An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

6th December, 2019

Ms. Mary O'Hara
Secretary to the Board
Aquaculture Licences Appeals Board
Kilminchy Court
Dublin Road
Portlaoise
Co. Laois

Your Ref: AP11/2019

Our Ref: T08/106 B, C & D

Dear Mary

I wish to acknowledge receipt of your letter to Mr. Michael Creed T.D., Minister for Agriculture, Food and the Marine (and copied to Mr. John Quinlan) regarding the appeal against the decision to refuse Aquaculture and Foreshore Licences to Moyasta Oysters Ltd. in relation to the above file.

I am attaching the following documentation in respect of the appeal as requested:-

1. Submission to the Minister which includes:

- The Application Form and all reports received in relation to the application;
- Submissions from Statutory Consultees.

2. Notification of the Minister's decision to the applicant.

3. A location map of the surrounding area including:

(i) Sites under application,

(ii) Sites lapsed,

(iii) Licensed sites,

(iv) Sites currently under appeal.

Please see below the hyperlinks to the Department's website where the three parts of the Shannon Estuary Appropriate Assessments Reports can be viewed (as the documents are too large to transmit by email).

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Food and the Marine

- The Shannon Estuary Appropriate Assessment (pdf 566Kb) Annex 1 (pdf 2,530Kb) and Annex 2 (pdf 4,339Kb) address the potential ecological impacts of aquaculture activity in the Lower River Shannon Special Area of Conservation and the River Shannon and River Fergus Estuaries Special Protection Area on the Conservation Objectives and Special Conservation Interests of the Natura 2000 sites.

If you require anything further please let me know.

Yours sincerely

Brendan Farr

Brendan Farr
Aquaculture & Foreshore Management Division
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An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

3rd October, 2019

Our Ref: T08/106B, C & D

Moyasta Oysters Ltd.
Moyasta
Kilrush
Co. Clare

BY REGISTERED POST

FISHERIES (AMENDMENT) ACT, 1997 (NO.23)
NOTICE OF MINISTERIAL DECISION TO REFUSE AQUACULTURE LICENCES AND FORESHORE LICENCES

Dear Sir

I would like to inform you that the Minister for Agriculture, Food and the Marine has refused the granting to you of Aquaculture Licences and accompanying Foreshore Licences, for the cultivation of Pacific Oysters and Native Oysters using bags and trestles / hanging baskets and trestles in Poulnasherry Bay, Shannon Estuary, Co. Clare on **Site References T08/106B, C & D** (see attached information note). I enclose an extract from the copy of the public notice of the decision which **the Department** has arranged to have published in 'The Clare Champion'.

Any person aggrieved by the decision may, in accordance with Section 41 of the Fisheries (Amendment) Act 1997, appeal against it in writing to the Aquaculture Licences Appeals Board. This appeal must be lodged within one month beginning on the date of the publication of the decision.

In addition, a person may question the validity of the Foreshore Licence determination by way of an application for judicial review, under Order 84 of the Rules of the Superior Court (SI No. 15 of 1986). Practical information on the review mechanism can be obtained from the Citizens Information Board at: http://www.citizensinformation.ie/

Yours sincerely

Brendan Farr
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An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

S.12 (3) OF THE FISHERIES (AMENDMENT) ACT, 1997 (NO.23)
INFORMATION NOTE TO APPLICANT FOR THE PURPOSE OF REGULATION 18 OF THE AQUACULTURE (LICENCE APPLICATION) REGULATIONS 1998

REFERENCE NO:	**T08/106B, C & D**
APPLICANT:	Moyasta Oysters Ltd.
AQUACULTURE TO WHICH DECISION RELATES:	Cultivation of Pacific Oysters and Native Oysters using bags and trestles / hanging baskets and trestles in Poulnasherry Bay, Shannon Estuary, Co. Clare on **Site References T08/106B, C & D.**
NATURE OF DECISION:	Refusal of Aquaculture Licences
DATE OF DECISION:	**2nd October 2019**

Reasons For Refusal

- *The proposed sites are located within the Lower River Shannon Special Area of Conservation (SAC) and the River Shannon and River Fergus Estuaries Special Protection Area (SPA). An Article 6 Appropriate Assessment has been carried out in relation to aquaculture activities in the SAC and SPA and the reports are available on the Department's website. The Licensing Authority's Natura Conclusion Statement (also available on the Department's website) outlines how certain proposed aquaculture activities, including Sites T08/106 B, C and D, shall not be permitted as the risk of disturbance to the integrity of the SAC and SPA cannot be discounted given the conclusions and recommendations of the Appropriate Assessment process;*

- *The precautionary principle must be evoked in relation to the licensing of certain areas in the Shannon Estuary given that the exact nature and level of existing and proposed activities within the Oyster Fishery Order areas is subject to change. The proposed aquaculture at these sites is not consistent with the Conservation Objectives for the SPA and could result in high levels of disturbance for protected shorebird species. Taking account of the recommendations from the Appropriate Assessment process, there is potential for the development of intertidal aquaculture sites in the Poulnasherry/Kilrush area to cause substantial displacement to the Grey Plover and for further significant cumulative impacts on bird species as a consequence of a combination of pressures including, among others, aquaculture (existing and proposed) and green algal accumulations (eutrophication) in intertidal areas, particularly when considered in combination with oyster trestle cultivation in the Fishery Order area, T08/008, which covers part of Poulnasherry Bay;*

