [1210]
- Perennial vegetation of stony banks [1220]

As there is no overlap with intertidal and subtidal aquaculture activities and the qualifying interests of the Carlingford Shore SAC, significant adverse impacts on the SAC conservation features can be discounted. This assessment can therefore stop at the screening stage.

Given the proximity of the harbour seal designated Murlough SAC to Carlingford Lough and the fact that both harbour and grey seals are Annex II species afforded protection wherever they occur, the impact on seals warrants further assessment.

8 ASSESSMENT OF AQUACULTURE ACTIVITIES

8.1 ASSESSMENT OF THE EFFECTS OF AQUACULTURE PRODUCTION ON THE HARBOUR SEAL *PHOCA VITULINA* AND GREY SEAL *HALICHOERUS GRYPUS* POPULATIONS IN CARLINGFORD LOUGH.

An assessment of the abundance and distribution of grey and harbour seals in Carlingford Lough was carried out in 2015-2016 as part of a planning condition for the Greenore-Greencastle Ferry Service (Martin, 2016).

The proportion of harbour seals hauled out in July (harbour seal post pupping period) was 51% with an estimated population of 228 adults and a maximum count of 29 pups from an observed range of 74 (93 – 167). The proportion of harbour seals hauled out in August/September (harbour seal moulting period) was 65% with an estimated population of 341 adults. A maximum count of 56 pups from an observed range of 130 (151 – 281) was recorded. In October/November harbour seals ranged from 49 to 105 animals and only eight harbour seal pups were observed. In January/April harbour seals ranged from a low of 29 to a maximum count of 140 in mid-April. Only nine harbour seal pups were observed, however it is possible that some pups may have been counted as adults.

In July grey seals ranged from 17 to 60 animals mainly in the Blockhouse/Greenore area. Two single pups were observed, presumably pupped the previous winter, and was included with the adults for the purposes of estimating abundance. In August/September grey seals ranged from 35 to 73 animals with a max count of 73 recorded on the 6th September of which 48 hauled out on the western side of Green Island. In October/November (grey seal pupping period) grey seals ranged from 10 to a maximum of 53. Almost all were sub-adults with no mature males seen at all. No grey seal pups were seen. In January/April (grey seal moulting period) grey seals raged from 13 to 80 animals. Grey seal breeding was not observed and all large grey males left the area from October/November.

The overall distribution pattern saw harbour seals occupying the inner less exposed parts of the Lough around Mill Bay, Green Island North and Seal Rock while grey seals occupied the more exposed outer parts around Blockhouse Island and reefs. There was a noted concentration of common seals on the north of Green Island during August. A small increase in harbour seals using Carrickbrada rock (Greenore) in spring was an exception. Seal rock, Carrigarean and Green Island were the main pup haul outs. Carrigarean was the only sandy haul out in all tides, all of the others being rocky.

Table 8.1 shows the cumulative distribution over all counts and Figure 8.1 shows the haul-out sites in relation to the aquaculture licences.

Species	Ballyedmond	Seal Rock	Carrigenean	Mill Bay	Green Isl.	Blockhouse Isl.	Blockhouse Reefs	Greenore
Harbour Seal	7	340	482	588	841	47	29	221
Harbour Seal Pups	0	83	54	29	112	4	5	16
Grey Seals	0	9	10	42	138	200	207	232

