Annex I

Report supporting Appropriate Assessment of Aquaculture in

Slaney River Valley SAC

(Site Code: 000781)

and

Raven Point Nature Reserve SAC

(Site Code: 000710)

August 2016

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1 Preface

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

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

For aquaculture operations, DAFM receives applications to undertake such activity and submits a set of applications, at a defined point in time, for assessment. The aquaculture applications are then subject to AA. If the AA 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. These assessments 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

Slaney River Valley and Raven Point Nature Reserve SACs are designated as Special Areas of Conservation (SAC) under the Habitats Directive. The marine areas are designated for Estuaries [1130] and for Intertidal mud and sand flats not covered by seawater at low tide [1140]. The area supports a variety of sub-tidal and intertidal sedimentary community types including those that are sensitive to aquaculture related pressures (e.g. dredging in bottom shellfish culture). The area is also designated for and supports significant numbers of Harbour Seal and Otter while Salmon and Sea Lamprey and Twaite Shad, migrate through the harbour as smolts and as mature animals returning from sea. Conservation Objectives for these habitats and species (within the Slaney River Valley SAC and Raven Point Nature Reserve SAC) were identified by NPWS (2011a,c) and relate to the requirement to maintain habitat distribution, structure and function, as defined by characterizing (dominant) species in these habitats. For designated species the objective is to maintain various attributes of the populations including population size, cohort structure and the distribution of the species in the Bay. Guidance on the conservation objectives is provided by NPWS (2011b, d).

2.2 Activities in the SAC

There is a small range of aquaculture activities in the Bay.

Aquaculture activities

The main aquaculture activities within the SACs (and vicinity) are bottom culture of mussels as well as applications to carry out intertidal oyster culture and subtidal suspended mussel culture. The Pacific oyster (*Crassostrea gigas*) is cultured on trestles in intertidal areas. The profile of the aquaculture industry in the Bay, used in this assessment, was prepared by BIM and is derived from the list of licence applications received by DAFM and provided to the MI for assessment in March 2015.

2.3 The appropriate assessment process

The function of this appropriate assessment report is to determine if the ongoing and proposed aquaculture and fisheries 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 (2011b, d) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in the Bay. 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.

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 AA process is an initial screening wherein activities which cannot have, because they do not spatially overlap with a given habitat or have a clear pathway for interaction, any impact on the conservation features and are therefore excluded from further consideration. The next phase is the Natura Impact Statement (NIS) where interactions (or risk of) are identified. Further to this, an assessment on the significance of the likely interactions between activities and conservation features is conducted. Mitigation measures (if necessary) may be identified 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 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 unless otherwise indicated. In the case or risk assessments consequence and likelihood of the consequence occurring are scored categorically as separate components of risk. Risk scores are used to indicate the requirement for mitigation.

2.4 Data supports

Distribution of habitats and species population data are provided by NPWS[1]. Information on Aquaculture licences and applications are provided by DAFM[2]. 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 any findings. It should be noted that data supporting the assessment of individual activities vary and provides for varying degrees of confidence in the findings.

2.5 Findings

Aquaculture

In Slaney River Valley SAC and the Raven Point Nature Reserve SAC and environs there are a range of aquaculture activities currently being carried out and proposed. Based upon this and the information provided in the aquaculture profiling, the likely interaction between aquaculture methodology and conservation features (habitats and species) of the site was considered.

[1] NPWS Geodatabase Ver: September 2013 - http://www.npws.ie/mapsanddata/habitatspeciesdata/

[2] DAFM Aquaculture Database version Aquaculture: 30th Aug 2013

2.5.1 Annex I Habitats

In relation to habitats an initial screening exercise resulted in a number of habitat features being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur and no likely interactions were identified.

The habitats and species excluded from further consideration were:

1. 1029 Freshwater Pearl Mussel *Margaritifera margaritifera*
2. 1096 Brook Lamprey *Lampetra planeri*
3. 1099 River Lamprey *Lampetra fluviatilis*
4. 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Floating river vegetation)
5. 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
6. 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

Given the nature of the activities proposed for aquaculture in Slaney River Valley, it is unlikely that aquaculture activities will impact on the conservation attributes for Salmon, Sea Lamprey and Twaite Shad. On that basis, **Salmon (*Salmo salar*), Sea lamprey (*Petromyzon marinus)*** and the **Twaite shad (*Alosa fallax*)** were excluded from further analysis.

Applications for subtidal suspended mussel cultivation were also screened out of full assessment on the basis that;

1) there was no spatial overlap with the two SACs considered in the assessment report,
2) any impacts are likely to be localised on the seabed beneath the footprint of the proposed licences or given the high degree of flushing experienced at the sites, will result rapid dispersion of dissolved nutrients, and
3) based upon published accounts, the structures are unlikely to disturb resident species in the SAC, i.e. Harbour seal and Otter.

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the features Annex 1 habitats Mudflats and sandflats not covered by seawater at low tide (1140), Estuaries (1160) in both Slaney River Valley SAC (0781) and Mudflats and sandflats not covered by seawater at low tide (1140) in Raven Point Nature Reserve SAC (0710). The likely effects of the aquaculture activities were considered in light of the sensitivity of the constituent communities of these Annex 1 habitats. A number of issues were highlighted in Section 8.3 and relate to certain aquaculture and habitat interactions the conclusions of which are presented below.

Conclusion 1: The culture/collection of wild mussel seed on longlines and rafts that might occur outside of the boundaries but are proximate to the two SACs are deemed to be non-disturbing to the conservation features of the SAC.

Conclusion 2: By virtue of extensive spatial cover the levels of existing and proposed culture of bottom mussel culture activities are considered disturbing to habitat feature Estuaries (1130) and Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Slaney River Valley SAC.

Conclusion 3: By virtue of extensive spatial cover the levels of existing and proposed culture of bottom mussel culture activities are considered disturbing to the community type - Estuarine muds dominated by polychaetes and crustaceans community complex within the habitat feature Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Raven Point Nature Reserve SAC.

Conclusion 4: The proposal to culture oysters (intertidally on trestles) is not considered disturbing to habitat feature Estuaries (1130) and Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Slaney River Valley SAC.

Conclusion 5: Removal of seed resources from intertidal habitat will also result in disturbance to 1140 habitat features by destabilising the reef structure formed by mussels and reducing habitat complexity and associated biodiversity.

2.5.2 Annex II Species

The likely interactions between the proposed aquaculture activities and the Annex II Species Harbour Seal (*Phoca vitulina*) and Otter (*Lutra lutra*) were also assessed.

It is acknowledged in this assessment that the favourable conservation status of the Harbour seal (*Phoca vitulina*) has been achieved given current levels of aquaculture production within the SAC. The aspect of the culture activities that could potentially disturb the Harbour seal status relates to movement of people and vessels within the sites as well as accessing the sites over intertidal areas and via water.

Conclusion 7: The current levels of aquaculture production are considered non-disturbing to harbour seal conservation features in all areas of the SAC. It is important to note that area covered by the (subtidal) bottom mussel culture activities would appear to be considerably smaller than those represented by licenced areas, which extend into the intertidal areas. If actual production were to occur over or close to the seal haul-out areas then a risk of disturbance to seal cannot be discounted.

Conclusion 8: In relation to new licence applications, similar to licensed areas, there is considerable overlap with seal haul out locations and a number of new applications. If actual culture activities were to extend to intertidal/shallower areas proximate to the seal sites then this would present a risk to seals. On the basis of distance from the seal haul out locations, the proposed oyster trestle culture sites are considered non-disturbing to seal conservation features.

It is recommended that a range of potential mitigation factors are carefully considered when proposing management responses to the conclusions above. These features relate specifically to the

fact that mussels appear to have been a historical constituent in the waterbody, that the filtration capacity of the mussels may have a beneficial impact on the eutrophication status of the bay and that the habitat provision by mussels can be beneficial to the ecological function of the system. In summary, it is our view that based upon the information presented that bottom mussel culture, at current levels, does have an overall positive role in ecosystem. The addition of more mussels to the system (with new applications) may have additional benefit in terms of reducing effects of eutrophication, and may further improve status in the outer parts of Wexford Harbour relative to the Lower Slaney waterbody; however, this remains to be determined/confirmed and is subject to availability of additional seed. Other mitigating/qualifying factors that are important to clarify are;

1) mussel culture only occurs in deeper subtidal areas of the SAC and with one exception, it is anticipated that no culture (and disturbance from same) will occur in intertidal and shallow subtidal areas;
2) given the patchy nature of shellfish distribution on the seafloor, the areas where mussel culture will occur will not result in 100% cover of the seabed; however, it is expected that disturbance (dredging relating to harvest and/or maintenance) will occur over the entire area where mussels are placed, and;
3) The input of mussels into the system is limited by seed availability which, if consistent with previous inputs (of seed stock), will result in greater dilution of stock within larger surface areas licensed.

3 Introduction

This document assesses the potential ecological interactions of aquaculture activities within Slaney River Valley SAC (Site Code 000286) on the Conservation Objectives of the site (COs).

The information upon which this report is generated was carried out was based upon 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 during May 2014, as well as aquaculture profiling information provided on behalf of the operators by Bord Iascaigh Mara (BIM). The spatial extent of aquaculture licences was derived from a database managed by the DAFM[3] and shared with the Marine Institute.

4 Conservation Objectives

The appropriate assessment of aquaculture in relation to the Conservation Objectives for Slaney River Valley SAC (Site Code: 000781) is based on Version 1.0 of the objectives (NPWS 2011a -21 October, 2011) and supporting documentation (NPWS 2011b - August, 2011). The appropriate assessment of aquaculture in relation to the Conservation Objectives for Raven Point nature Reserve SAC (Site Code: 000710) is based on Version 1.0 of the objectives (NPWS 2011c - December, 2011) and supporting documentation (NPWS 2011d - August, 2011). The spatial data for conservation features was also provided by NPWS[4].

4.1 Slaney River Valley SAC extent

Slaney River Valley SAC (Figure 1) is a large site situated on the southeast coast of Ireland, comprising extensive terrestrial, freshwater, estuarine and marine features. In addition, 6 aquatic species as well as two mammal species are designated within the site. Specific to marine habitats, the site is comprised of two Annex I habitats, estuaries [1130] and mudflats and sandflats not covered by seawater at low tide (1140].

[3] DAFM Aquaculture Database version Aquaculture: October 2014
[4] NPWS Geodatabase Ver: September 2014 - http://www.npws.ie/mapsanddata/habitatspeciesdata/

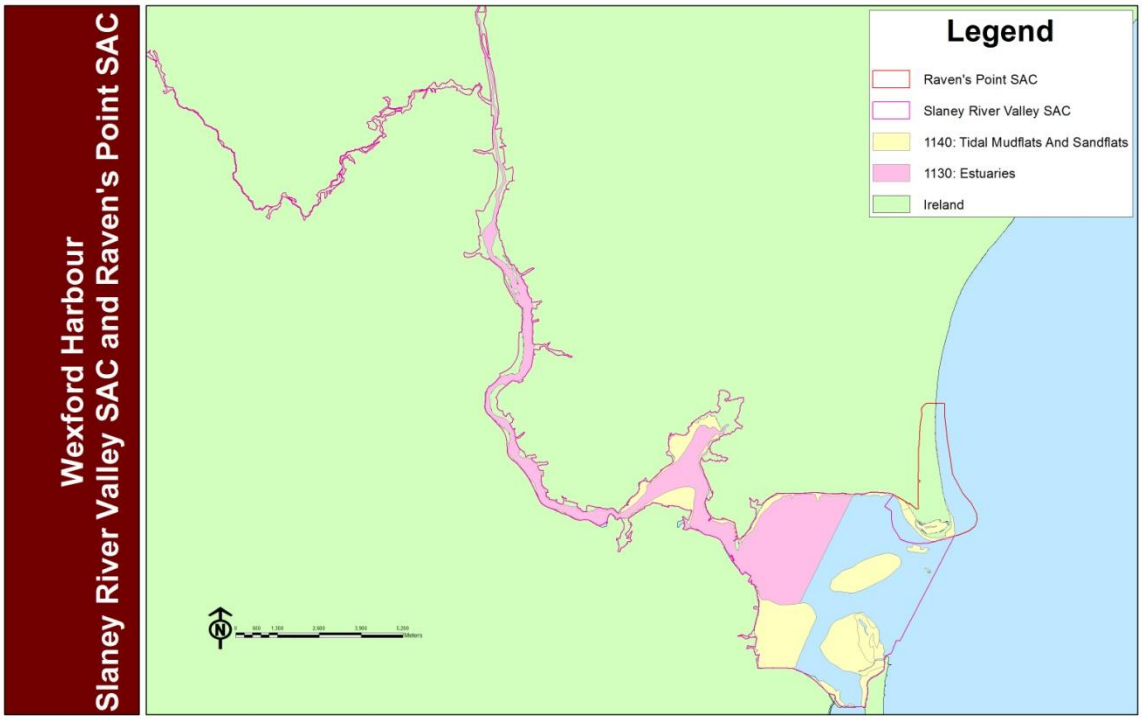

Figure 1. The extent of Slaney River Valley SAC (Site Code: 000781) and Raven Point Nature Reserve SAC and qualifying marine habitats.

4.1.1 Qualifying interests (SAC)

The SAC is designated for the following habitats and species (NPWS 2011a), as listed in Annex I and II of the Habitats Directive:

- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera*
- 1095 Sea Lamprey *Petromyzon marinus*
- 1096 Brook Lamprey *Lampetra planeri*
- 1099 River Lamprey *Lampetra fluviatilis*
- 1103 Twaite Shad *Alosa fallax*
- 1106 Atlantic Salmon *Salmo salar* (only in fresh water)
- 1130 Estuaries
- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1355 Otter *Lutra lutra*
- 1365 Harbour Seal *Phoca vitulina*
- 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Floating river vegetation)
- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
- 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

Three constituent community complexes recorded within the qualifying interests of Estuaries (1130) and Mudflats and sandflats not covered by seawater at low tide (1140) are listed below (NPWS 2011a Ver 1) and illustrated in Figure 2.