- *The potential risks from licensing the proposed aquaculture activities at these sites on the integrity of the relevant Natura 2000 sites cannot be discounted given the locations, nature and scale of the development;*

- *Taking account of the issues raised during the public and statutory consultation phase."*

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Extract from Copy of Public Notice to be inserted in 'The Clare Champion' by the Department

FISHERIES (AMENDMENT) ACT, 1997 (NO. 23) AND FORESHORE ACT, 1933 (NO. 12)
NOTICE OF DECISION TO REFUSE TO GRANT AQUACULTURE AND FORESHORE LICENCES

The Minister for Agriculture, Food and the Marine has decided to grant Aquaculture and Foreshore Licences to:

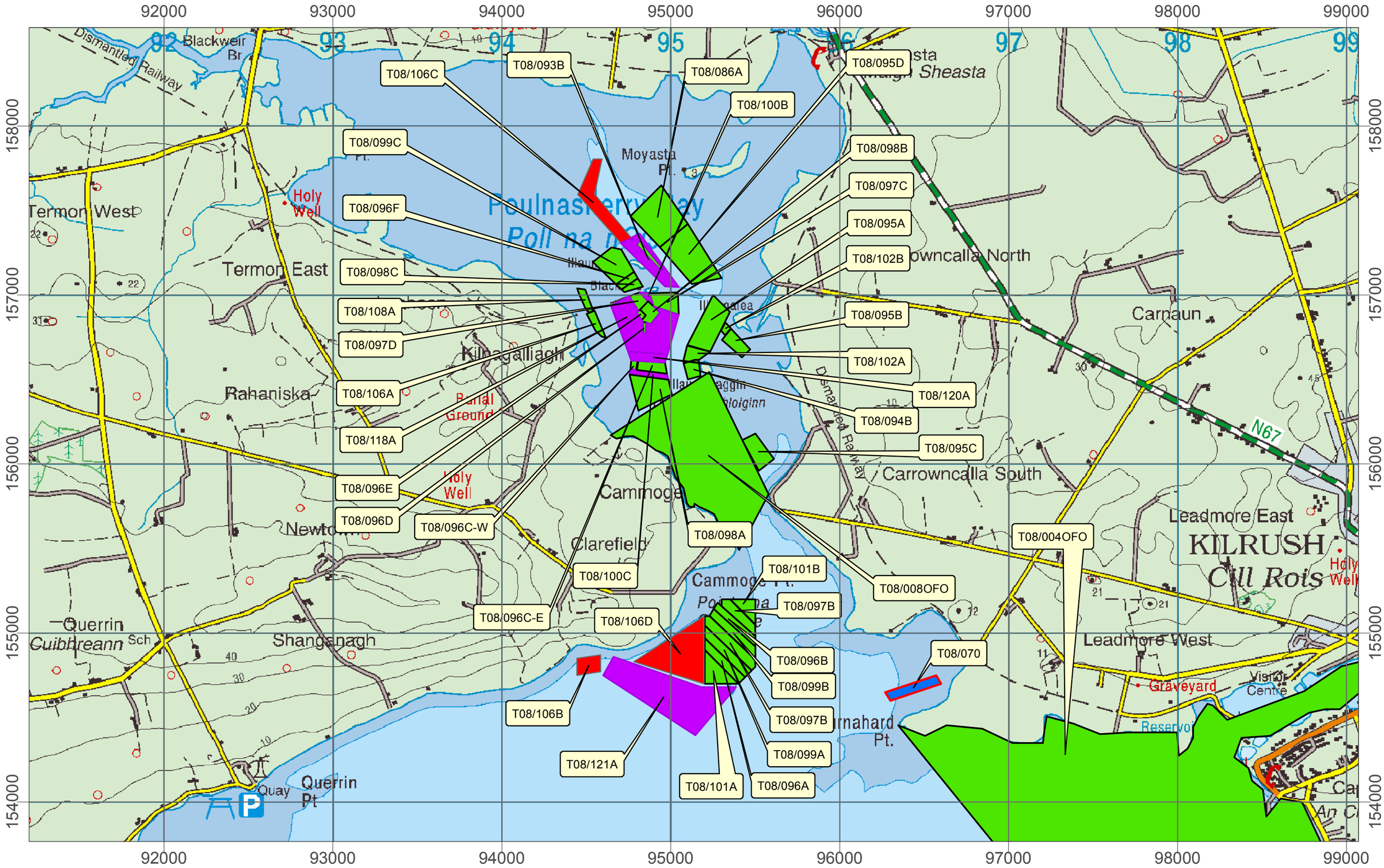
File Reference	Applicant	Minister's Decision	Species, Location, No. of Sites and Site References
T08/106B, C & D.	Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare	Refuse	Native and Pacific Oysters – Trestle and Bag/Hanging Baskets. Poulnasherry Bay, Shannon Estuary, Co. Clare - 3 sites: T08/106B, C and D.