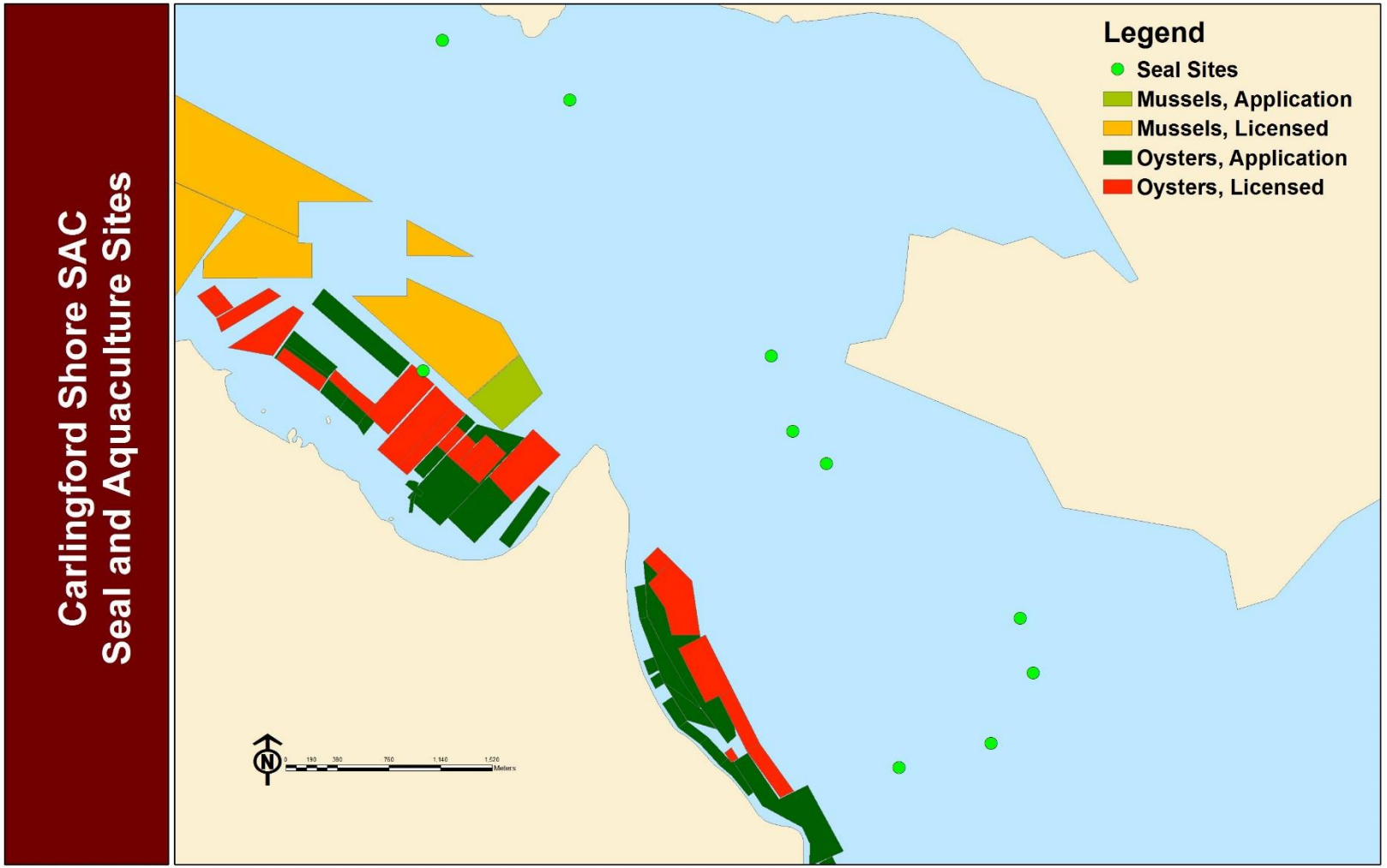

Figure 8-1- Seal haul out sites (after Martin, 2016) in the vicinity of the Carlingford Lough aquaculture sites.

All of the haul-out sites are located outside the Carlingford Shore SAC however one haul out site (Seal Rock) overlaps an existing oyster licence site. During the survey by Martin (2016), a total of 340 harbour seals were recorded at this haul out site along with 83 pups and 9 grey seals. Seal rock is a basaltic intrusion separated from the main mudflats and reefs by a deep channel. Given the rocky nature of this haul out site it is unsuitable for subtidal mussel culture. Largest numbers using this haul out site were in the months of July and August (post pupping and moulting periods), this coincides with a period of low intensity for seed relaying and a period of high intensity for harvesting.