- **Mixed sediment community complex;**
- **Estuarine muds dominated by polychaetes and crustaceans community complex; and**
- **Sand dominated by polychaetes community complex.**

An additional community complex, 'fine sand with *Spiophanes bombyx* community complex', is described for subtidal elements outside of the Estuaries habitat.

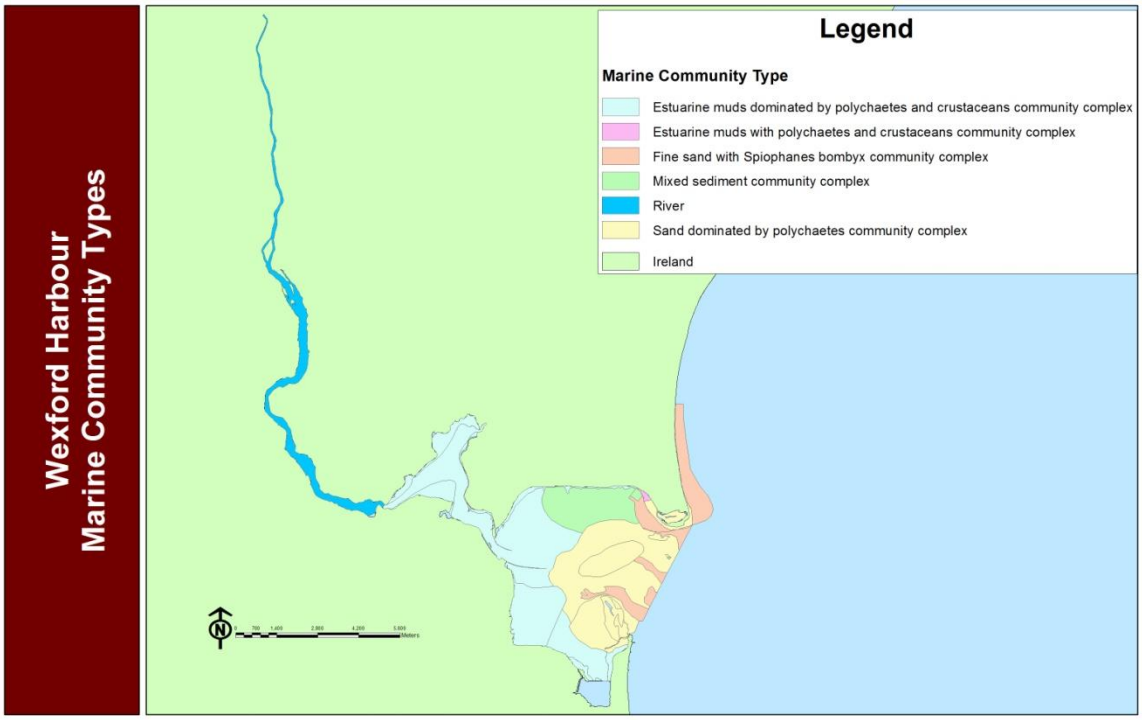

Figure 2 Principal benthic communities recorded within the qualifying interests of Slaney River Valley SAC (Site Code: 000781) and Raven Point Nature Reserve SAC (Source: NPWS, 2011a, c).

The Slaney River Valley SAC is designated for the Harbour seal (*Phoca vitulina*). The site has been the subject of targeted monitoring surveys in 2003 (Cronin et al. 2003) and 2012 (Duck and Morris, 2013). During 2003, 17 harbour seals were recorded from two locations within the SAC. In 2012, this increased to 49. In the intervening period, additional records from within the site comprised 22 seals of all ages ashore in early September 2007 and 27 in early September 2009 (NPWS 2011).

A number of different locations have been identified within the SAC and are considered important to the overall welfare and health of the populations at the site. Figure 3 identifies these locations and

distinguishes between breeding, moulting and resting sites. These sites are broadly concentrated on sandbanks at the central and eastern boundaries of the SAC. Both moulting and breeding locations are considered particularly sensitive periods in the life cycle of the seals, i.e. NPWS. The pupping season (May-July) and moulting season (August-September) and are clearly defined and important to the overall health of the population in the SAC and that any disturbance during these times should be kept to a minimum. Less information is known about resting period (October-April) and resting areas throughout the SAC. However, the resting locations provided on Figure 3 are identified on the basis of sightings; however, all sheltered areas within the entire SAC are considered suitable habitat for resting (NPWS, 2013a). The importance of the resting sites are likely a function of the abundance of seals using the site and/or the degree of shelter afforded the location.

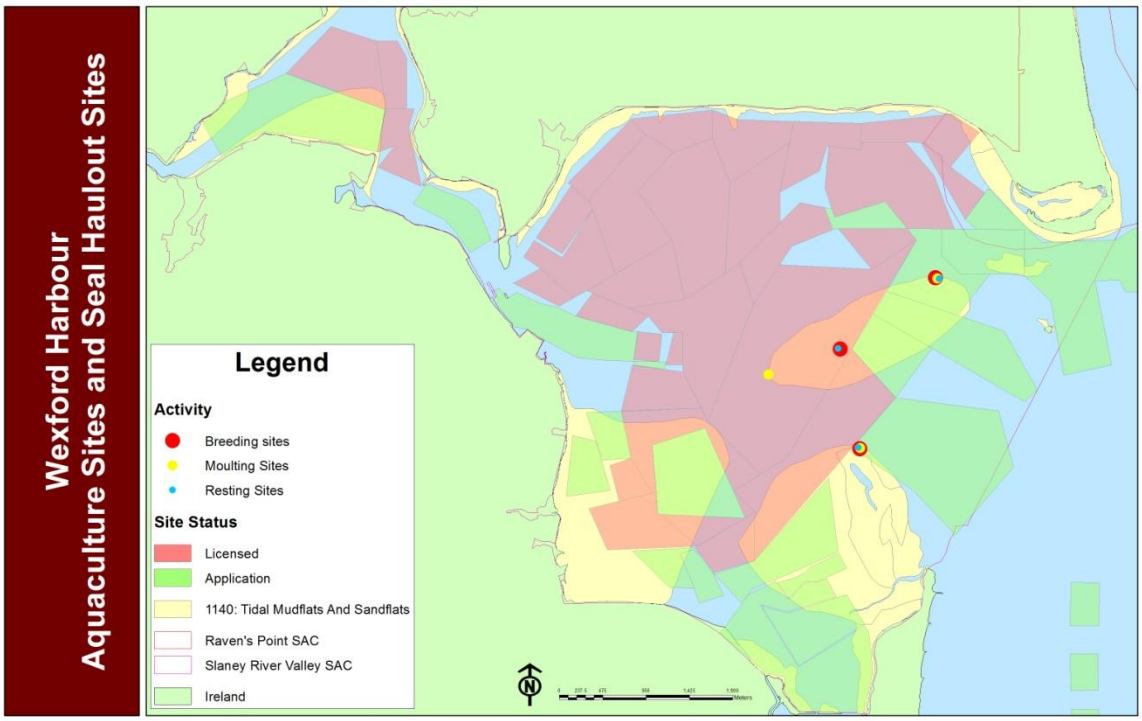

Figure 3 Harbour Seal (*Phoca vitulina*) locations in Slaney River Valley SAC (Site Code: 000781) (Sources: DAFM and NPWS, 2011a).

4.1.2 Conservation objectives

The conservation objectives for the qualifying interests of the Slaney River Valley (000781) were identified by NPWS (2011a) and NPWS (2011b), respectively. The natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution. Habitat availability should be maintained for designated species and human disturbance should not adversely affect such species. The features, objectives and targets of each of the qualifying interests within the SACs are listed in Table 1 below.

Table 1 Conservation objectives and targets for marine habitats and species in Slaney River Valley SAC (000781) (NPWS 2011a). Annex I and II features listed in bold.

FEATURE (COMMUNITY TYPE)	OBJECTIVE	TARGET
1130 ESTUARIES	Maintain favourable conservation condition	1,905ha; Permanent habitat is stable or increasing, subject to natural processes
MIXED SEDIMENT COMMUNITY COMPLEX		200 ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
ESTUARINE MUDS DOMINATED BY POLYCHAETES AND CRUSTACEANS COMMUNITY COMPLEX		587ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
SAND DOMINATED BY POLYCHAETES COMMUNITY COMPLEX		441ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
1140 MUDFLATS AND SANDFLATS NOT COVERED BY SEAWATER AT LOW TIDE	Maintain favourable conservation condition	1,027ha; Permanent habitat is stable or increasing, subject to natural processes
ESTUARINE MUDS DOMINATED BY POLYCHAETES AND CRUSTACEANS COMMUNITY COMPLEX		587ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
SAND DOMINATED BY POLYCHAETES COMMUNITY COMPLEX		441ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
1029 FRESHWATER PEARL MUSSEL *MARGARITIFERA MARGARITIFERA*	Currently under review	Currently under review

FEATURE (COMMUNITY TYPE)	OBJECTIVE	TARGET
1095 SEA LAMPREY *PETROMYZON MARINUS*	Restore to favourable conservation condition	For a number of attributes - Greater than 75% of main stem length of rivers accessible from estuary; At least three age/size groups present; Juvenile density at least 1/m²; No decline in extent and distribution of spawning beds; Improved dispersal of spawning beds into areas upstream of barriers; More than 50% of sample sites positive.
1096 BROOK LAMPREY *LAMPETRA PLANERI*	Restore to favourable conservation condition	For a number of attributes - Access to all water courses down to first order streams; At least three age/size groups of brook lamprey present; Mean catchment juvenile density of brook/river lamprey at least 2/m²; No decline in extent and distribution of spawning beds; More than 50% of sample sites positive
1099 RIVER LAMPREY *LAMPETRA FLUVIATILIS*	Restore to favourable conservation condition	For a number of attributes - Greater than 75% of main stem length of rivers accessible from estuary; At least three age/size groups of river lamprey present; Mean catchment juvenile density of brook/river lamprey at least 2/m²; No decline in extent and distribution of spawning beds; More than 50% of sample sites positive
1103 TWAITE SHAD *ALOSA FALLAX*	Restore to favourable conservation condition	Greater than 75% of main stem length of rivers accessible from estuary; more than one age class present; No decline in extent and distribution of spawning habitats; DO concentration should be no lower than 5 mg/L; Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth.
1106 ATLANTIC SALMON *SALMO SALAR* (ONLY IN FRESH WATER)	Restore to favourable conservation condition	For a number of attributes - 100% of river channels down to second order should be accessible from estuary; the Conservation Limit (CL) for each system should be consistently exceeded; Maintain or exceed 0+ fry mean

FEATURE (COMMUNITY TYPE)	OBJECTIVE	TARGET
		catchment-wide abundance threshold value which is currently set at 17 salmon fry/5 min electrofishing sampling; no significant decline in smolt abundance; No decline in number and distribution of spawning redds; due to anthropogenic causes; Salmon spawn in clean gravels; Water quality set at EPA Q4 at all sites.
1355 OTTER *LUTRA LUTRA*	Restore to favourable conservation condition	Maintain distribution - 88% positive survey sites nationally from 1981 baseline, No significant decline in extent of marine habitat; Couching sites and holts - no significant decline and minimise disturbance: Fish biomass - No significant decline in marine fish species in otter diet. Barriers to connectivity - No significant increase.
1365 HARBOUR SEAL *PHOCA VITULINA*	Maintain favourable conservation condition	The range of use within the site should not be restricted by artificial barriers; all sites (breeding, moult haul-out, resting) should be maintained in natural condition; human activities should occur at levels that do not adversely affect harbour seal population at the site.
3260 WATER COURSES OF PLAIN TO MONTANE LEVELS WITH THE *RANUNCULION FLUITANTIS* AND *CALLITRICHO-BATRACHION* VEGETATION (FLOATING RIVER VEGETATION)	Maintain favourable conservation condition	No decline of habitat distribution, subject to natural processes; Habitat area stable; Maintain appropriate hydrological regimes; Maintain natural tidal regime; For the tidal subtype, the substratum of the channel must be dominated by particles of sand to gravel, with silt at the river margins; The concentration of nutrients in the water column must be sufficiently low to prevent changes in species composition or habitat condition; for vegetation composition the typical species of the relevant habitat sub-type reach favourable status; The area of active floodplain at and upstream of the habitat must be maintained.

FEATURE (COMMUNITY TYPE)	OBJECTIVE	TARGET
91A0 OLD SESSILE OAK WOODS WITH *ILEX* AND *BLECHNUM* IN THE BRITISH ISLES	Maintain favourable conservation condition	Habitat area stable or increasing; No decline in habitat distribution; Woodland size stable or increasing; Diverse structure with a relatively closed canopy containing mature trees; Maintain diversity and extent of community types; Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy; At least 30m³/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter; No decline in mature and veteran trees; no decline in indicators of local distinctiveness; no decline in native tree cover with a broad representation of native species and control of invasive taxa.
91E0 * ALLUVIAL FORESTS WITH *ALNUS GLUTINOSA* AND *FRAXINUS EXCELSIOR* (*ALNO-PADION, ALNION INCANAE, SALICION ALBAE*)	Restore to favourable conservation condition	Habitat area stable or increasing; no decline in habitat distribution; woodland area stable or increasing with diverse population and community structure (including dead wood) to allow for natural regeneration; Appropriate hydrological regime necessary for maintenance of alluvial vegetation; no declin in mature trees, native trees or indicators of local distinctiveness with control of invasive taxa;

4.2 Raven Point Nature Reserve SAC extent

Ravens Point Nature Reserve SAC a small reserve site situated on the southeast coast of Ireland adjacent to the Slaney River Valley SAC, comprising coastal and marine features (Figure 1).

4.2.1 Qualifying interests (SAC)

The SAC is designated for the following habitats (NPWS 2011c), as listed in Annex I and II of the Habitats Directive:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1210 Annual vegetation of drift lines
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 2110 Embryonic shifting dunes
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
- 2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')
- 2170 Dunes with *Salix repens ssp. argentea (Salicion arenariae*)
- 2190 Humid dune slacks

Three constituent community complexes recorded within the qualifying interest Mudflats and sandflats not covered by seawater at low tide (1140) are listed below (NPWS 2011c) and illustrated in Figure 2.