The reasons for this decision are elaborated on the Department's website at:

https://www.agriculture.gov.ie/seafood/aquacultureforeshoremanagement/aquaculturelicensing/aquaculturelicencedecisions/clare/

An appeal against an Aquaculture Licence decision may be made in writing, within one month of the date of its publication, to THE AQUACULTURE LICENCES APPEALS BOARD, Kilminchy Court, Portlaoise, Co. Laois, by completing the Notice of Appeal Application Form available from the Board, phone 057 86 31912, e-mail info@alab.ie or website at http://www.alab.ie/

A person may question the validity of a Foreshore Licence determination by way of an application for judicial review, under Order 84 of the Rules of the Superior Court (SI No. 15 of 1986). Practical information on the review mechanism can be obtained from the Citizens Information Board at: http://www.citizensinformation.ie/



Aqua Culture Sites

<all other values>

Site_Status

- Lapsed
- Under Appeal
- Application
- Licensed

Drawn : 03-12-2019

POULNASHERRY BAY, CO. CLARE.
AQUACULTURE SITES

Scale = 1:20,000

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Submission AGR 00530-19: Recommendation to Refuse Aquaculture/Foreshore Licences for 3 sites (T08/106 B, C & D)

TO:	Minister	AUTHOR:	Farr, Brendan
STATUS:	Completed	OWNER:	Farr, Brendan
PURPOSE:	For Decision	REVIEWERS:	ODonovan, Geraldine Horan, Helena Quinlan, John Beamish, Cecil Kelly, Aiden
DIVISION:	Coastal Zone Management		
DECISION BY:			

Final comment

Minister determines that the Aquaculture/Foreshore Licences be refused for the reasons outlined.

Action required

Ministerial Determination on Aquaculture/Foreshore Licensing Application (T08/106 B, C & D)

Executive summary

The Minister's determination is requested please in relation to an application for Aquaculture Licences from Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare. The application is for the cultivation of Pacific Oysters and Native Oysters using bags and trestles / hanging baskets and trestles in relation to three sites numbered T08/106B (1.42 ha), T08/106C (3.96 ha) and T08/106D (8.3 ha), totalling 13.68 ha on the foreshore at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare.

There is also a submission in respect of this application for Foreshore Licences, for the Minister's consideration.

It is recommended that the Minister determines that the Aquaculture/Foreshore Licences **be refused** for the reasons outlined in the 'Detailed Information' section below.

Detailed information

Note: Tabs may contain additional information which is subject to redaction if transmitted to third parties.

Recommendation to Refuse Aquaculture Licences for three sites (refs: T08/106 B, C & D)

DECISION SOUGHT

The Minister's determination is requested please in relation to an application for Aquaculture Licences from Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare for three sites numbered T08/106 B, C & D at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare.

A submission in respect of the application for Foreshore Licences is also set out below, for the Minister's consideration.

BACKGROUND

Marine aquaculture operations require separate Aquaculture and Foreshore Licences and Ministerial approval is required in respect of this submission (Aquaculture Submission) and submission below (Foreshore Submission) which refer to the same sites.

The Aquaculture Licence defines the activity that is permitted on a particular site and the Foreshore Licence allows for the occupation of that particular area of foreshore. The continuing validity of each licence is contingent on the other licence remaining in force.

APPLICATION FOR AQUACULTURE LICENCES

An application for Aquaculture Licences has been received from the applicant referred to above (in conjunction with an application for Foreshore Licences) for the cultivation of Pacific Oysters and Native Oysters using bags and trestles / hanging baskets and trestles in relation to three sites numbered T08/106B (1.42 ha), T08/106C (3.96 ha) and T08/106D (8.3 ha), totalling 13.68 ha on the foreshore at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare (see **Tab A**).

LEGISLATION

Section 7 of the Fisheries (Amendment) Act 1997 provides that the Licensing Authority (i.e. the Minister, delegated officer or, on appeal, the Aquaculture Licences Appeals Board) may, if satisfied that it is in the public interest to do so, license a person to engage in aquaculture.

Article 6 (3) of the Habitats Directive provides that *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon … shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives … the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned …"*

CONSULTATION AND PUBLIC COMMENT

The application was sent to the Department's technical experts, statutory consultees and was also publicly advertised in a composite public notice covering both aquaculture and foreshore elements.

Technical Consultation

Observations/Comments were made by Technical Advisers as follows (see **Tab B**):

Marine Engineering Division (MED): MED have no objection to the licensing of these sites. The consistency of the seabed at these locations is suitable for oyster farming. The adjacent aquaculture in Poulnasherry Bay and Cammoge Point has been in place for many years and has become embedded in the landscape. Aquaculture has not been cultivated at Querrin previously. The proposed aquaculture sites have been configured to facilitate navigation, farming operations and visual impact within the overall aquaculture area. MED noted the Clare County Development Plan 2017-2023 which indicates scenic routes surrounding Poulnasherry Bay. They acknowledged that the landscape is relatively flat and there are only obscured views of the water from the N67. They also observed that the West County Railway is part of the heritage landscape for the area but does not pass by Cammoge. Querrin is within a heritage landscape but it is not along a scenic route. MED concluded, from a visual impact perspective, that in general, the views of these sites are obscured and limited from scenic routes.

Marine Survey Office (MSO): The MSO have no objection to this application from a navigational viewpoint. A group navigational marking scheme is in place for the adjacent aquaculture in Poulnasherry Bay and at Cammoge Point. The scheme provides a safe system of navigation for all marine users and can be extended to include these new sites. The proposed aquaculture should comply with the Co-ordinated Local Aquaculture Management System (CLAMS) and Special Unified Marking Scheme (SUMS) within the Bay/North Shannon region and be marked conducive to safe navigation.