It is considered that Given the use of Seal Rock as a haul out site for harbour seals (4th largest in terms of adult numbers and 2nd highest in terms of pup numbers in the Lough), the current level of aquaculture production and in particular the level of activity at the adjacent aquaculture sites is considered **non-disturbing** to harbour seals and by default it is also considered non-disturbing to grey seals as they use the site considerably less. However, while the haul-out is located between a licenced aquaculture site (bottom mussels) and intertidal oyster sites, it should be noted, that the bottom mussel site had not been utilised for the period 2010-2015 (AFBI 2015) and in recent years (BIM, personal communication) and that the oyster culture activities have few structures (and hence activity) within 400+m (Figure 8-2) based upon recent mapping (DAFM-Marine Engineering Division). This lack of use of the sites and consequential lack of disturbance to seals could be a factor which has resulted in the high counts at seal rock.

It is recommended that the use of these sites be confirmed and that any relicensing of this site be considered carefully.

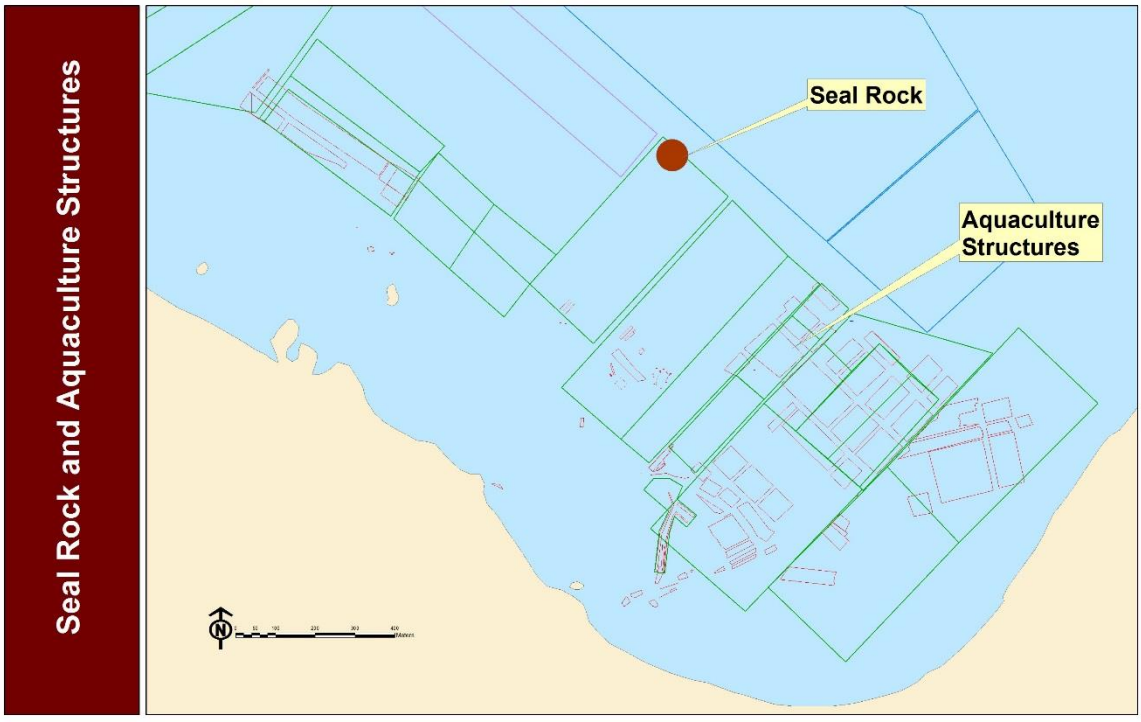

Figure 8-2 Seal Rock seal haul out location relative licenced aquaculture sites and intertidal structures (indicating activity levels).

8.2 OTHER CONSIDERATIONS

8.2.1 Eel grass distribution

The presence of eel grass (*Zostera*) beds in Carlingford, although not feature of the SAC, warrant some attention. There are extensive eel grass beds founds within the boundaries of the SAC and given the importance (to biodiversity and as bird feeding habitat) as well as the sensitive nature of this biogenic habitat its preservation is considered important. It is clear that a number of routes that access the intertidal shellfish culture sites run directly through the eel grass beds (Figure 8-3). It is also probable that these 'open' areas within the eel grass are a direct result of the activities (use as access routes to aquaculture sites) through the grass beds. It is recommended that, if licencing is to proceed, that consideration be given to identifying alternative access routes that avoid eel grass beds and provide some buffer against accidental intrusion.