- **Mixed sediment community complex**
- **Estuarine muds dominated by polychaetes and crustaceans community complex**
- **Fine sand with *Spiophanes bombyx* community complex**
- **Sand dominated by polychaetes community complex**

4.2.2 Conservation objectives

The conservation objectives for the qualifying interests of the Raven Point Nature Reserve SAC (000710) were identified by NPWS (2011c) and NPWS (2011d), respectively. The natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution. Human disturbance should not adversely affect such habitats. The features, objectives and targets of each of the qualifying interests within the SACs are listed in Table2 below.

Table 2. Conservation objectives and targets for marine habitats and species in Raven Point Nature Reserve SAC (000710) (NPWS 2011b). Annex I and II features listed in bold.

FEATURE (COMMUNITY TYPE)	OBJECTIVE	TARGET
1140 MUDFLATS AND SANDFLATS NOT COVERED BY SEAWATER AT LOW TIDE	Maintain favourable conservation condition	73ha; Permanent habitat is stable or increasing, subject to natural processes
ESTUARINE MUDS DOMINATED BY POLYCHAETES AND CRUSTACEANS COMMUNITY COMPLEX		8ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
SAND DOMINATED BY POLYCHAETES COMMUNITY COMPLEX		65ha; Conserved in a natural condition, significant continuous or ongoing disturbance should not exceed <15% of area
1210 ANNUAL VEGETATION OF DRIFT LINES	Maintain favourable conservation condition	0.37ha; 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.
1330 ATLANTIC SALT MEADOWS (*GLAUCO-PUCCINELLIETALIA MARITIMAE*)	Maintain favourable conservation condition	0.22ha; 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.
2110 EMBRYONIC SHIFTING DUNES	Restore favourable conservation condition	1.13ha; 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.
2120 SHIFTING DUNES ALONG THE SHORELINE WITH *AMMOPHILA ARENARIA* ("WHITE DUNES")	Restore favourable conservation condition	9.38ha; 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
2130 FIXED COASTAL DUNES WITH HERBACEOUS VEGETATION (GREY DUNES)	Restore favourable conservation condition	22.65ha; 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.
2170 DUNES WITH *SALIX REPENS SSP. ARGENTA (SALICION ARENARIAE*)	Maintain favourable conservation condition	0.14ha; Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.

FEATURE (COMMUNITY TYPE)	OBJECTIVE	TARGET
2190 HUMID DUNE SLACKS	Restore favourable conservation condition	0.75ha; 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.

4.3 Screening of Adjacent SACs

In addition to the two SACs under consideration in this report, Slaney River Valley SAC and Raven's Point SAC, there are a number of other Natura 2000 sites proximate to the proposed activities (Figure 4). The characteristic features of these sites are identified in Table 3 where a preliminary screening is carried out on the likely interaction with aquaculture and fishery activities based primarily upon the likelihood of spatial overlap or other interactions (*ex-situ* effects). All qualifying features screen out and are not considered further in this assessment.

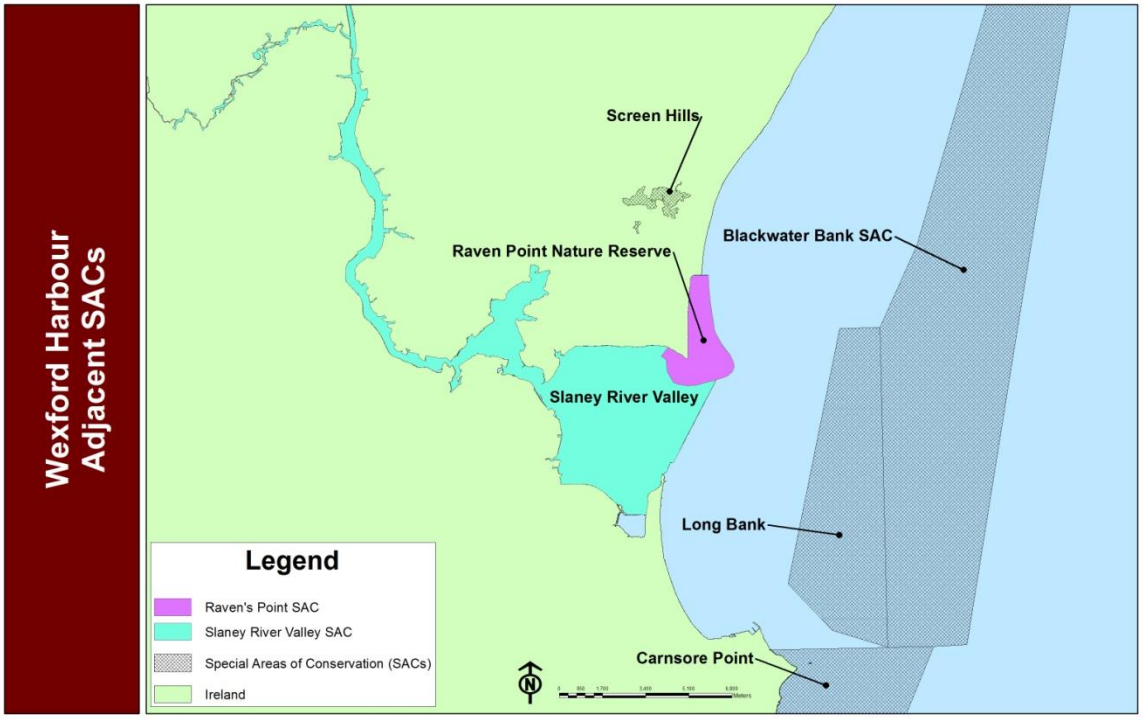

Figure 4. Natura 2000 sites adjacent to the Slaney River Valley SAC and the Raven Point Nature Reserve SAC.

Table 3: Natura Sites adjacent to Slaney River Valley SAC and Raven Point Nature Reserve SAC and qualifying features with initial screening assessment on likely interactions with fisheries and aquaculture activities

NATURA SITE	QUALIFYING FEATURES [HABITAT CODE]	FISHERY AND AQUACULTURE INITIAL SCREENING
Carnsore Point SAC (002269)	Mudflats and sandflats not covered by seawater at low tide [1140]	No spatial overlap or likely interaction with fisheries and aquaculture activities Slaney River Valley and Raven Point Nature Reserve SACs – excluded from further consideration.
	Reefs [1170]	No spatial overlap or likely interaction with fisheries and aquaculture activities Slaney River Valley and Raven Point Nature Reserve SACs – excluded from further consideration.
Long Bank SAC (002161)	Sandbanks which are slightly covered by sea water all the time [1110]	Bottom mussel aquaculture relies predominantly on seed mussels fished from the Irish Sea, including beds adjacent and found within the Long Bank SAC. An assessment of this activity has been required and published at the following site. http://www.fishingnet.ie/sea-fisheriesinnaturaareas/concludedassessments/irishsea-includingmusselseedfishery/#d.en.72197 Given the assessment of the fishery has been completed, and there is no spatial overlap of aquaculture activities on this SAC this site is excluded from further consideration.
Screen Hills SAC (000708)	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]	No spatial overlap or likely interaction with fisheries and aquaculture activities Slaney River Valley and Raven Point Nature Reserve SACs – excluded from further consideration.

NATURA SITE	QUALIFYING FEATURES [HABITAT CODE]	FISHERY AND AQUACULTURE INITIAL SCREENING
	European dry heaths [4030]	No spatial overlap or likely interaction with fisheries and aquaculture activities Slaney River Valley and Raven Point Nature Reserve SACs – excluded from further consideration.
Blackwater Bank SAC (002953)	Sandbanks which are slightly covered by sea water all the time [1110]	Bottom mussel aquaculture relies predominantly on seed mussels fished from the Irish Sea, including beds adjacent and found within the Blackwater Bank SAC. An assessment of this activity has been required and published at the following site. http://www.fishingnet.ie/sea-fisheriesinnaturaareas/concludedassessments/irishsea-includingmusselseedfishery/#d.en.72197 Given the assessment of the fishery has been completed, and there is no spatial overlap of aquaculture activities on this SAC this site is excluded from further consideration.

5 Aquaculture Activities

5.1 Shellfish Aquaculture

Aquaculture in Slaney River Valley and the Raven Point Nature Reserve SACs focuses solely on shellfish species (oysters and mussels; Figures 5). Spatial extents of existing and proposed activities within the qualifying interests (Mudflats and sandflats not covered by sea water at low tide (1140), Estuaries (1130)) within the two SACs were calculated using coordinates of activity areas in a Geographic Information System (GIS).

The spatial extent of the various aquaculture activities (current and proposed) overlapping the habitat features of the Slaney River Valley SAC is presented in Table 4. The level of spatial overlap between aquaculture (licenced and applications) activities and Mudflats and Sandflats not covered by sea water at low tide is 608ha, which represent 59.2% of this Annex I habitat feature within the SAC; between aquaculture (licenced and applications) activities and Estuaries is, approximately, 990ha which is equivalent to 52% of the feature.

Within the Raven Point Nature Reserve SAC, the level of spatial overlap between aquaculture activities (active and proposed) and Mudflats and Sandflats not covered by sea water at low tide is 2.6 ha, which represent 3.6% of this Annex I habitat feature within the SAC (Table 5).

5.1.1 Oyster culture-Intertidal (Slaney River Valley SAC only)

The Pacific oyster, *Crassostrea gigas*, is the oyster species proposed for cultivation in the Slaney River Valley SAC. There primary production method is suspended culture, using the bag and trestle method. The bag and trestle method uses steel table-like structures which rise from the shore to just above knee height on the middle to lower intertidal zone, arranged in double rows with wide gaps between the paired rows to allow for access. The trestles hold plastic (HDPE) bags approximately 1m by 0.5m by 10cm, which are closed and fastened to the trestles using rubber and wire clips. When first put to sea, there may be up to 2000 oysters in a single bag, but as they grow and are graded this number is gradually reduced. Over the course of the two or three years that it takes an oyster to reach market size, the density is reduced until market ready oysters, of approximately 100g each (when grown to full size) are being grown in bags of approximately 100 oysters per bag.

5.1.2 Mussel culture

The vast majority of seed mussels are sourced off the east coast which is regulated by the DAFM. The range of seed size sourced is 15-40mm but the ideal range is 25-35mm. Variations in seed quality among the seed beds do exist within years and between years. For example, seed sourced from the Cahore area was usually regarded as more delicate, whereas Wicklow seed would in the past have

been regarded as more robust. The quantity of seed available on the east coast varies considerably between years. In poor seed years seed intake may be supplemented by rope seed from Ireland or bottom dredged/hand raked seed from Morcambe Bay, UK (subject to separate assessment). The preference by operators is for East Coast Seed.

In general, the seed sourced on the east coast beds is brought back into the harbour on the same day for relaying. The opening of the seed beds vary and is dependent on when DAFM authorise it. Late summer is normally the seed fishing period.

Two sites within the harbour are proposed to be used for seed collection which involves identifying natural intertidal mussel settlement within the sites and relocating the seed mussels to subtidal areas.

The stocking density of seed within the harbour varies across each producer and is site dependent. At present the seed stocking density ranges from 10-60 T/Ha with the average around 30 T/Ha. Relaying of seed mussels from the hold is carried out by water jet through holes in the side of vessel. Once relayed it can take from 12-24 months to reach market size but the average is around 18 months. However the time on the relay plot can depend on the stock level from the previous year, the progression of sales from the previous year's stock, the progression of sales of the current year's stock, the market price and demand and the fluctuations of meat yield levels. Mussels sold have to be purified and degritted as Wexford Harbour outer is classified as B. Wexford Inner is classified as C and mussels from here would have to be moved out into the outer harbour for finishing to have them classified as B mussels.

During the ongrowing period after relaying of seed, stock can be fished for starfish and green crab although not all producers do this. There are two boats fishing for green crab across the harbour on a variety of sites where they have permission or licence. Starfish are generally confined to the outer sections of the harbour closer to the Raven Point.

Some producers move stock between sites e.g. they may have ground that is good for finishing (maximising meat yield) and will ensure to finish their stock on such grounds. Cleaning of the sites is normally done through the action of harvesting. Most harvesting is carried out from September to April with many operators finished up by Christmas. Some harvesting can be carried out during the summer months also depending on the market. The slack time is normally February to June. During this time monthly sampling occurs to track stock quality. However, during the harvesting period sites would be accessed more frequently and this varies considerably among the producers and is probably dependent on the quantity of stock the producer normally exports. During the harvesting season access varies from 1 to 6 times per week. Access to sites usually happens between half flood to half ebb where the tidal restriction is 3 hrs either side of high tide and for some sites the restriction is greater (1.5 hours before and after high tide). On existing renewals it is important to note that

dredgers do not access sites at low water unless the site is a deep site such as in parts of Wexford Inner Harbour and along the main channel from the bridge down to the end of the training walls.

During harvesting and relaying the dredgers move slowly over the site. With dredges trailing about 30m behind which when full are winched in and the contents emptied into the hold. Once in the hold mussels are moved up a conveyor belt through a washer and crabs/starfish are picked off along with stones/waste. The mussels are then directed by conveyor to one tonne bags hanging in the other part of the hold. Normally about 20 Tonnes are harvested for each transport to the market. Unloading from the boat is either carried out at the quayside by an onboard crane or using a crane on a lorry onto wooden pallets which are then loaded into a transport lorry.