Sea Fisheries Protection Authority (SFPA): The SFPA previously made general observations regarding the reconfiguration of sites and realigning of access routes in Poulnasherry Bay and the surrounding area. They confirmed they have no specific observations to make in respect of these sites.

Statutory Consultation

Regulation 10 of the Aquaculture (Licence Application) Regulations, 1998 requires certain statutory bodies to be notified of an Aquaculture Licence application.

Observations/Comments were made by Statutory Consultees as follows (see **Tab C**)

Marine Institute (MI): The MI noted that the sites are located within the West Shannon Poulnasherry Shellfish Growing Waters area and oysters in the bay currently have an "A" Classification. The MI recommended that the applicant be required to provide details of steps that would be taken to ensure that the risk of the introduction of any invasive non-native species into the proposed sites with seed stock or structures is minimised.

The MI stated that Sites T08/106 B, C and D are located within the Lower River Shannon
Special Area of Conservation (SAC) and the River Shannon and River Fergus Estuaries Special Protection Area (SPA) and noted the findings of the Appropriate Assessment reports and the Licensing Authority's Natura Conclusion Statement. The MI recommended that full account be taken of the conclusions and recommendations of the Appropriate Assessment process and the mitigation measures set out in the Natura Conclusion Statement with regards to the impacts on the Conservation Objectives within the Lower

River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

Commissioners of Irish Lights (CIL): CIL had no objection to the granting of these licences and noted that the applicant could secure Statutory Sanction (under a group marking scheme) for the relevant navigational aids as required.

Department of Culture, Heritage and the Gaeltacht (DCHG): The DCHG commented on the Appropriate Assessment reports and the Natura Conclusion Statement for the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA from a nature conservation perspective. They observed the in-combination effects of the aquaculture activities and activities within the Oyster Fishery Order (OFO) areas for designated habitats and the potential for interactions with the Bottlenose dolphin. They acknowledged that the Natura Conclusion Statement identifies the potential for significant displacement impacts for a number of bird species within the SPA. Concerns were raised regarding the potential effectiveness of the Adaptive Management Plan to be implemented based on the results of the targeted monitoring programme of shorebirds in the Poulnasherry/Kilrush area and on the lack of data surrounding the exact nature and level of current and proposed activities within the Fishery Order areas. The DCHG requested a review of the local knowledge available and further actions which might be required in the event of deterioration of conservation status of the features at the Shannon Natura 2000 sites.

The Department and its scientific advisers, the Marine Institute, considered the DCHG concerns including the extent of the Fishery Order areas in the Estuary. The pertinent issues are addressed in the updated Natura Conclusion Statement (see **Tab D**) along with a summary of mitigation measures and management actions that are being implemented as a consequence of the findings in the Appropriate Assessment reports.

The Marine Institute have also provided comments on the DCHG observations at the Department's request (see **Tab E**). The main concerns have been responded to as follows:

- The DCHG noted that the 15% threshold for a number of community types has been exceeded and that a precautionary approach be adopted in future licensing decisions. In addition, they highlight the risk to Bottlenose dolphin habitat.

The MI's Appropriate Assessment report for aquaculture activities within the Lower River Shannon SAC acknowledges the unknown nature and extent of the activities within the Oyster Fishery Order areas. To this end, a precautionary approach was employed such that any aquaculture activities likely to result in disturbance were considered in-combination with those as likely to occur in the OFOs. On this basis, the MI advised that caution be applied when considering if certain proposed aquaculture activities, including Sites T08/106 B, C & D, were to be licensed. As identifying the extent of the activities within the OFOs was not possible for the assessment and as the management of these areas is within the remit of the Department of Communications, Climate Action and Environment, it was not possible to dictate the extent of activity that may or may not be permitted within the OFO areas. The MI, therefore, assumed 100% occupancy/utility of the OFO areas.

The unknown nature of the activities and their extent within the OFOs also meant that the MI assumed full occupancy of these areas and assumed disturbance in their assessment of the Bottlenose dolphin habitat. The MI, however, stated that conservative assumptions were applied in the Appropriate Assessment in relation to the Bottlenose dolphin and they noted a recent study that concluded that shellfish farms appeared to have a positive impact on dolphin occurrence, with increased Bottlenose dolphin occurrence in waters close to aquaculture zones.

- The DCHG also make reference to the likely disturbance of shorebird species from aquaculture activities and requested clarification on the Adaptive Management Plan proposed for a number of areas.

The MI clarified that the output of the Appropriate Assessment report for the SPA indicated that there is, in a number of areas within the SPA, a risk of significant disturbance to a number of bird species as a consequence of a combination of pressures including, among others, aquaculture (existing and proposed) and green algal accumulations (eutrophication) in intertidal areas.

There is potential for the development of intertidal aquaculture sites in the Poulnasherry/Kilrush area to cause substantial displacement to the Grey Plover and for further significant cumulative impacts on bird species from the development of aquaculture sites in combination with oyster trestle cultivation in the Fishery Order area, T08/008, which covers part of Poulnasherry Bay.

The MI stated that these were conservative conclusions based on an assessment within, what is in relation to the SPA overall, relatively small but important areas for bird conservation features and that the recommended management responses were highly precautionary due to the lack of data surrounding the exact nature and level of current and proposed activities within the OFO areas.