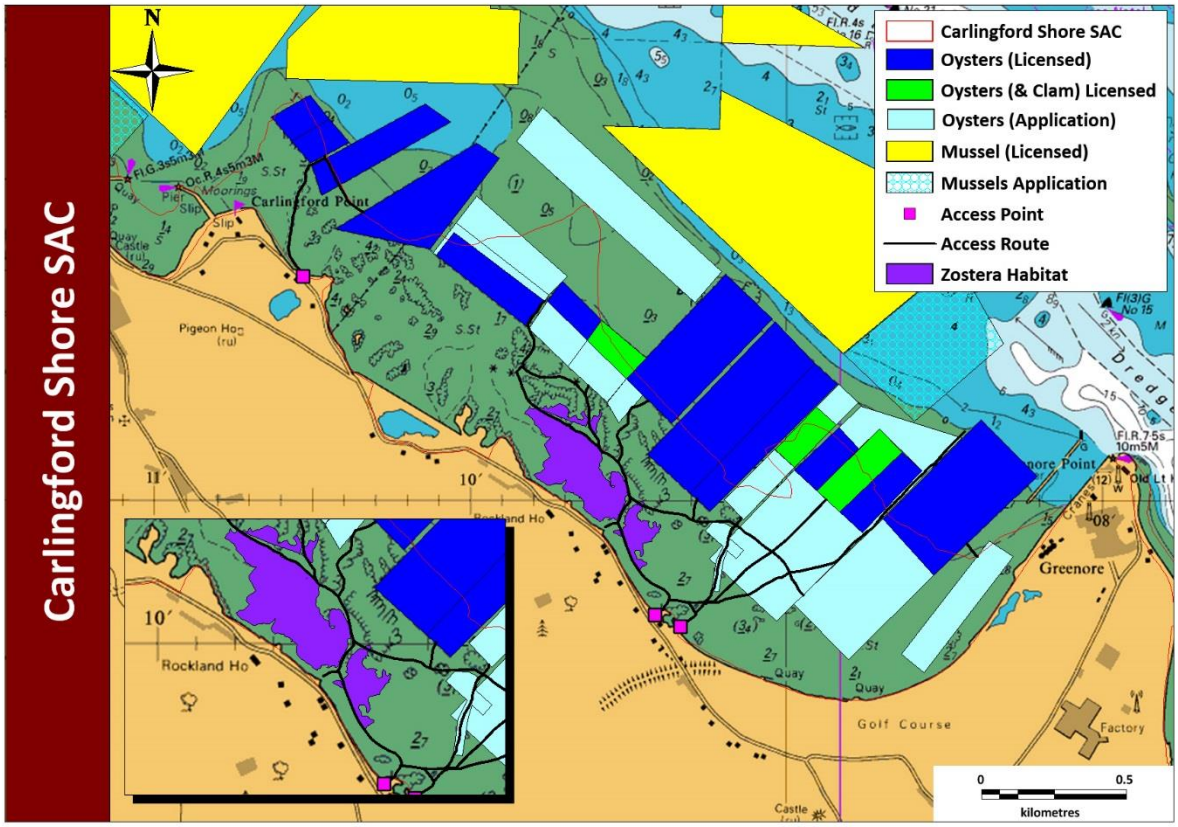

Figure 8-3 Eel grass beds and access routes overlap in Carlingford Lough

8.2.2 Carrying capacity

AFBI (2015) carried out an assessment on the likely interactions between aquaculture activities on the northern shore of Carlingford Lough and conservation features of the lough and adjacent Natura sites. As part of this assessment an ecological carrying capacity model was generated, which considered the likely impact filtration by shellfish aquaculture species will have on the background chlorophyll (Chl^a) levels in the lough (SMILE-Ferreira et al (2007)). The model runs included existing aquaculture

operations on the southern shore of Carlingford Lough (considered in this assessment report). Chlorophyll-a was considered a proxy for phytoplankton biomass. The bay was partitioned into a number of sectors (Figure 8-4) within which baseline Chl[a] filtration (wild species only) was estimated as well as phytoplankton depletion caused by a combination of wild and aquaculture species. A 30% reduction in phytoplankton biomass as a result of filtration by aquaculture species within each sector was considered a threshold above which aquaculture was deemed to have a significant impact on the ecological carrying capacity of the system.