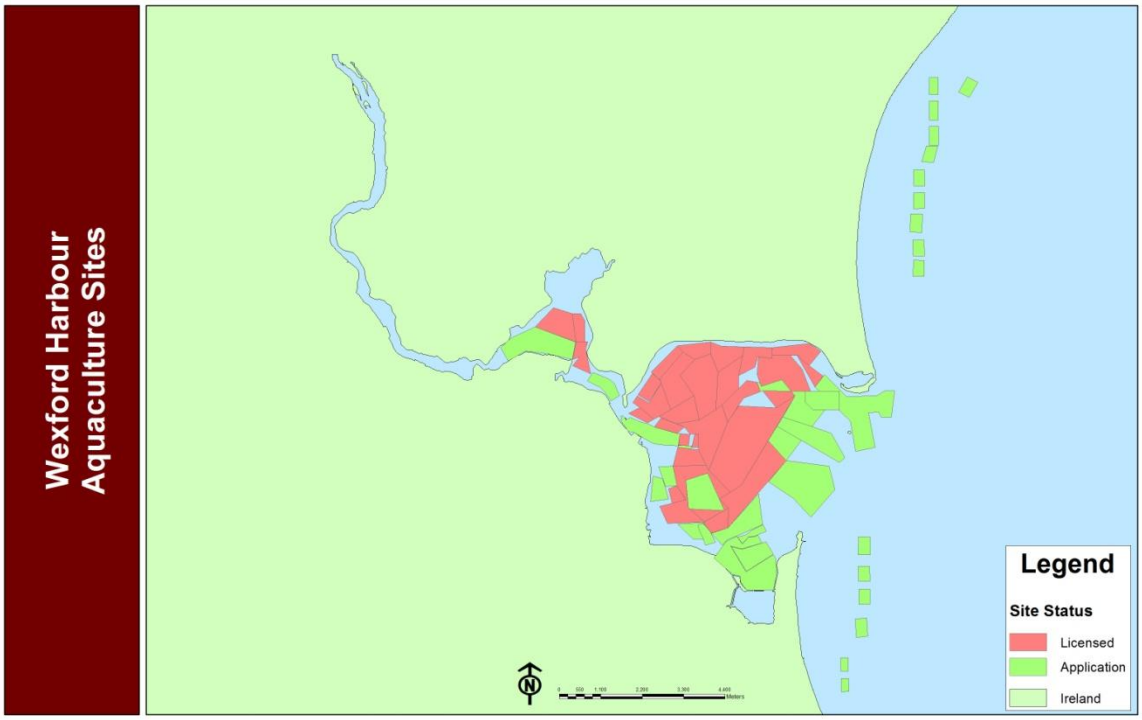

Figure 5. Proposed and existing shellfish culture activity within the Slaney River Valley SAC and Ravens Point Nature Reserve SAC (Source: DAFM).

Table 4: Spatial extent (ha) of aquaculture activities overlapping with the marine qualifying interests in Slaney River Valley SAC presented according to culture species, method of cultivation and license status.

Species	Status	Location	1130 Estuaries (1,905 ha)		1140 Mudflats and sandflats not covered by seawater at low tide (1,027ha)	
			Area (ha)	% Feature	Area (ha)	% Feature
Oysters	Application	Intertidal	22.13	1.16	33.6	3.2
Mussels	Licensed	Subtidal	756.83	39.75	228.8	22.3
Mussels	Application	Subtidal	211.10	11.08	345.6	33.7
Totals			990.06	51.99%	608	59.2%

Table 5. Spatial extent (ha) of aquaculture activities overlapping with the marine qualifying interests of Raven Point Nature Reserve SAC presented according to culture species, method of cultivation and license status.

Species	Status	Location	1140 Mudflats and sandflats not covered by seawater at low tide (73ha)	
			Area (ha)	% Feature
Mussels	Licensed	Subtidal	2.4	3.3
Mussels	Application	Subtidal	0.19	0.3
Totals			2.59	3.6%

Suspended Mussel Culture

In addition to bottom mussel culture and intertidal oyster activities currently occurring or proposed within the SACs there are a number of applications (16) for the culture of mussels using suspended culture outside the boundaries of the two SACs (Figure 5). There are two operators applying for the 16 sites (Operators A and B applying for 5 and 11 sites, respectively).

Suspended mussel cultivation will involve mussel seed collection on ropes suspended from longlines or a combination of longlines and rafts. The longlines will be aligned across the tidal flow and will be spaced a minimum of 10 m apart and will occupy a total area of 1 ha in each site (Operator A). Operator B will use around 20% of the surface area of each site. Therefore, the total production area will be 29.6 ha.

Projected production is 75 tonnes of seed per site, or 375 tonnes for the five sites combined for one operator while the second operator. Operator B's projected production is 7-8 tonnes/ha, which would amount to 861-984 tonnes for the 11 sites combined. The size of the mussel seed when harvested will be 25-30 mm (Operator A), or 5-20 mm (Operator B).

The mussel seed settlement will be collected between April and September, with the seed harvest being relayed in late September. All structures with the exception of the mooring blocks and navigational marks will be taken in after harvest and redeployed in late March.

The only activity by Operator A between October and March will be basic maintenance to the permanent navigation buoys. This will require a visit once a month, or after very bad weather. Operator B has not indicated any activity between October and March.

There will be no site cleaning, no fallowing, no predator control, no stock movement other than to harvest and/or relay to other sites. Stock maintenance will involve checking droppers and lines.

The sites will be accessed by boat from Wexford Harbour through the main navigation channel. Operator A will visit sites on five days per week. Operator B will make one round trip per week. Both operators will visit all their sites on the same day.

6 Natura Impact Statement for the proposed activities

The potential ecological effects of activities on the conservation objectives for the site relate to the physical and biological effects of aquaculture structures and human activities on designated species, intertidal and sub-tidal community types within the habitat features (e.g., 1130 and 1140). 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.

6.1 Aquaculture

Within the Slaney River Valley SAC, the species cultured are:

1. Oysters (*Crassostrea gigas*) in suspended culture (bags & trestles) confined to intertidal areas.
2. Mussels (*Mytilus edulis*) on-bottom in subtidal areas.

Within the Raven Point Nature Reserve SAC, the species cultured is:

1. Mussels (*Mytilus edulis*) on-bottom in subtidal areas.

Details of the potential biological and physical effects of these aquaculture activities on the habitat features, their sources and the mechanism by which the impact may occur are summarised in Table 6 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 shellfish culture (e.g. Black 2001; McKindsey et al. 2007; National Research Council 2010; O'Beirn et al 2012; Cranford et al 2012; ABPMer, 2013a-h).

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

One aspect to consider in relation to the culture of shellfish is the potential risk of alien species arriving into an area among consignments of seed or stock sourced from outside of the area under consideration (Brenner et al., 2014). When the seed is sourced locally (e.g. suspended mussel culture, Irish Sea) the risk is likely zero. When seed (e.g. oysters) is sourced at a small size from hatcheries in Ireland the risk is also small. When seed is sourced from hatcheries outside of Ireland (this represents the majority of cases particularly for oyster culture operations) the risk is also considered small, especially if the nursery phase has been short. When ½-grown stock (oysters and mussels) is introduced from another area (e.g. France, UK) the risk of introducing alien species (hitchhikers) is considerably greater given that the stock will have been grown in the wild for a prolonged period (i.e. ½-grown stock) or may have actually been sourced from wild-set.

Furthermore, the culture of a non-native species (e.g. the Pacific Oyster - *Crassostrea gigas*) also presents a risk of establishment of this species in the SAC. Recruitment of *C. gigas* has been documented in a number of bays in Ireland and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann et al 2012; 2013). Factors deemed to influence the successful recruitment of *C. gigas* include; residence time of the bay, presence of suitable habitat (hard substrata and/or biogenic reef) and large intertidal areas (Kochmann et al., 2013). However, a recent study (Kochmann and Crowe, 2014) has identified heavy macroalgal cover as a potential factor governing successful recruitment, with higher algal cover resulting in lower recruitment. The use of triploid (putatively non-reproducing) stock is the main method employed to manage this risk of successful reproduction.

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

1. Hydrography – low current speeds (or tidal range) may result in material being deposited directly beneath the trestles. If tidal height is high and large volumes of water moved through the culture area an acceleration of water flow can occur beneath the trestles and bags, resulting in a scouring effect or erosion and no accumulation of material.

2. Turbidity of water – as with suspended mussel culture, 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 increase build-up of material beneath culture structures.
3. Density of culture – the density of oysters in a bag and consequently the density of bags on a trestle will increase the likelihood of accumulation on the seafloor. In addition, if the trestles are located in close proximity a greater dampening effect can be realised with resultant accumulations. Close proximity may also result in impact on shellfish performance due to competitive interactions for food.
4. Exposure of sites - the degree to which the aquaculture sites are exposed to prevailing weather conditions will also dictate the level of accumulated organic material in the area. As fronts move through culture areas increased wave action will resuspend and disperse material away from trestles.

Shading may also be an issue as a consequence of the structures associated with intertidal oyster culture and impact on sensitive species (e.g. sea grasses) found underneath (Skinner et al., 2014).

The structures used for culture of shellfish (subtidal and intertidal) may facilitate the introduction and establishment and of some non-native species. Structures also may provide nektonic organisms with protection against predation, act as aggregation devices and may increase production (National Research Council 2009)

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 (Forde et al., 2015).

Removal of seed resources from intertidal habitat will also result in disturbance to habitat features by destabilising the reef structure formed by mussels and reducing habitat complexity and associated biodiversity.

Sub-tidal mussel culture: This activity involves relaying mussels on the seabed. There may be increased enrichment due to production of faeces and pseudofaeces. The existing in-faunal community may be changed as a result. Seabed habitat change may also be a consequence of dredging during maintenance and harvesting. The activities associated with this culture practice (dredging of the seabed) are considered disturbing which can lead to removal and/or destruction of infaunal species and changes to sediment composition. In addition, the location of large numbers of a single epifaunal species onto what is, in essence, an infaunal dominated system will likely result in a change to

structure and function of the habitat this is particularly true if the area has no history of natural mussel or shellfish beds. Finally, the transfer of seed stock (mussel) from one broad geographic location to another presents a risk of introduction of non-native species (hitch-hikers) or other threats (Brenner et al., 2014).

Other considerations: Due to the nature of the (high density) culture methods the risk of transmission of disease within cultured stock is high. The risk of disease transmission from cultured oysters/mussels to other species is unknown.

Table 6. Potential indicative environmental pressures of aquaculture and fishing activities within Slaney River Valley SAC (Site Code: 000781).

CULTURE / FISHING METHOD	PRESSURE CATEGORY	PRESSURE	POTENTIAL EFFECTS	EQUIPMENT	DURATION (DAYS)	TIME OF YEAR	FACTORS CONSTRAINING THE ACTIVITY/EFFECTS
Suspended **Bags & trestles (Oysters)**	**Biological**	Deposition	Faecal and pseudofaecal deposition on seabed potentially altering sediment and community composition		365	All year	Hydrography, Turbidity, Culture/structure density
		Seston filtration	Alteration of phyto/zooplankton communities and potential impact on carrying capacity		365	All year	Culture density, Turbidity
		Shading	Prevention of light penetration to seabed potentially impacting light sensitive species		365	All year	Culture/structure density
		Introduction of non-native species	Potential for non-native culture and 'hitchhiker' species to become naturalized. Potential for structures to act as habitat for non-native species.				Screening/ Culture method/ Introduce biosecurity plan/seed from low-risk sources
		Disease risk	Potential for disease introduction and uncontrolled spread				Screening/ Introduce biosecurity plan
		Nutrient exchange	Changes in ammonium and dissolved inorganic nitrogen resulting in increased primary production. N_2 removal at harvest or denitrification at sediment surface.				Culture density

CULTURE / FISHING METHOD	PRESSURE CATEGORY	PRESSURE	POTENTIAL EFFECTS	EQUIPMENT	DURATION (DAYS)	TIME OF YEAR	FACTORS CONSTRAINING THE ACTIVITY/EFFECTS
	Physical	Current alteration	Structures may alter the current regime resulting in increased deposition of fines or scouring therefore changing sedimentary composition	Long lines, Bags, Trestles, Floats etc	365	All year	Culture/structure density
		Surface disturbance	Ancillary activities at intertidal sites increase the risk of sediment compaction resulting in sediment changes and associated community changes.	Site services & human traffic			
		Shading	Structures prevent light penetration to the seabed and therefore potentially impact on light sensitive species	Long lines, Bags, Trestles, Floats etc	365	All year	Culture/structure density
Bottom Culture (Mussels)	**Biological**	Deposition	Faecal and pseudofaecal deposition on seabed potentially altering sediment and community composition		365	All year	Hydrography, Turbidity, Culture/structure density
		Seston filtration	Alteration of phyto/zooplankton communities and potential impact on carrying capacity		365	All year	Culture density, Turbidity
		Introduction of non-native species	Potential for non-native culture and 'hitchhiker' species become naturalized and proliferate. Potential for structures to act as habitat for non-native species				Screening; Culture/structure density; best practice guidelines - managing non-native species.
		Nutrient exchange	Changes in ammonium and dissolved inorganic nitrogen				Culture density

CULTURE / FISHING METHOD	PRESSURE CATEGORY	PRESSURE	POTENTIAL EFFECTS	EQUIPMENT	DURATION (DAYS)	TIME OF YEAR	FACTORS CONSTRAINING THE ACTIVITY/EFFECTS
			resulting in increased primary production. N_2 removal at harvest or denitrification at sediment surface.				
		Disease risk	Potential for disease introduction and uncontrolled spread				Screening
	Physical	Sub-surface disturbance	Shallow and deep disturbance, Epifaunal and infaunal community disturbance	Dredge	Seed collection, relaying spat, harvesting	Summer - Autumn; Nov. - Apr	

Aquaculture and marine mammal interactions

Potential interactions between mariculture and marine mammals are broadly summarized in Table 5. It should be noted that direct demonstrations of these impacts are rare, and in most cases, potential effects are therefore predicted from the best existing information (National Research Council, 2010). Furthermore, none of the studies published to explore impacts on marine mammals and in particular Harbour Seals, were specifically designed to detect ecological impacts on this species (National Research Council 2009; Becker et al., 2009, 2011). Even where studies have been carried out around shellfish farms, uncertainty over spatial and temporal variation in both the location of structures (Watson-Capps and Mann, 2005) and levels of disturbance (Becker et al., 2009; 2011) constrain the conclusions that can be drawn about the impacts of mariculture on critical life functions such as reproduction and foraging.

Mariculture operations are considered a source of marine litter (Johnson, 2008). Ingestion of marine litter has also been shown to cause mortality in birds, marine mammals, and marine turtles (Derraik, 2002). Mariculture structures can provide shelter, roost, or haul-out sites for birds and seals (Roycroft et al., 2004). This is unlikely to have negative effects on bird or seal populations, but it may increase the likelihood that these species cause faecal contamination of mollusc beds.