In the Poulnasherry/Kilrush area, a winter low tide count survey for shorebirds (including Scaup) was initiated in 2018 to consider bird use in the area in light of existing aquaculture activity as well as assessing the in-combination effects with green algae cover on the shore. An Adaptive Management Plan is being applied based on the results of this targeted monitoring programme of shorebirds. The outputs and conclusions of monitoring efforts provide the basis for any necessary management actions while

future licensing will be dependent on the location, nature and scale of the aquaculture activity and be subject to favourable monitoring outputs.

An Taisce: An Taisce noted that the sites are located within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA and the importance of these Natura 2000 sites in terms of designations and as a coastal wetland site. They raised a number of issues regarding the risks of displacement to a number of bird species and to the Bottlenose dolphin. They also raised concerns in relation to certain aquaculture activities in combination with Fishery Order areas and stated that further clarification regarding the extent of current and planned aquaculture activities within the Fishery Order areas should be sought. These issues are dealt with in the Licensing Authority's updated Natura Conclusion Statement.

Concerns were also raised in relation to the potential impact of aquaculture on water quality in the Shannon Estuary. An Taisce considered the cumulative impacts with other aquaculture projects, Fishery Order areas and with point source outfalls from wastewater treatment plants and septic tanks. These issues have been dealt with through observations received from the Department's technical and scientific advisers (see **Tab E**). It was concluded that water quality degradation in the estuary is unlikely.

Irish Water: Irish Water noted the locations of this application in relation to designated shellfish waters and the proximity of wastewater discharges to proposed aquaculture developments. A table identifying the coordinates of existing primary and secondary discharge locations was provided and circulated to the Department's technical and scientific advisers for comment.

The Marine Institute observed that the site locations are within the boundaries of the West Shannon Poulnasherry Shellfish Growing Waters area. Considering oysters in Poulnasherry Bay and Cammoge have an "A" Classification status, the MI is of the view that the locations of the current discharges would not indicate a significant risk of microbiological contamination of shellfish in the area (see **Tab E**).

Marine Engineering Division stated that a number of the discharges are on the west coast of Clare and are of no significance to the aquaculture applications in Poulnasherry Bay and the surrounding area. MED concluded that this issue should not affect the licensing of aquaculture in Poulnasherry Bay and the surrounding area, given the flow of water/tidal exchange in the Shannon Estuary (see **Tab E**).

Clare County Council: Acknowledged the statutory consultation notification for licence applications in Poulnasherry Bay and the surrounding area, including this application, and noted the role of the Appropriate Assessment process in the preparation of the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary. Clare County Council did not comment on this specific licence application.

Bord Iascaigh Mhara (BIM): BIM have no objection and are satisfied that the application does not conflict with any other aquaculture or inshore fisheries interests in the area.

Inland Fisheries Ireland (IFI): The IFI made a number of observations on proposed licensing conditions but had no objection to this application.

Harbour Master: The Harbour Master of the Shannon Foynes Port Company is satisfied that the aquaculture locations in Poulnasherry Bay and the surrounding area do not impact on commercial shipping activities.

Department of Housing, Planning and Local Government (DHPLG): No observations were received from the DHPLG in respect of this application from a water quality or foreshore perspective.

Fáilte Ireland: No comments were received in respect of this application.

Údarás na Gaeltachta: No comments were received on this application.

Public Consultation

The application was publicly advertised using a composite public notice covering both aquaculture and foreshore elements in 'The Clare Champion' on 27th April 2018. The application and supporting documentation were available for inspection at Kilrush Garda Station for a period of 4 weeks from the date of publication of the notice in the newspaper.

There were **no objections** received from the public consultation process.

CRITERIA IN MAKING LICENSING DECISIONS

The Licensing Authority, in considering an application, is required by statute to take account, as appropriate, of the following points

and also be satisfied that it is in the public interest to license a person to engage in aquaculture:

- the suitability of the place or waters

  Scientific advice is to the effect that the waters are suitable for the cultivation of oysters. Technical advice indicates that the hydrodynamic regime is suitable for this type of aquaculture. The proposed aquaculture has been configured to facilitate navigation, farming operations and visual impact within the overall aquaculture area in Poulnasherry Bay and at Cammoge Point. The proposed site at Querrin is an extension of the overall oyster aquaculture industry in the North Shannon Estuary.

- other beneficial uses of the waters concerned

  There is fishing and marine leisure in the area. The Wild Atlantic Way surrounds Poulnasherry Bay with a point of interest at the West Clare Railway and Heritage Centre but does not pass by Cammoge. Querrin is within a heritage landscape but it is not along a scenic route. Public access to recreational and other activities could be accommodated by this project.

- the particular statutory status of the waters

  Natura 2000
  The proposed sites are located within the Lower River Shannon Special Area of Conservation (SAC) and the River Shannon and River Fergus Estuaries Special Protection Area (SPA). An Article 6 Appropriate Assessment has been carried out in relation to aquaculture activities in the SAC and SPA and the reports are available on the Department's website. The Licensing Authority's Natura Conclusion Statement (also available on the Department's website) outlines how certain proposed aquaculture activities shall not be permitted as the risk of disturbance to the integrity of the SAC and SPA cannot be discounted given the conclusions and recommendations of the Appropriate Assessment process.

  It is proposed that these sites cannot be licensed from a Natura 2000 perspective. The Department's scientific advisers, the Marine Institute, concluded that significant impacts from the proposed aquaculture activities at Sites T08/106 B, C and D could not be discounted given the locations, nature and scale (13.68 ha) of the development.