The results of the runs of the model are presented in the table below. The model ran for baseline and for existing aquaculture activities only. The sectors relevant aquaculture on the southern shore of Carlingford Lough are highlighted in Table 8-1.

From the model outputs (Table 8-1), it is clear that all bar one sector relative to the current licencing considerations exceed or are close to the 30% threshold. This would suggest that all sectors inside Greenore cannot accommodate any additional aquaculture activities and that in some sectors the level of existing activity might be reduced. It is important to note that the models assume that all sites are being utilised and there is full occupancy of the aquaculture sites. As indicated above some sites are likely to be underutilised.

SMILE Box	Culture Species	Run 1	Run 2	% Reduction
38	mussel	11.38	3.38	70.343
36	mussel	10.59	4.78	54.878
25	mussel	6.56	3.43	47.789
29	mussel	9.09	5.28	41.933
35	mussel	9.58	5.75	39.974
28	mussel	6.9	4.24	38.575
34	mussel	9.11	5.61	38.464
33	mussel	8.05	4.96	38.456
32	mussel	7.03	4.62	34.275
23	mussel	5.82	3.98	31.731
30	no	10.95	7.59	30.704
27	no	5.71	3.96	30.549
22	Oyster/mussel	4.99	3.56	28.73
26	no	4.4	3.39	22.91
31	Oyster	4.1	3.31	19.186
24	Oyster	3.44	2.87	16.67
37	no	2.05	1.77	13.659

Table 8-1 Output of SMILE Ecological Carrying Capacity (ECC) model run (from AFBI 2015). Run 1 refers to baseline phytoplankton estimate. Run 2 refers to depletion caused by addition of aquaculture species. Sectors (Boxes) highlighted in the table are those relevant to aquaculture activities on the southern shore of Carlingford Lough (Figure 8-2). Those sectors highlighted in red are those that clearly exceed ECC threshold (30% reduction) for the bay; yellow are those considered close to the threshold value and blue sectors are those below the ECC threshold.