Harbour seal (*Phoca vitulina*)

Little information is available on the potential interactions between seals and the activities in question (see National Research Council 2009). There has been no targeted research conducted in similar ecosystems that has directly assessed the impact of this type of aquaculture on Harbour seals or indeed any other seal populations. There has, however, been considerable research on short-term responses of Harbour seals to disturbance from other sources, and these can be used to inform assessments the potential impacts of disturbance from aquaculture activities currently underway and proposed in Slaney River Valley SAC. These disturbance studies have focused on impacts upon groups of seals that are already ashore at haul-out sites. Sources of potential disturbance have varied widely, and include people and dogs (Allen et al., 1984; Brasseur & Fedak, 2003), recreational boaters (Johnson & Acevedo-Gutierrez, 2007; Lelli & Harris, 2001; Lewis & Mathews, 2000), commercial shipping (Jansen et al., 2006), industrial activity (Seuront & Prinzivalli, 2005) and aircraft (Perry et al., 2002). A Harbour seal's response to disturbance may vary from an increase in alertness, movement towards the water, to actual entering into the water, i.e. flushing (Allen et al., 1984) and is typically governed by the location and nature of the disturbance activity. For example, kayaks may elicit a stronger response than power boats (Lewis & Mathews, 2000; Suryan & Harvey, 1999), and stationary boats have been shown to elicit a stronger response than boats moving along a predictable (or predetermined) route (Johnson & Acevedo-Gutierrez, 2007). Furthermore, the mean distance at which seals are flushed into the water by small boats and people ranges between 80m and 530m, with

some disturbances recorded at distances of over 1000m. In certain areas, these empirical studies have been used to inform management actions in marine protected areas, for example where a 1.5km buffer is set around Harbour seal haul-out sites in the Dutch Wadden Sea to exclude recreational disturbance (Brasseur & Fedak, 2003).

Displacement from areas may also result from disturbances attributable to the activities of mariculture workers (Becker et al., 2009; 2011). This disturbance may be caused directly by the presence of workers on intertidal areas. However while disturbance from shellfish culture operations have been proposed to influence the distribution of seal within a sheltered embayment, no inference can be made on the effect on broader population characteristics of harbour seals from this study (Becker 2011).

In the Slaney River Valley SAC it would appear that the overall Harbour Seal numbers (population) has been stable or increasing between 2003 and 2012 (Duck and Morrris, 2013). While no definitive conclusions can be drawn regarding the population status of harbour seals in Wexford Harbour and more widely around Ireland, it is noted that from a conservation perspective, the population is considered 'favourable' (NPWS, 2013a and c).

Otter (*Lutra lutra*)

There is little literature regarding the otter and its potential interactions with aquaculture. According to the NPWS (2009) habitat destruction, pollution and accidental death /persecution are considered the major threats to this species. The main interactions between otter and aquaculture are listed in Table 5.

The most recent otter survey in Ireland was carried out in 2004/2005 (Bailey & Rochford, 2006), which found that otter densities had declined from nearly 90% in 1980 to 70.5%, but that the species was still present throughout the country. However, according to NPWS (2013) the overall conservation assessment is "good" for otter. The risk posed to otter by the proposed shellfish culture activity stated in the submission is considered low. Given the crepuscular nature of otter activity, likely interactions (and disturbance) with operators on the foreshore are considered low. Furthermore, shellfish culture (intertidal and suspended) are not considered a threat to otters. In the threat response plan NPWS (2009) state "Little evidence has come to light in recent studies to suggest that disturbance by recreation is a significant pressure". Recreation in the NPWS report is defined as angling, boating and mariculture.

Table 7 Potential interactions between aquaculture activities and the Annex II species Harbour Seal (*Phoca vitulina*), Otter (*Lutra lutra*) within the Slaney River Valley SAC (000268).

CULTURE METHOD	PRESSURE CATEGORY	PRESSURE	POTENTIAL EFFECTS	EQUIPMENT	DURATION (DAYS)	TIME OF YEAR	FACTORS CONSTRAINING THE ACTIVITY/EFFECTS
All Aquaculture Methods	**Physical**	Habitat Exclusion	Structures may result in a barrier to movement of species.	Bags and trestles	365	All year	Spatial extent and location of structures used for culture.
		Disturbance	Ancillary activities at sites increase the risk of disturbance to species at haul out sites (e.g. resting, breeding and/or moulting) or in the water.	Site services, human, boat and vehicular traffic	365	All year	Seasonal levels of activity relating to seeding, grading, and harvesting. Peak activities do no coincide with more sensitive periods for seals (i.e. pupping and moulting)
		Entanglement	Entanglement of species from ropes or material used on structures or during operation of farms or during fishing.	Trestles, bags, ropes and/or nets used in day to day	365	All year	Farm management practices, weather, closed season.
		Ingestion	Ingestion of waste material used on farm	Ties used to secure bags and secure bags to trestle	365	All year	Farm management practices, weather, closed season.
	Biological	Biomass extraction	Food source of mammals removed by fishery activity (targeted species or by-catch).	Nets			Seasonal fishery, weather.

7 Appropriate Assessment Screening

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

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

7.1 Aquaculture Activity Screening

Slaney River Valley SAC

- **Table 4** highlights the spatial overlap between (existing and proposed) aquaculture activities and Qualifying Interests of the site (i.e. Estuaries (1130), Mudflat and sandflats not covered by seawater at low tide (1140)).
- **Tables 8 and 9** provides an overview of overlap (ha, %) of aquaculture activities and specific community types within the broad habitat features of 1130 and 1140 (identified from Conservation Objectives, NPWS, 2011a). Where the overlap between an aquaculture activity and a feature is zero, and no interaction is considered likely, it is screened out and not considered further.

None of the aquaculture activities (existing or proposed) overlaps with the following features or species, given their exclusive freshwater nature, and therefore these three habitats and three taxa are excluded from further consideration in this assessment:

1. 1029 Freshwater Pearl Mussel *Margaritifera margaritifera*
2. 1096 Brook Lamprey *Lampetra planeri*
3. 1099 River Lamprey *Lampetra fluviatilis*
4. 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Floating river vegetation)
5. 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

6. 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

The **Atlantic salmon (*Salmo salar*)** migrates through outer Wexford harbour into the Slaney River Valley SAC. Given the nature of the activities proposed for aquaculture in Slaney River Valley, it is unlikely that aquaculture activities will impact on the conservation attributes for Salmon, which are:

- Distribution (in freshwater)
- Fry abundance (freshwater)
- Population size of spawners (fish will not be impeded or captured by the proposed activity)
- Smolt abundance (out migrating smolts will not be impeded or captured by the proposed activity)
- Water quality (freshwater)

On this basis, **Salmon (*Salmo salar*)** is excluded from further analysis.

The **Sea lamprey (*Petromyzon marinus*)** and the **Twaite shad (*Alosa fallax*)** migrate through outer Wexford Harbour into the Slaney River Valley SAC. The aquaculture activities do not present a barrier to migration of these species, given they are confined to on-bottom subtidal areas and any structures used (oyster trestles), will be deployed in intertidal areas away from channels. Given the activities carried out or proposed for the Slaney River Valley SAC, it is unlikely that they will impact upon the other attributes and their targets for Sea lamprey and Twaite Shad, which are primarily freshwater in nature. The attributes are:

- Extent of anadromy
- Population structure (of juveniles for Sea Lamprey only)
- Juvenile density in fine sediment (Sea Lamprey only)
- Extent and distribution of spawning habitat
- Water Quality - O_2 levels (Twaite Shad only)
- Availability of juvenile habitat (Sea lamprey only)
- Spawning habitat quality (Twaite Shad only)

On this basis, **Sea lamprey (*Petromyzon marinus)*** and the **Twaite shad (*Alosa fallax*)** have been excluded from further analysis.

Raven Point Nature Reserve SAC

None of the aquaculture activities (existing or proposed) overlaps with the following features and given their broad terrestrial/coastal nature, the following 7 habitats are excluded from further consideration in this assessment:

- 1210 Annual vegetation of drift lines
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 2110 Embryonic shifting dunes
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
- 2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')
- 2170 Dunes with *Salix repens ssp. argentea (Salicion arenariae*)
- 2190 Humid dune slacks

Table 5 highlights the spatial overlap between (existing and proposed) aquaculture activities and the relevant marine qualifying interests of the site (i.e. Mudflat and sandflats not covered by seawater at low tide (1140) and Estuaries (1130)).

Table 10 provides an overview of overlap (ha, %) of aquaculture activities and specific community types within the broad habitat features (identified from Conservation Objectives, NPWS, 2011b). Where the overlap between an aquaculture activity and a feature is zero, and no interaction is considered likely, it is screened out and not considered further. No activity screens out on this basis.

In addition to the above there are a number of applications (n=16) for the culture/collection of wild mussel seed on longlines and rafts that might occur outside of the boundaries but are proximate to the two SACs. These applications are deemed to be non-disturbing to the conservation features of the SAC on the basis of;

1) There is no spatial overlap with the SACs
2) Any impact on the seabed is likely to be confined to the footprint of the licenced area and is unlikely to impact on features or ecological functions within the SACs.
3) The hydrology regime at the sites is such that any dissolved nutrients will be quickly dispersed from the site and will unlikely enter into the estuary.
4) On the basis of published literature, the structures and activities associated with this culture operation are unlikely to impact negatively on Annex II species, harbour seal and otter.

Consequently, these aforementioned mussel seed capture sites will screen out from full assessment and will not be considered further in this report.

Table 8 Habitat utilisation i.e. spatial overlap in hectares and proportion of specific habitat (%) by aquaculture activity within the qualifying interest 1140 of Slaney River Valley SAC. (Based on licence database provided by DAFM. Habitat data provided in NPWS 2011a, 2011c); (Location I-Intertidal, S-Subtidal; Method Int.-Intensive, Ext.-Extensive; Status L-Licensed, A-Application)

				1140 - Mudflats and sandflats not covered by seawater at low tide (1028ha)	
Culture Species	Location	Method	Status	Estuarine muds dominated by polychaetes and crustaceans community complex (587ha)	Sand dominated by polychaetes community complex (441ha)
Oysters (*C. gigas)*	I	Int.	A	22.1 (3.8%)	11.5 (2.6%)
Mussels (*M. edulis*)	S	Ext.	L	104.5 (17.8%)	124.3 (28.2%)
Mussels (*M. edulis*)	S	Ext.	A	182.7 (31.1%)	167.0 (37%)
Totals				309.3 (52.7%)	302.8 (67.8%)

Table 9. Habitat utilisation i.e. spatial overlap in hectares and proportion of specific habitat (%) by aquaculture activity within the qualifying interest 1130 of Slaney River Valley SAC. (Based on licence database provided by DAFM. Habitat data provided in NPWS 2011a, 2011c); (Location I-Intertidal, S-Subtidal; Method Int.-Intensive, Ext.-Extensive; Status L-Licensed, A-Application)

				1130 - Estuaries (1,904ha)		
Culture Species	**Location**	**Method**	**Status**	**Estuarine muds dominated by polychaetes and crustaceans community complex (1268.5ha)**	**Sand dominated by polychaetes community complex (26.7ha)**	**Mixed sediment community complex (200.1ha)**
Oysters (*C. gigas)*	**I**	**Int.**	**A**	**22.1 (1.16%)**		
Mussels (*M. edulis*)	**S**	**Ext.**	**L**	**545.5 (43%)**	**26.5 (99.3%)**	**185 (92.6%)**
Mussels (*M. edulis*)	**S**	**Ext.**	**A**	**211.1 (16.6%)**		
Totals				**778 (61.4%)**	**26.5 (99.3%)**	**185 (92.6%)**

Table 10. Habitat utilisation i.e. spatial overlap in hectares and proportion of specific habitat (%) by aquaculture activity within the qualifying interest 1140 of The Raven point Nature Reserve SAC. (Based on licence database provided by DAFM. Habitat data provided in NPWS 2011c, 2011d).; (Location I-Intertidal, S-Subtidal; Method Int.-Intensive, Ext.-Extensive; Status L-Licensed, A-Application)

				1140 - Mudflats and sandflats not covered by seawater at low tide (73ha)	
Culture Species	**Location**	**Method**	**Status**	**Estuarine muds dominated by polychaetes and crustaceans community complex (7.6ha)**	**Sand dominated by polychaetes community complex (65.4ha)**
Mussels (*M. edulis*)	**S**	**Ext.**	**L**	**2.4 (32%)**	**-**
Mussels (*M. edulis*)	**S**	**Ext.**	**A**	**-**	**0.2 (0.3%)**
Totals				**2.4 (32%)**	**0.2 (0.3%)**

8 Appropriate Assessment

8.1 Determining significance

The significance of the possible effects of the proposed activities on habitats, as outlined in the Natura Impact statement (Section 6) and subsequent screening exercise (Section 7), is determined here in the assessment. The significance of effects is determined on the basis of Conservation Objective guidance for constituent habitats and species (Figure 1-3 and NPWS 2011 a, b, c, d).

Within the Slaney River Valley SAC the qualifying habitats/species considered further in this assessment are:

- 1130 Estuaries
- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1355 Otter *Lutra lutra*
- 1365 Common (Harbour) seal *Phoca vitulina*

Within the Raven Point Nature Reserve SAC the qualifying habitat is:

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

For broad habitats and sedimentary community types (Figures 1 and 2) significance of impact is determined in relation to, first and foremost, spatial overlap (see Section 7 and Figure 12). Subsequent disturbance and the persistence of disturbance are considered as follows:

1. The degree to which the activity will disturb the qualifying interest. By disturb is meant change in the characterising species, as listed in the Conservation Objective guidance (NPWS 2011b) for constituent communities. The likelihood of change depends on the sensitivity of the characterising species to the aquaculture activities. Sensitivity results from a combination of intolerance to the activity and recoverability from the effects of the activity (see Section 8.2 following).
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.