  In the Poulnasherry/Kilrush area, a winter low tide count survey for shorebirds (including Scaup) was initiated in 2018 to consider bird use in the area in light of existing aquaculture activity as well as assessing the in-combination effects with green algae cover on the shore. An Adaptive Management Plan is being applied based on the results of this targeted monitoring programme of shorebirds. The outputs and conclusions of monitoring efforts provide the basis for any necessary management actions while future licensing will be dependent on the location, nature and scale of the aquaculture activity and be subject to favourable monitoring outputs.

  Shellfish Waters
  The sites are located within the West Shannon Poulnasherry Shellfish Growing Waters area. The MI stated that oysters in this area currently have an "A" Classification under Annex II of EU Regulation 854/2004 which means that oysters from this bay can be placed directly on the market without the need for purification.

- the likely effects on the economy of the area

  Aquaculture has the potential to provide a range of benefits to the local community such as employment, the attraction of investment capital, development of support services etc.

- the likely ecological effects on wild fisheries, natural habitats, flora and fauna

  No significant issues arose regarding wild fisheries. The potential ecological impacts of aquaculture activities on natural habitats, flora and fauna are addressed in the Appropriate Assessment reports for the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA and in the Licensing Authority's Natura Conclusion Statement (which are available on the Department's website).

- the effect on the environment generally

  Following considerations implicit to Section 61 (e and f) of the Fisheries (Amendment) Act 1997, the Marine Institute advised

that the impacts of existing aquaculture on protected shorebird species be monitored before granting certain proposed aquaculture activities which could potentially result in high levels of disturbance for protected shorebird species.

The DCHG raised no objection to the development from an underwater archaeological perspective.

RECOMMENDATION

It is recommended that the Minister:

refuses the granting of Aquaculture Licences to Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare for the cultivation of Pacific Oysters and Native Oysters using bags and trestles / hanging baskets and trestles in relation to three sites numbered T08/106B (1.42 ha), T08/106C (3.96 ha) and T08/106D (8.3 ha), totalling 13.68 ha on the foreshore at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare.

This recommendation is based on the findings and conclusions of the Appropriate Assessment process for the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA and the Licensing Authority's updated Natura Conclusion Statement.

The proposed aquaculture at these sites is not consistent with the Conservation Objectives for the SPA and could result in high levels of disturbance for protected shorebird species. There is potential for the development of intertidal aquaculture sites in the Poulnasherry/Kilrush area to cause substantial displacement to the Grey Plover and for further significant cumulative impacts on bird species as a consequence of a combination of pressures including, among others, aquaculture (existing and proposed) and green algal accumulations (eutrophication) in intertidal areas, particularly when considered in combination with oyster trestle cultivation in the Fishery Order area, T08/008, which covers part of Poulnasherry Bay.

REASONS FOR DECISION

The Minister for Agriculture, Food and the Marine is required to give public notice of both the licensing determination and the reasons for it. To accommodate this, it is proposed to publish the following on the Department's website, subject to the Minister approving the above recommendation:

"Determination of Aquaculture/Foreshore Licensing Application – T08/106 B, C & D

Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare have applied for authorisation to cultivate Pacific Oysters and Native Oysters using bags and trestles / hanging baskets and trestles on three sites numbered T08/106B (1.42 ha), T08/106C (3.96 ha) and T08/106D (8.3 ha), totalling 13.68 ha on the intertidal foreshore at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare.

The Minister for Agriculture, Food and the Marine has determined that it is ***not in the public interest to grant*** *Aquaculture and Foreshore Licences for these sites. In making his determination the Minister considered those matters which by virtue of the Fisheries (Amendment) Act 1997 and other relevant legislation he was required to have regard.*

Such matters include any submissions and observations received in accordance with statutory provisions. The following are the reasons and considerations for the Minister's determination to ***refuse*** *the licences sought:-*

- *The proposed sites are located within the Lower River Shannon Special Area of Conservation (SAC) and the River Shannon and River Fergus Estuaries Special Protection Area (SPA). An Article 6 Appropriate Assessment has been carried out in relation to aquaculture activities in the SAC and SPA and the reports are available on the Department's website. The Licensing Authority's Natura Conclusion Statement (also available on the Department's website) outlines how certain proposed aquaculture activities, including Sites T08/106 B, C and D, shall not be permitted as the risk of disturbance to the integrity of the SAC and SPA cannot be discounted given the conclusions and recommendations of the Appropriate Assessment process;*

- *The precautionary principle must be evoked in relation to the licensing of certain areas in the Shannon Estuary given that the exact nature and level of existing and proposed activities within the Oyster Fishery Order areas is subject to change. The proposed aquaculture at these sites is not consistent with the Conservation Objectives for the SPA and could result in high levels of disturbance for protected shorebird species. Taking account of the recommendations from the Appropriate Assessment process, there is potential for the development of intertidal aquaculture sites in the Poulnasherry/Kilrush area to cause substantial displacement to the Grey Plover and for further significant cumulative impacts on bird species as a consequence of a combination of pressures including, among others, aquaculture (existing and proposed) and green algal*

accumulations (eutrophication) in intertidal areas, particularly when considered in combination with oyster trestle cultivation in the Fishery Order area, T08/008, which covers part of Poulnasherry Bay;

- *The potential risks from licensing the proposed aquaculture activities at these sites on the integrity of the relevant Natura 2000 sites cannot be discounted given the locations, nature and scale of the development;*

- *Taking account of the issues raised during the public and statutory consultation phase."*

Recommendation to Refuse Foreshore Licences for three sites (refs: T08/106 B, C & D)

DECISION SOUGHT

The Minister's determination is requested please in relation to an application for Foreshore Licences from Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare for three sites numbered T08/106 B, C and D at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare in which it is proposed to conduct aquaculture.