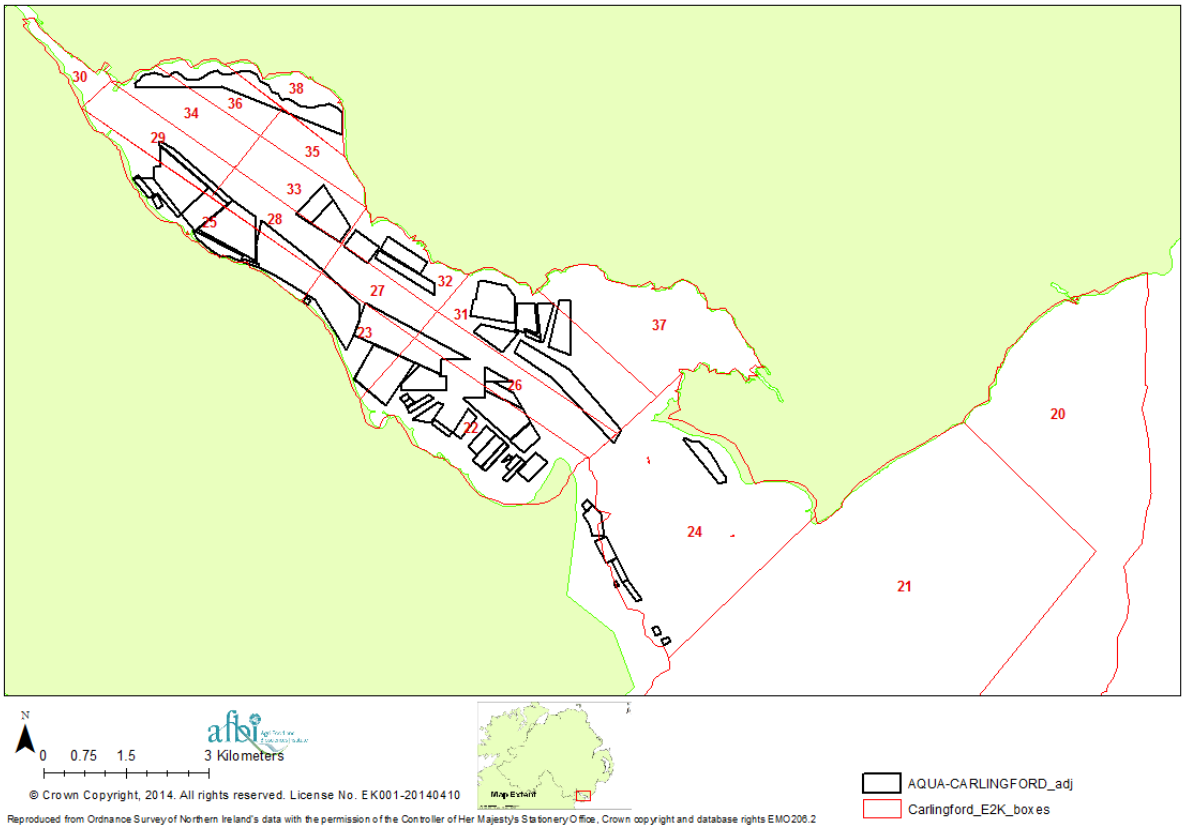

Figure 8-4 Model partition sectors considered and presented in the SMILE model run (Figure reproduced from AFBI 2015).

9 IN-COMBINATION EFFECTS OF AQUACULTURE, FISHERIES AND OTHER ACTIVITIES

9.1 FISHERIES

Extensive crab *Cancer pagurus* and lobster *Homarus gammarus* pot fishing occurs within Carlingford Lough, however as the Carlingford Shore SAC has no marine Qualifying Interests, there is no spatial overlap between fishing activities and marine annexed habitats.

Impacts from fishing on the SAC **can be discounted**.

10 SAC AQUACULTURE CONCLUDING STATEMENT

10.1 ASSESSMENT REPORT CONCLUDING STATEMENT

Current and proposed aquaculture activities occurring in the Carlingford Shore SAC focuses on the cultivation of oysters (using bags and trestles) in the intertidal zone and bottom cultivation of mussels in the subtidal zone. Based upon this and the information provided in the aquaculture profiling report (**Section 5**), the likely interaction between these culture methodologies and conservation features (habitats and species) of the SAC were considered.

10.1.1 Habitats

An initial screening exercise resulted in all habitats for which the Carlingford Shore SAC is designed for being excluded from further assessment as there is no overlap between these habitats and the aquaculture activities in the Lough.

10.1.2 Species

The likely interactions between the proposed aquaculture activities and seals was assessed as there are a number of haul out sites in Carlingford Lough despite these species not being qualifying interests of the Carlingford Shore SAC. Negative interactions with seals cannot be discounted at the haul out location entitled 'Seal Rock' on the southern shore of the Lough. It is recommended that the licencing at the relevant sites be carefully considered such that potential disturbance to seal is reduced to negligible levels.

The rest of the haul out locations within the bay are considered not at risk from current or proposed aquaculture practices.

10.1.3 Other considerations

Fishing activities in the Lough do not overlap annexed habitats for which the SAC is designated and as a result it is considered that fishing both alone and in-combination with aquaculture activities is non-disturbing the qualifying interests of the SAC.

On the basis of overlap of access routes with eel grass beds in the SAC, it is recommended that, if licencing is to proceed, alternative access routes be identified that specifically avoid eel grass beds and provide some buffer against accidental intrusion.

The ecological carrying capacity in Carlingford appears to be exceeded in all, bar two, aquaculture sectors and therefore, additional licencing is not recommended in these areas.

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