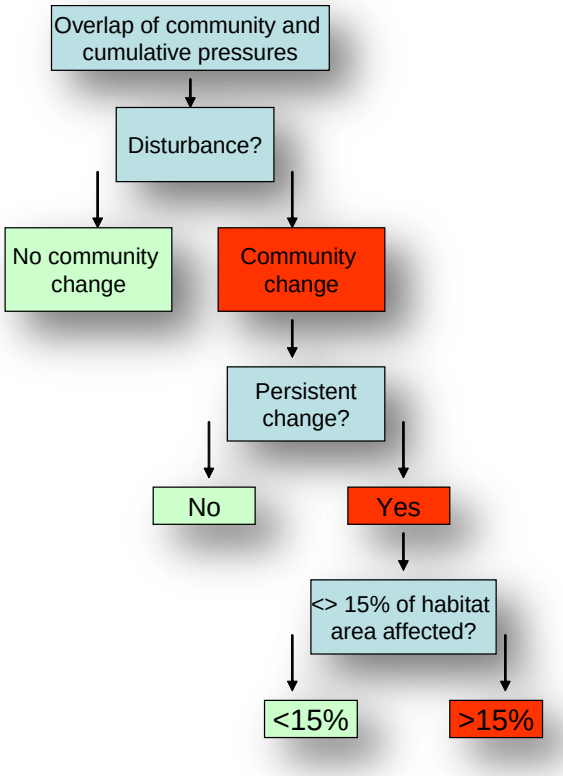

Figure 6. Determination of significant effects on community distribution, structure and function.

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

8.2 Sensitivity and Assessment Rationale

This assessment primarily employed a number of sources of information in assessing the sensitivity of the characterising species of each community recorded within the benthic habitats of Slaney River Valley SAC and Raven Point Nature Reserve SAC. The primary source of information is a series of commissioned reviews by the Marine Institute which identify habitat and species sensitivity to a range of pressures likely to result from aquaculture (and fisheries) 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 primary scientific literature. 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-the ability to return to a state close to that which existed before the activity or event caused change). Life history and biological traits are important determinants of sensitivity of species to pressures from aquaculture.

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

- For **persistent pressures** i.e. activities that occur frequently and throughout the year recovery capacity may be of little relevance except for species/habitats that may have extremely rapid (days/weeks) recovery capacity or whose populations can reproduce and recruit in balance with population damage caused by aquaculture. In all but these cases and if sensitivity is moderate or high then the species/habitats may be negatively affected and will exist in a modified state. Such interactions between aquaculture and species/habitat/community represent persistent disturbance. They become significantly disturbing if more than 15% of the community is thus exposed (NPWS 2011b, d).
- In the case of episodic pressures i.e. activities that are seasonal or discrete in time both the intolerance and recovery components of sensitivity are relevant. If sensitivity is high but recoverability is also high relative to the frequency of application of the pressure then the species/habitat/community will be in favourable conservation status for at least a proportion of time.

The **sensitivities** of the community types (or surrogates) found within the Slaney River Valley SAC and Raven Point Nature Reserve SAC to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are listed, where available, in Table 9. The sensitivities of species which are characteristic (as listed in the Conservation Objective supporting document) of benthic communities to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are listed, where available, in Table 10.

Table 11. Matrix showing the sensitivity to pressure scores (ABPMer 2013a-h) of communities (or surrogates) recorded within Slaney River Valley SAC (Site Code: 000781). (Note: Table 13 provides the code for the various categorisation of sensitivity and confidence.)

	Pressure Type																				
Community Type (Eunis surrogate)	**Surface Disturbance**	**Shallow Disturbance**	**Deep Disturbance**	**Trampling-Access by foot**	**Trampling-Access by vehicle**	**Extraction**	**Siltation (addition of fine sediments, pseudofaeces, fish food)**	**Smothering (addition of materials biological or non-biological to the surface)**	**Changes to sediment composition-increased coarseness**	**Changes to sediment composition-increased fine sediment proportion**	**Changes to water flow**	**Increase in turbidity/suspended sediment**	**Decrease in turbidity/suspended sediment**	**Organic enrichment-water column**	**Organic enrichment of sediments-sedimentation**	**Increased removal of primary production-phytoplankton**	**Decrease in oxygen levels-sediment**	**Decrease in oxygen levels-water column**	**Introduction of non-native species**	**Removal of Target Species**	**Removal of Non-target species**	**Introduction of hydrocarbons**
Sand dominated by polychaetes community complex (A5.24) Subtidal	NS (***)	L (*)	L (***)	NE	NE	L-M (*)	L-M (*)	L-M (*)	M-L (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	L (***)	NS (*)	L (*)	L (*)	H (***)	NS (*)	NS (*)	L (*)
Estuarine muds dominated by polychaetes and crustaceans community complex (A5.32) Subtidal	NS-L (*)	L (*)	L (*)	NE	NE	L-M (*)	NS (*)	M-H (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	L (*)	H (*)	NS (*)	NS (*)	L (*)
Mixed sediment community complex (A5.42) Subtidal	NS (*)	L (*)	L (*)	NE	NE	L-M (*)	L-M (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	H (*)	NS (*)	NS (*)	L (*)

Table 12 Matrix showing the sensitivity to pressure scores (ABPMer 2013a-h) of some characterising species recorded within Slaney River Valley SAC (Site Code: 000781). (Note: Table 13 provides the code for the various categorisation of sensitivity and confidence.)

	Pressure Type																		
Pressure	Surface Disturbance	Shallow Disturbance	Deep Disturbance	Trampling-Access by foot	Trampling-Access by vehicle	Extraction	Siltation	Smothering (addition of materials biological or non-biological to the surface)	Changes to sediment composition-increased coarseness	Changes to sediment composition-increased fine sediment proportion	Increase in turbidity/suspended sediment	Decrease in turbidity/suspended sediment	Organic enrichment of sediments-sedimentation	Increased removal of primary production-phytoplankton	Decrease in oxygen levels- sediment	Decrease in oxygen levels-water column	Introduction of non-native species	Removal of Target Species	Removal of Non-target species	Introduction of hydrocarbons
Angulus tenuis	NS (*)	L (*)	L (***)	NS (*)	L (*)	M (*)	NS (*)	H (*)	M-H (*)	NS (*)	L (*)	NS (*)	NEv	L-NS (*)	NEv	NEv	M (*)	NS (*)	NS (*)	NEv
Corophium volutator	L (***)	L (***)	L (***)	L (*)	L (*)	L (*)	L (***)	L (***)	M (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (*)	L (***)	L (***)	Nev	NS (*)	NS (*)	L (***)
Eteone sp.	NS (*)	L (*)	L (*)	NS (*)	L (*)	M (*)	NS (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)
Hediste diversicolor	NS (*)	L-M (**)	L-H (**)	NS (*)	L (*)	L-H (*)	NS (***)	L-M (*)	M-H (*)	NS (*)	NS (*)	NS (*)	NS (**)	NS (*)	NS (**)	NS (**)	L-M (*)	L-M (*)	NS (*)	M-H (**)
Lanice conchilega	NS (*)	NS-L (***)	NS-L (***)	NS-L (*)	NS-L (*)	M-H (*)	NS (*)	M-H (*)	NS (*)	NS ***	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	M (*)	M-H (*)	NS (*)	NS (*)	L (***)
Nephtys hombergii	NS (*)	L (*)	L (***)	NS (*)	L (*)	L (*)	NS (**)	NS (*)	L (*)	NS (*)	NS (*)	NS (*)	NS (**)	NS (*)	NS (***)	NS (***)	NS (*)	M (*)	NS (*)	M (***)
Pygospio elegans	L (*)	L (**)	M (***)	L (*)	L (*)	L-M (*)	L (***)	L-M (***)	L-M (*)	NS (**)	NS (*)	NS (*)	NS (***)	NS (*)	L (**)	L (**)	M (*)	NS (*)	NS (*)	NEv
Scoloplos armiger	NS (*)	L (*)	L-M (*)	NS (*)	L (*)	H (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (*)	M (***)	M (***)	M (*)	M (**)	NS (*)	NEv
Spio spp.	L (*)	L (***)	L (***)	L (*)	L (*)	L-M (*)	NS (*)	M (*)	L-M (*)	L-M (*)	NS (*)	NS (*)	NS (***)	NS (*)	NEv	NEv	VH (*)	NS (*)	NS (*)	NS (***)
Steblospio shrubsolii	L (*)	L (***)	L (***)	L (*)	L (*)	L (*)	L (***)	L (*)	L (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (*)	NS (***)	NS (***)	NEv	NS (*)	NS (*)	NS (*)

Table 13 Codes of sensitivity and confidence applying to species and pressure interactions.

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

8.3 Assessment of the effects of aquaculture production on the Conservation Objectives for habitat features in Slaney River Valley SAC.

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

1. **Habitat Area** – it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Mudflats and Sandflats not Covered by Seawater at Low Tide. The habitat area is likely to remain stable.
2. **Community Distribution - (conserve a range of community types in a natural condition).**

   The following community types, found within the qualifying interest 1140 of the SAC have overlap with aquaculture activities:

   - **Estuarine muds dominated by polychaetes and crustaceans community complex**
   - **Sand dominated by polychaetes community complex.**

   The community types listed above will be exposed to differing ranges of pressures from aquaculture activities currently being carried out or proposed (i.e., intertidal oyster culture (bag and trestle) and on-bottom culture of mussels). Bottom mussel culture may result in chronic and longterm changes in infaunal community composition as a result of high density of culture organisms being laid on the sea and dredging for mussel will result in physical

disturbance to infanal communities. The movement of seed or larger stock from outside the SAC might present a risk of introduction of alien species.

Oyster culture in bag and trestles is not considered disturbing to infaunal communities (Forde et al 2015). In addition, access to the sites proposed for oyster culture is by boat so transport across habitats by vehicles will not occur. It is further concluded that culture of the Pacific oyster does not present a risk of proliferation of this oyster species in the SAC by virtue of fact that the maximum residence time calculated for Wexford Harbour is approximately 17 days (Hartnett et al. 2011), which is considerably below the threshold for risk (21 days) identified in Kochmann et al (2013).

Table 11 lists the community types (or surrogates) and Table 12 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores in Table 11 and 12 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Slaney River Valley SAC.

Table 14 below identify the likely interactions between the relevant aquaculture activities and the broad habitat feature (1140) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. In summary,

- Oyster trestle culture is considered non-disturbing.
- Bottom mussel culture may likely result in long-term change to the community types identified above and in all cases extends beyond 15% threshold for each community type (Tables 8 and 14). In addition, combined activities considered disturbing (bottom mussel culture) will overlap with 56% of habitat feature (1140) Mudflats and Sandflats not covered by seawater at low tide (Table 4).
- Intertidal collection of seed is considered disturbing to 1140 habitat features by destabilising the reef structure formed by mussels and reducing habitat complexity and associated biodiversity.

For **Estuaries (1130)** there are a number of attributes (with associated targets) relating to the following broad habitat features as well as constituent community types;

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

   The following community types, found within the qualifying interest 1130 of the SAC have overlap with aquaculture activities:

1. **Mixed sediment community complex**
2. **Estuarine muds dominated by polychaetes and crustaceans community complex**
3. **Sand dominated by polychaetes community complex.**

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities currently being carried out or proposed (i.e., intertidal oyster culture (bag and trestle) and on-bottom culture of mussels). Bottom mussel culture may result in chronic and longterm changes in infaunal community composition as a result of the high density of culture organisms being laid on the seafloor and harvest activities, i.e., dredging for which will result in physical disturbance to infanal communities. The movement of seed or larger stock from outside the SAC might present a risk of introduction of alien species.

Oyster culture in bag and trestles is not considered disturbing to infaunal communities (Forde et al 2015). In addition, access to the sites proposed for oyster culture is by boat so transport across habitats by heavy vehicles will not occur. Table 11 lists the community types (or surrogates) and Table 12 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores in Table 11 and 12 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Slaney River Valley SAC.

Table 15 below identify the likely interactions between the relevant aquaculture activities and the broad habitat feature (1130) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the Community type in question. In summary:

- Oyster trestle culture is considered non-disturbing.
- Bottom mussel culture will likely result in long-term change to the community types identified above and in all cases the impact extends beyond 15% threshold for each community type (Tables 9 and 15). In addition, activities considered disturbing (i.e. bottom mussel culture) will overlap with approximately 51% of habitat feature (1130) Estuaries (Table 4).

8.4 Assessment of the effects of aquaculture production on the Conservation Objectives for habitat features in Raven Point Nature Reserve SAC.

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

1. **Habitat Area –** it is unlikely that the activities proposed will reduce the overall extent of permanent habitat within the feature Mudflats and Sandflats not Covered by Seawater at Low Tide. The habitat area is likely to remain stable.
2. **Community Distribution - (conserve a range of community types in a natural condition).**

   The following community types, found within the qualifying interest 1140 of the SAC have overlap with aquaculture activities:

   - **Estuarine muds dominated by polychaetes and crustaceans community complex**
   - **Sand dominated by polychaetes community complex.**

   The community types listed above will be exposed to differing ranges of pressures from aquaculture activities currently being carried out or proposed (i.e., on-bottom culture of mussels). Bottom mussel culture may result in chronic and long term changes in infaunal community composition as a result of high density of culture organisms being laid on the sea and dredging for mussel will result in physical disturbance to infanal communities. The movement of seed or larger stock from outside the SAC might present a risk of introduction of alien species.

   Table 11 lists the community types (or surrogates) and Table 12 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores in Table 11 and 12 are derived from a range of sources identified above. The pressures are listed as those likely to result from the primary aquaculture activities carried out in the Raven Point Nature Reserve SAC.

   Table 16 below identify the likely interactions between the relevant aquaculture activities and the broad habitat feature (1140) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. In summary:

   - Bottom mussel culture will likely result in long-term change to the community types identified above and extends beyond 15% threshold for the community type (32%), Estuarine muds dominated by polychaetes and crustaceans community complex (Tables 10 and 16). Combined activities considered disturbing will overlap with 3.6% of habitat feature (1140) Mudflats and Sandflats not covered by seawater at low tide (Table 5).

8.4 General Conclusions

Conclusion 1: The culture/collection of wild mussel seed on longlines and rafts that might occur outside of the boundaries but are proximate to the two SACs are deemed to be non-disturbing to the conservation features of the SAC.