BACKGROUND

Marine aquaculture operations require separate Aquaculture and Foreshore Licences and Ministerial approval is required in respect of this submission (Foreshore Submission) and submission above (Aquaculture Submission), which refer to the same sites.

The Foreshore Licence allows for the occupation of the particular area of foreshore while the Aquaculture Licence defines the activity that is permitted in this area. The continuing validity of each licence is contingent on the other licence remaining in force.

APPLICATION FOR FORESHORE LICENCES

An application for Foreshore Licences has been received from the applicant referred to above (in conjunction with an application for Aquaculture Licences) relating to the occupation of the foreshore associated with the Aquaculture Licence application which covers three sites numbered T08/106B (1.42 ha), T08/106C (3.96 ha) and T08/106D (8.3 ha), totalling 13.68 ha on the foreshore at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare (see **Tab A**).

LEGISLATION

Section 3 of the Foreshore Act, 1933 gives power to the Minister to license the use of foreshore, if he is of the opinion that it is in the public interest to do so.

CONSULTATION AND PUBLIC COMMENT

The application was sent to the Department's technical experts and was also publicly advertised in a composite public notice covering both aquaculture and foreshore elements.

This application was also sent to the Department of Housing, Planning and Local Government (DHPLG) in accordance with subsection (1B) of Section 3 of the Foreshore Act, 1933, which requires consultation between the Minister for Agriculture, Food and the Marine and the Minister for Housing, Planning and Local Government. Whilst aquaculture legislation requires certain statutory bodies to be notified of an aquaculture application, no other statutory bodies are prescribed consultees under Fisheries related foreshore legislation.

DHPLG: No observations were received from the Department of Housing, Planning and Local Government in respect of this application from a water quality or foreshore perspective.

Technical Consultation

Marine Engineering Division (MED): MED have no objection to the licensing of these sites. The consistency of the seabed at these locations is suitable for oyster farming. The adjacent aquaculture in Poulnasherry Bay and Cammoge Point has been in place for many years and has become embedded in the landscape. Aquaculture has not been cultivated at Querrin previously. The proposed aquaculture sites have been configured to facilitate navigation, farming operations and visual impact within the overall aquaculture area. MED noted the Clare County Development Plan 2017-2023 which indicates scenic routes surrounding Poulnasherry Bay. They

acknowledged that the landscape is relatively flat and there are only obscured views of the water from the N67. They also observed that the West County Railway is part of the heritage landscape for the area but does not pass by Cammoge. Querrin is within a heritage landscape but it is not along a scenic route. MED concluded, from a visual impact perspective, that in general, the views of these sites are obscured and limited from scenic routes.

Marine Survey Office (MSO): The MSO have no objection to this application from a navigational viewpoint. A group navigational marking scheme is in place for the adjacent aquaculture in Poulnasherry Bay and at Cammoge Point. The scheme provides a safe system of navigation for all marine users and can be extended to include these new sites. The proposed aquaculture should comply with the Co-ordinated Local Aquaculture Management System (CLAMS) and Special Unified Marking Scheme (SUMS) within the Bay/North Shannon region and be marked conducive to safe navigation.

Sea Fisheries Protection Authority (SFPA): The SFPA previously made general observations regarding the reconfiguration of sites and realigning of access routes in Poulnasherry Bay and the surrounding area. They confirmed they have no specific observations to make in respect of these sites.

Public Consultation

The application was publicly advertised using a composite public notice covering both aquaculture and foreshore elements in 'The Clare Champion' on 27th April 2018. The application and supporting documentation were available for inspection at Kilrush Garda Station for a period of 4 weeks from the date of publication of the notice in the newspaper.

There were **no objections** received from the public consultation process.

CRITERIA IN MAKING LICENSING DECISIONS

The Minister, in considering an application for a Foreshore Licence, may, if satisfied that it is in the public interest to do so, grant such a licence.

Section 82 of the Fisheries (Amendment) Act, 1997 stipulates that the Minister, in considering an application for a licence under the Foreshore Acts, which is sought in connection with the carrying on of aquaculture pursuant to an Aquaculture Licence, shall have regard to any decision of the Licensing Authority in relation to the Aquaculture Licence.

RECOMMENDATION

It is recommended that the Minister, taking account of the decision on the related aquaculture licence application:

refuses the granting of Foreshore Licences to Moyasta Oysters Ltd., Moyasta, Kilrush, Co. Clare for the occupation of three sites numbered T08/106B (1.42 ha), T08/106C (3.96 ha) and T08/106D (8.3 ha), totalling 13.68 ha on the foreshore at Querrin, Poulnasherry Bay and Cammoge South, Shannon Estuary, Co. Clare.