Conclusion 2: By virtue of extensive spatial cover the levels of existing and proposed culture of bottom mussel culture activities are considered disturbing to habitat feature Estuaries (1130) and Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Slaney River Valley SAC.

Conclusion 3: By virtue of extensive spatial cover the levels of existing and proposed culture of bottom mussel culture activities are considered disturbing to the community type - Estuarine muds dominated by polychaetes and crustaceans community complex within the habitat feature Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Raven Point Nature Reserve SAC.

Conclusion4: The proposal to culture oysters (intertidally on trestles) is not considered disturbing to habitat feature Estuaries (1130) and Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Slaney River Valley SAC.

Conclusion 5: Removal of seed resources from intertidal habitat will also result in disturbance to 1140 habitat features by destabilising the reef structure formed by mussels and reducing habitat complexity and associated biodiversity.

Conclusion 6: Based upon experience elsewhere, the introduction of '½ grown' or 'wild' oyster or mussel seed stock into aquaculture plots (both within and proximate to the SAC) from outside of Ireland does pose a clear risk of establishment of non-native species in the SAC.

Table 14. Assessment of effect of aquaculture activities on Mudflats and sandflats not covered by seawater at low tide - 1140 community types recorded within Slaney River Valley (Site Code: 000781)

1140 - Mudflats and sandflats not covered by seawater at low tide (743.97ha)		
Culture Type	**Estuarine muds dominated by polychaetes and crustaceans community complex**	**Sand dominated by polychaetes community complex.**
Oysters - Application (*C. gigas*) Bags & trestles	**Disturbing:** No **Justification:** The community type is considered tolerant to pressures from this activity. The species have high recoverability and are tolerant. The stock, sourced from hatcheries, is contained in bags. Conditions in Wexford, i.e. habitat availability and residence time are such that the risk of successful Pacific oyster recruitment is low.	**Disturbing:** No **Justification:** The community type is considered tolerant to pressures from this activity. The species have high recoverability and are tolerant. The stock, sourced from hatcheries, is contained in bags. Conditions in Wexford, i.e. habitat availability and residence time are such that the risk of successful Pacific oyster recruitment is low.
Mussels - Licenced On-bottom	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 17.8% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay.	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 28.2% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay.
Mussels – Application On-bottom	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 31.1% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay.	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 37% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay.

Table 15. Assessment of effect of aquaculture activities on Estuaries (1130) community types recorded within Slaney River Valley (Site Code: 000781)

1130 - Estuaries			
Culture Type	**Estuarine muds dominated by polychaetes and crustaceans community complex**	**Sand dominated by polychaetes community complex.**	**Mixed Sediment community complex**
Oysters - Application (*C. gigas*) Bags & trestles	**Disturbing:** No **Justification:** The community type is considered tolerant to pressures from this activity. The species have high recoverability and are tolerant. The stock, sourced from hatcheries, is contained in bags. Conditions in Wexford, i.e. habitat availability and residence time are such that the risk of successful Pacific oyster recruitment is low.	-	-
Mussels –Licenced On-bottom	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 43% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 99.3% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 92.6% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay
Mussels – Application On-bottom	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 16.6% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay	-	-

Table 16. Assessment of effect of aquaculture activities on Mudflats and sandflats not covered by seawater at low tide - 1140 community types recorded within Raven Point Nature Reserve SAC (Site Code: 0710)

1140 - Mudflats and sandflats not covered by seawater at low tide (73ha)		
Culture Type	**Estuarine muds dominated by polychaetes and crustaceans community complex**	**Sand dominated by polychaetes community complex.**
Mussels - Licenced On-bottom	**Disturbing:** Yes **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. In addition, the spatial overlap is 32% of this community type (>15% threshold). The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay.	-
Mussels – Application On-bottom	-	**Disturbing:** No **Justification:** This activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The importation of mussel seed/stock from areas outside of the harbour may present a risk of introducing non-native species into the bay. However, the spatial overlap is 0.3% of this community type (<15% threshold). This is likely a mapping artefact.

8.4 Assessment of the effects of shellfish production on the Conservation Objectives for Harbour Seal (*Phoca vitulina*) in Slaney River Valley SAC.

Slaney River Valley SAC is designated for the Harbour Seal (*Phoca vitulina*). The distribution of harbour seal habitat and site use are identified in Figure 3. The conservation objectives for this species are listed in Table 1 and can be found in detail in NPWS (2011 a, b). While the conservation status of the species is considered favourable at the site (NPWS 2013), the interactions between harbour seals and the features and aquaculture activities carried out in the SAC must be ascertained.

The interactions between aquaculture operations and aquatic mammal species are a function of:

1. The location and type of structures used in the culture operations - is there a risk of entanglement or physical harm to the animals from the structures or is access to locations restricted?

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

The proposed activities must be considered in light of the following attributes and measures for the Harbour Seal:

- Access to suitable habitat – number of artificial barriers
- Disturbance – frequency and level of impact
- Harbour Seal Sites: Breeding sites, Moulting sites, Resting sites

Restriction to suitable habitats and levels of disturbance are important pressures that must be considered to ensure the maintenance of favourable conservation status of the harbour seal and implies that the seals must be able to move freely within the site and to access locations considered important to the maintenance of a healthy population. They are categorised according to various life history stages (important to the maintenance of the population) during the year. Specifically they are breeding, moulting and resting sites (Figure 3). It is important that the access to these sites is not restricted and that disturbance, when at these sites, is kept to a minimum. The structures used in culture of oysters (bags on trestles) may form a physical barrier to seals when both submerged and exposed on the shoreline such that the access to haul-out locations might be blocked. Activities at sites and during movement to and from culture sites may also result in disturbance events such that the seals may note an activity (head turn), move towards the water, or actually flush into the water. While such disturbance events might have been documented, the impacts of these disturbances at the population level have not been studied more broadly (National Research Council 2009).

Shell fish production has been conducted in and around Lower River Slaney SAC for many years. It is considered that, given the favourable conservation status of Harbour Seals in Ireland (NPWS 2013c) and by stable numbers observed since 2009 (NPWS 2010, 2011, 2012) that the current

shellfish production levels (and activities associated with them) are conducive with the favourable conservation status. It is important to note that licenced area does not equate to active production areas (Figure 3). For example, in Wexford Harbour mussel culture is typically confined to subtidal areas only, this in spite of the fact that much of the licenced areas are intertidal. The seal haul-out areas in the Lower Slaney River Valley SAC are confined to intertidal areas but are also overlapped by licenced areas and applications. The risk to the seals is presented if shellfish culture activities occur on the intertidal mudflats and/or in close proximity to the haul out sites.

Conclusion 7: The current levels of aquaculture production are considered non-disturbing to harbour seal conservation features in all areas of the SAC. It is important to note that area covered by the (subtidal) bottom mussel culture activities would appear to be considerably smaller than those represented by licenced areas, which extend into the intertidal areas. This is verified by aerial imagery which shows no mussel beds in the vicinity of the seal sites (Figure 7). If actual production were to occur over or close to the seal haul-out areas then a risk of disturbance to seal cannot be discounted.

Conclusion 8: In relation to new licence applications, similar to licenced areas, there is considerable overlap with seal haul out locations and a number of new applications. If actual culture activities were to extend to intertidal/shallower areas proximate to the seal sites then this would present a risk to seals. On the basis of distance from the seal haul out locations, the proposed oyster trestle culture sites are considered non-disturbing to seal conservation features.

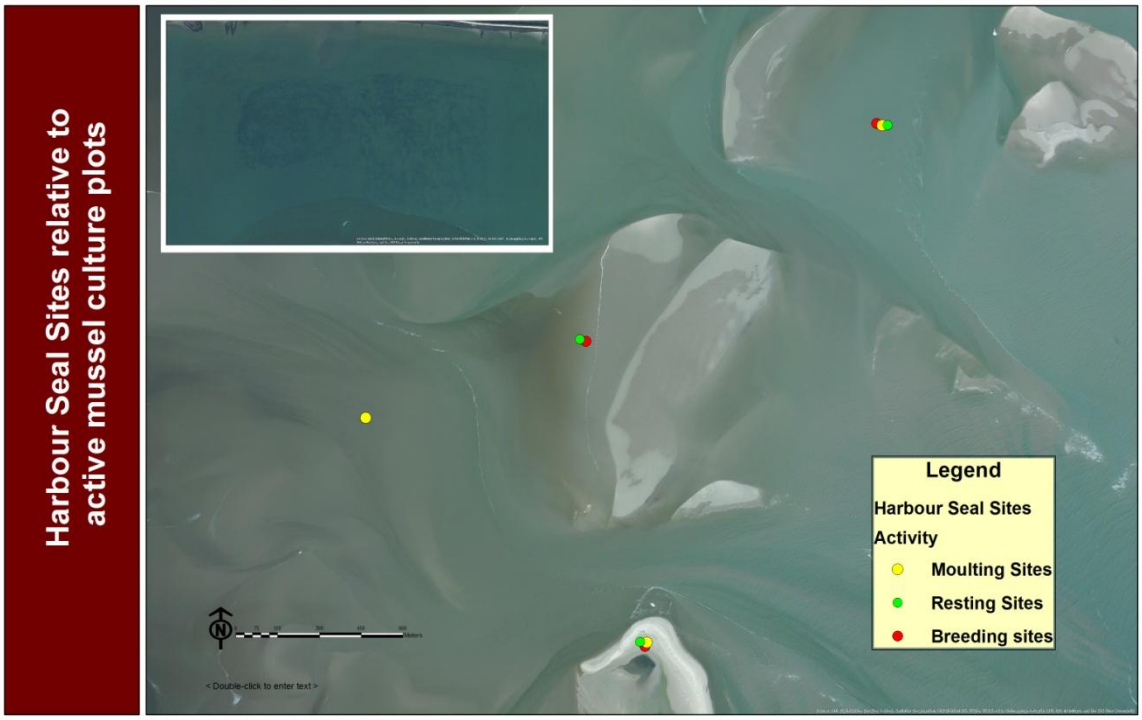

Figure 7. Harbour Seal Sites in Slaney River Valley SAC and adjacent sedimentary habitat which demonstrate no bottom mussel culture activity. Insert image is of bottom mussel culture

plot elsewhere within the SAC; shading indicates the pattern expected to be found if the culture activity was proximate to the seal haul out locations. (Images source: ESRI basemap).

8.5 Assessment of the effects of shellfish production on the Conservation Objectives for the Otter (*Lutra lutra*) in Slaney River Valley SAC.

Slaney River Valley SAC is designated for the Otter (*Lutra lutra*); the conservation objectives for such are listed in Table 1 and can be found in detail in NPWS (2013a). The otter is known to forage within an 80m of the shoreline. As the aquaculture production activities within the SAC spatially overlap with otter these activities may have negative effects on the abundance and distribution of populations of these species.

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

1. The location and type of structures used in the culture operations- is there a risk of entanglement or physical harm to the animals from the structures.

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

Bottom culture (Mussels)

Given that this culture type does not entail any structures and all operations are likely to be carried out in daylight hours, while the otter foraging is primarily crepuscular, the interaction with bottom culture operators/operations with the otter is likely to be minimal. It is unlikely that this culture type poses a risk to otter populations in Slaney River Valley SAC. Impacts can be discounted.

Suspended culture (Oyster)

Given the intertidal location of the structures and activities associated this form of oyster culture it is unlikely that otters will have any negative interaction with this culture method. Impacts can be discounted.

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

- Extent of terrestrial habitat,
- Extent of marine habitat or freshwater habitat.
- The activity involves net input rather than extraction of fish biomass so that no negative impact on the essential food base (fish biomass) is expected.
- The number of couching sites and holts or, therefore, the distribution, will not be directly affected by aquaculture activities.
- Shellfish production activities are unlikely to pose any risk to otter populations through entrapment or direct physical injury.

- Disturbance associated with vessel and foot traffic could potentially affect the distribution of otters at the site. However, the level of disturbance is likely to be very low given the likely encounter rates will be low dictated primarily by tidal regime.

Conclusion 9: The current and proposed levels of aquaculture are considered non-disturbing to otter conservation features in all areas of the SAC.

9 In-combination effects of activities

Fishing activities in the Lower Slaney River Valley SAC are confined to activities associated with the bottom mussel culture. Specifically, this relates to potting for crabs as a predator control measure to remove crabs from the mussel beds. Other fisheries occur outside of the SAC and specifically seed mussel fisheries which supply the majority of seed into the harbour which was assessed separately during 2013[5], and presents no in-combination effects with the aquaculture activities in the SAC. The potting is unlikely to impact on the habitat or species features in the SAC.

There are a number of wastewater plants presenting a pollution risk to the SAC upstream and within the River Slaney Valley SAC. Details can be found in the shellfish water characterisation reports[6]. Specifically, the wastewater treatment plant in Wexford Town has secondary treatment, nutrient removal and UV disinfection. The pressure derived from these facilities is a discharge that may impact upon levels of dissolved nutrients, suspended solids and some elemental components e.g. aluminium in the case of water treatment facilities. It should be noted that the pressures resulting from fisheries and aquaculture activities are primarily morphological in nature. It was, therefore, concluded that given the pressure resulting from say, a point discharge location (e.g. urban waste-water treatment plant or combined sewer overflow) would likely impact on physico-chemical parameters in the water column, any in-combination effects with aquaculture activities are considered to be minimal or negligible.

Other activities that may occur in the SAC are primarily recreational activities (hunting, sailing, recreational fishing and beach activities). In summary, there are no likely in-combination effects between these other activities and aquaculture in relation to habitat qualifying features. In terms of disturbance to species, the in-combination effects of aquaculture related activities, if conditions identified in Conclusion 5 above prevail, and hunting may result in significant disturbance to Harbour Seal.

[5] http://www.fishingnet.ie/sea-fisheriesinnaturaareas/concludedassessments/irishsea-includingmusselseedfishery/#d.en.72197

[6] http://www.environ.ie/en/Environment/Water/WaterQuality/ShellfishWaterDirective/ShellfishWatersFinalCharacterisationReportsandPRPs/Wexford-Waterford/

10 Aquaculture Appropriate Assessment Concluding Statement

In Slaney River Valley SAC there are a range of aquaculture activities currently being carried out and proposed. Based upon this and the information provided in the aquaculture profiling (Section 5), the likely interaction between aquaculture methodology and conservation features (habitats and species) of the site was considered.

10.1 Annex I Habitats and Annex II Species

In relation to habitats an initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities or likely interactions was expected to occur.

The habitats and species excluded from further consideration were:

1. 1029 Freshwater Pearl Mussel *Margaritifera margaritifera*
2. 1096 Brook Lamprey *Lampetra planeri*
3. 1099 River Lamprey *Lampetra fluviatilis*
4. 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Floating river vegetation)
5. 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
6. 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

Given the nature of the activities proposed for aquaculture in Slaney River Valley, it is unlikely that aquaculture activities will impact on the conservation attributes for Salmon, Sea Lamprey and Twaite Shad. On that basis, **Salmon (*Salmo salar*), Sea lamprey (*Petromyzon marinus)*** and the **Twaite shad (*Alosa fallax*)** were excluded from further analysis.

Applications for subtidal suspended mussel cultivation were also screened out for full assessment on the basis that,

1) there was no spatial overlap with the two SACs considered in the assessment report,
2) any impacts are likely to be localised on the seabed beneath the footprint of the proposed licences or given the high degree of flushing experienced at the sites, will result in rapid dispersion of dissolved nutrients, and
3) based upon published accounts, the structures are unlikely to disturb resident species in the SAC, i.e. Harbour Seal and Otter.

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the features Annex 1 habitats Mudflats and sandflats not covered by seawater at low tide (1140), Estuaries (1160) in both Slaney River Valley SAC (0781) and Mudflats and sandflats not

covered by seawater at low tide (1140) in Raven Point Nature Reserve SAC (0710). The likely effects of the aquaculture activities were considered in light of the sensitivity of the constituent communities of these Annex 1 habitats. A number of issues were highlighted in Section 8.3 and relate to certain aquaculture and habitat interactions the conclusions of which are presented below.

Conclusion 1: The culture/collection of wild mussel seed on longlines and rafts that might occur outside of the boundaries but are proximate to the two SACs are deemed to be non-disturbing to the conservation features of the SAC.

Conclusion 2: By virtue of extensive spatial cover (>15%) the levels of existing and proposed culture of bottom mussel culture activities are considered disturbing to habitat feature Estuaries (1130) and Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Slaney River Valley SAC.

Conclusion 3: By virtue of extensive spatial cover (>15%) the levels of existing and proposed culture of bottom mussel culture activities are considered disturbing to the community type - Estuarine muds dominated by polychaetes and crustaceans community complex within the habitat feature Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Raven Point Nature Reserve SAC.

Conclusion4: The proposal to culture oysters (intertidally on trestles) is not considered disturbing to habitat feature Estuaries (1130) and Mudflats and Sandflats not Covered by Seawater at Low Tide (1140) in the Slaney River Valley SAC.

Conclusion 5: Removal of seed resources from intertidal habitat will also result in disturbance to 1140 habitat features by destabilising the reef structure formed by mussels and reducing habitat complexity and associated biodiversity.

Conclusion 6: Based upon experience elsewhere, the introduction of '½ grown' or 'wild' oyster or mussel seed stock into aquaculture plots (both within and proximate to the SAC) from outside of Ireland does pose a clear risk of establishment of non-native species in the SAC.

10.2 Annex II Species

The likely interactions between the proposed aquaculture activities and the Annex II Species Harbour Seal (*Phoca vitulina*) and Otter (*Lutra lutra*) were also assessed.

It is acknowledged in this assessment that the favourable conservation status of the Harbour seal (*Phoca vitulina*) has been achieved given current levels of aquaculture production within the SAC. The aspect of the culture activities that could potentially disturb the Harbour seal status relates to movement of people and vessels within the sites as well as accessing the sites over intertidal areas and via water.

Conclusion 7: The current levels of aquaculture production are considered non-disturbing to harbour seal conservation features in all areas of the SAC. It is important to note that area covered by the (subtidal) bottom mussel culture activities would appear to be considerably smaller than those represented by licenced areas, which extend into the intertidal areas. This is verified by aerial imagery which shows no mussel beds in the vicinity of the seal sites (Figures 7). If actual production were to occur over or close to the seal haul-out areas then a risk of disturbance to seal cannot be discounted.

Conclusion 8: In relation to new licence applications, similar to licenced areas, there is considerable overlap with seal haul out locations and a number of new applications. If actual culture activities were to extend to intertidal/shallower areas proximate to the seal sites then this would present a risk to seals. On the basis of distance from the seal haul out locations, the proposed oyster trestle culture sites are considered non-disturbing to seal conservation features.

C**onclusion 9:** The current and proposed levels of aquaculture are considered non-disturbing to otter (*Lutra lutra*) conservation features in all areas of the SAC.

11 Mitigation factors to consider in management responses

Given the findings above, i.e., that the current and proposed (bottom mussel culture activities) appear to conflict with the conservation goals of the SAC, it would suggest that any management response might result in a reduction of the current licence levels. However, prior to taking any decisions in relation to licencing existing levels or proposed levels of bottom mussel culture in Slaney River Valley SAC, there are a number of important features in relation to the culture of this species that should be considered especially if reduction of current cultivation area is proposed. More specifically, there are three factors relating to historical, ecological and potential eutrophication mitigation benefits that bottom mussel culture currently may provide to this system.

1. ***Mussels as historical ecosystem components.*** The profile of aquaculture in the area[7] provides a historical perspective not only in relation to mussel culture activities within the harbour but also some observations in relation to the extent of natural mussel populations in the harbour. Historically, mussels have had a natural presence in the harbour and this is confirmed by fisheries reports from the 19th century. It is clear, from early records, that mussels would have been present in the harbour presumably contributing to the ecosystem functioning of same. Within the conservation objectives (NPWS 2011a, b), no specific community type is designated (named) as mussel reefs; however, mussels are considered a component of the Mixed Sediment Community Complex found in the habitat feature Estuaries (1130). How much of the mussels currently in the harbour might be considered 'natural' or as a consequence of aquaculture practices is unknown? However, it is expected that the mussel standing stock present in the harbour would appear stable (see seed inputs and production on Table 17 below). The inclusion of mussels as a component in the community type Mixed Sediment Community is appropriate; whether the quantity of mussels would be retained within the system without the aquaculture intervention is unclear as the level and extent of natural recruitment is unknown?

Table 17. Mussel seed input and annual harvest in Wexford Harbour (Source: BIM)

Year	Seed Input (T)	Harvested (T)
2013	2,050	1,458
2012	3,185	2,855
2011	3,311	4,950

[7] BIM. 2014. Summary of shellfish aquaculture in Wexford Harbour. Report prepared by BIM for Wexford AA. 42pp.

2010	**2,283**	**5,256**
2009	**5,025**	**4,546**
2008	**3,885**	**3,473**
2007	**5,952**	**2,413**
2006	**2,168**	**3,493**
2005	**3,385**	**4,887**
Totals	**31,244**	**33,331**

2. ***Trophic status in harbour***. As outlined previously, suspension-feeding bivalve molluscs feed at the lowest trophic level and influence the nutrient and organic coupling of benthic and pelagic systems. Bivalve molluscs graze on seston which consist of phytoplankton in the water column, re-suspended microalgae, detritus and zooplankton (a competitor for phytoplankton). Their ability to influence these components give bivalves an important role in the consumption and movement of energy within marine systems. The ability to control/mediate excess phytoplankton is an important ability of bivalve molluscs. Numerous authors have concluded that bivalve filter feeders have the ability to control (i.e., reduce) phytoplankton abundance in shallow water systems (Dame, 2013; Dame and Olenin, 2005; National Research Council 2010; Gallardi 2014; Filgueira et al 2015; Petersen et al 2015). Dame (2013) suggested that when conditions of shallow flowing water with adequate food supply are present, benthic bivalve feeders will tend to dominate a system. Such conditions are likely found in the Slaney River Valley SAC. The Environmental Protection Agency (EPA) uses the Trophic Status Assessment Scheme (TSAS; Toner et al., 2005) to measure of the health of system which reflects the loading in estuarine and coastal waters of nutrients and organic matter. The TSAS measures nutrient enrichment, algal concentrations and oxygen and based upon derived thresholds and provides a classification of the status of the waterbody ranging from unpolluted to eutrophic. The Slaney River Valley system has been classed as polluted or potentially eutrophic in the last number of cycles (EPA, 2015) (Table 18). What is demonstrated is that the Lower Slaney (Estuary) invariably has a lower trophic status than Wexford Harbour. While the TSAS classification during 2010-2012 was similar for both Lower Slaney and Wexford Harbour (i.e. Potentially Eutrophic) it is important to point out that the threshold exceedance was considerably greater in the Lower Slaney than Wexford Harbour, 72% and 23%, respectively. The eutrophication effect is a function of run-off from heavy agriculture activities as well as some large urban areas upstream. While dilution and a shift in nutrient balance (from marine waters) may be contributory factors for the observed differences between the waterbodies, O'Boyle et al (2015) propose a conceptual model on other factors influencing phytoplankton growth/proliferation in Irish Estuaries. Muylaert and Raine (1999) (reiterated by O'Boyle et al. (2015)) suggest that grazing by macrobenthic organisms (e.g.

mussels) in estuarine/coastal systems may play a role in regulating phytoplankton levels and hence, eutrophication status, *sensu*, Dame (2013). Given the ability of large aggregations of bivalve molluscs to filter large volumes of water and remove excess phytoplankton (Dame and Olenin 2005 and references therein; Dame 2013) and enhance sediment denitrification (Pollack et al 2013; Kellogg et al., 2013, 2014; Smyth et al , 2015), it has been suggested that they would represent a realistic mitigation feature to control eutrophication of coastal waters (Dame and Olenin 2005 and references therein; Kotta et al 2004; Lindahl et al 2005; Gren et al 2009; Dame 2013; Bergstrom et al 2015; Marques et al 2013; Petersen et al 2015). Additionally, harvesting as a mechanism for removal of nitrogen from the system has also been postulated (Guyondet et al. 2014; Bergstrom et al. 2015) and promoted by Rose et al (2015). Given these observations, it is likely that in the Slaney River Valley SAC (i.e., Wexford Harbour) grazing by mussels (the majority of which are in culture), while not explicitly demonstrated, is likely an important potential control mechanism of eutrophication in the system (Shane O'Boyle, EPA, personal communication).

Table 18 . Trophic status of Lower Slaney River and Wexford Harbour (source EPA, Ireland).

	Waterbody Trophic Status (TSAS)	
Year	**Lower Slaney**	**Wexford Harbour**
2012-2014	Eutrophic	Intermediate
2010-2012	Potentially Eutrophic	Potentially Eutrophic
2007-2009	Eutrophic	Unpolluted
2001-2005	Eutrophic	Intermediate

3. ***Habitat provided by shellfish***. Shellfish assemblages (particularly epibenthic forms) provide important structure and enhance habitat heterogeneity in marine systems (Walles et al 2015). The bivalve shells provide an important attachment site for other epifaunal species. In addition, the structure can provide refuge for a range of mobile taxa. Numerous studies have documented considerable diversity of attached species and nekton associated with shellfish reefs, when compared with surrounding sedimentary habitats (Lehnert and Allen, 2002; Tolley and Volety 2005; Boudreaux et al 2006; Humphries and LePeyre 2015; Scyphers et al 2011) and specifically for mussels (Borthagaray and Carranza 2007; Norling and Kautsky 2007, 2008; McDermott et al. 2008; Drent and Deker 2013; Norling et al 2015; see review by Guitierrez et al 2003). Yet, under high densities (e.g. intertidal mussel beds) the diversity of associated biota can be lower than expected (Palomo et al., 2007) which may be due to intensive filtration which prevents larval settlement of any associated organisms (Woodin

1976) or a lack of interstitial space for colonisation. In addition, it has also been proposed that zooplankton and larval fishes which depend on phytoplankton can compete with bivalves; also, mussels have the ability to reduce the abundance of zooplankton by filtering; however, the importance of this is still as yet unknown. However, any impact on fisheries might be offset by the value of heterogeneous habitats created by mussel patches to fishes (McDermott 2008).

In Wexford Harbour, mussel culture practices result in a mottled distribution of mussels on the seabed forming in a heterogenous habitat structure (See insert in Figure 7 and Section 6.56-6.60 in SPA report[8]). Such a structural arrangement is likely to benefit overall system diversity (Norling and Kautsky 2008), which is broadly in keeping with the conclusions of Buschbaum et al (2009) that mussel reef systems (on sedimentary habitats), as found in Wexford, enhance habitat heterogeneity and species diversity at the ecosystem level.

In summary, it is our view, based upon the information presented above, that bottom mussel culture, at current levels, does have a positive role in ecosystem function in terms of nutrient and phytoplankton mediation as well as provision of habitat. The addition of more mussels to the system (with new applications) may have additional benefit in terms of reducing effects of eutrophication, and may further improve status in the outer parts of Wexford Harbour relative to the Lower Slaney waterbody; however, this remains to be determined/confirmed and is subject to availability of additional seed.

In addition to the points outlined above; other mitigating/qualifying factors that are important to clarify are;

1) there is a clear distinction between current licence levels and current levels of activity in that mussel culture only occurs in deeper subtidal areas of the SAC and with one exception, it is anticipated that no culture (and disturbance from same) will occur in intertidal and shallow subtidal areas. This is an important consideration, particularly in the outer parts of the waterbody where the qualifying feature is Mudflats and sandflats not covered by seawater at low tide (1140) which if boundaries were to be redrawn would result in minimal or no coverage of this qualifying feature;
2) given the patchy nature of shellfish distribution on the seafloor, the areas where mussel culture will occur will not result in 100% cover of the seabed; however, it is expected that disturbance (dredging relating to harvest and/or maintenance) will occur over the entire area where mussels are placed, and;

[8] Marine Institute Bird Studies: Wexford Harbour, the Raven and Rosslare Bay: Preliminary Appropriate Assessment of Aquaculture. Atkins July 2016. 164pp

3) The input of mussels into the system is limited by seed availability which, if consistent with previous estimates, will result in greater dilution of stock within larger surface areas licensed.

12 References

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