The reasons for the recommendation to refuse the granting of the application are as follows:

- This recommendation is based on the findings and conclusions of the Appropriate Assessment process for the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA and the Licensing Authority's updated Natura Conclusion Statement;

- The proposed aquaculture at these sites is not consistent with the Conservation Objectives for the SPA and could result in high levels of disturbance for protected shorebird species. There is potential for the development of intertidal aquaculture sites in the Poulnasherry/Kilrush area to cause substantial displacement to the Grey Plover and for further significant cumulative impacts on bird species as a consequence of a combination of pressures including, among others, aquaculture (existing and proposed) and green algal accumulations (eutrophication) in intertidal areas, particularly when considered in combination with oyster trestle cultivation in the Fishery Order area, T08/008, which covers part of Poulnasherry Bay.

Submitted for approval, please.

Aquaculture and Foreshore Management Division.

Related submissions

There are no related submissions.

Comments

ODonovan, Geraldine - 25/09/2019 17:00
I recommend the refusal of licences for these three sites (T08/106 B, C & D) as outlined in the Aquaculture and Foreshore Licence Submissions.

Horan, Helena - 27/09/2019 15:11
I agree with the recommendation that the Aquaculture and Foreshore licences sought be refused for the reasons outlined.

Quinlan, John - 30/09/2019 13:25
Refusal is recommended in this case please.

Beamish, Cecil - 30/09/2019 15:09
Recommended that the Minister determines that the Aquaculture/Foreshore Licences be refused for the reasons outlined in the submission.

Kelly, Aiden - 30/09/2019 15:25
Approved by the SG for submission to the Minister. AK 30/09

Lennox, Graham - 02/10/2019 16:20
Minister determines that the Aquaculture/Foreshore Licences be refused for the reasons outlined.

User details

INVOLVED:	Farr, Brendan ODonovan, Geraldine Horan, Helena Quinlan, John Beamish, Cecil Sub Sec Gens Office eSub Sec Gen eSub Ministers Office eSub Minister
READ RECEIPT:	Farr, Brendan ODonovan, Geraldine Horan, Helena Quinlan, John Beamish, Cecil Kelly, Aiden Lennox, Graham

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Marine Engineering Division

Report on Aquaculture Licence Application

Application Reference No:	**T08/106B**
Report Prepared By:	**Edwina Forde**
Date:	16th April 2018
Applicant	Moyasta Oysters Ltd. Thomas and Michael Galvin, Moyasta, Co. Clare
Location	Querrin, Shannon Estuary, Co. Clare
Applicant Type	Aquaculture/Foreshore Licence Application
Sites	B
Site Area (Ha)	1.42
Species	Pacific Oysters (crassostrea gigas)
Cultivation Method	Trestle and Bag
Intertidal/Non-Intertidal	Intertidal
Annual Production Estimates	80 Tonnes (Year 4)
Shellfish Waters Designation Reference:	Yes ☒ No ☐ S.I.55 of 2009 West Shannon / Poulnasherry Bay
Environmental Designation Reference:	Yes ☒ No ☐ River Shannon and River Fergus SPA (site code 004077) Lower River Shannon SAC (site code 2165)
Development Plans Reference:	Yes ☒ No ☐ Clare County Development Plan 2017-2023
Pre-Consultation Meeting	Yes ☒ No ☐ Date: 12/04/16

Drawing Validation Sheet

OSI Maps **Yes** ☒ **No** ☐
Comment: 6" scale maps prepared by GIS Mapping Section.

BA Chart **Yes** ☒ **No** ☐
Comment: BA Charts prepared by GIS Mapping Section.

Farm Layout Drawing **Yes** ☒ **No** ☐

Directional Arrow	Yes	☒	No	☐
Scale	Yes	☒	No	☐
Title Block	Yes	☒	No	☐
Date	Yes	☒	No	☐

Comment: Drawings submitted are suitable.

Drawings of structures **Yes** ☒ **No** ☐
Comment: Drawings submitted are suitable.

Details of Proposed Navigation Marking **Yes** ☒ **No** ☐
Comment: Existing group navigation scheme in place.

Site Access Indicated **Yes** ☒ **No** ☐
Comment: Site access maps prepared by GIS Mapping Section.

Site Co-Ordinates Indicated **Yes** ☒ **No** ☐
Comment: Site co-ordinates indicated in application.

Site Overlap **Yes** ☐ **No** ☒
Comment:

Oyster Fishery Order Overlap **Yes** ☐ **No** ☒
Comment:

☒ **The application is submitted with each of the requirements listed and is therefore deemed to be a valid application.**

☐ **AFMD should be aware that insufficient details have been submitted as per above.**

Site Suitability Assessment

Site Location
Site location maps have been submitted with the application. The site is located at Querrin in Co Clare, adjacent to the Shannon Estuary. Aquaculture has not been cultivated at this location previously. The consistency of the seabed at this location has a firm substrate and suitable for the aquaculture proposed. Querrin Point provides shelter from a westerly direction.

Site Management
This application is for new aquaculture activity at Querrin, Co, Clare. This site was surveyed over a period from 2015 to 2016 as part of the overall surveys of aquaculture activity in south county Clare. There are no structures on the foreshore. It would be prudent to place structures on the foreshore on a phased basis as the area has not been trailed for aquaculture before and the size of the proposed application.

Proposed Site Layout and Structures
The applicant proposes cultivating oysters using the bag and trestle including hanging basket and floating bag method. Details of these structures were submitted by the applicant as they were not provided at the time of submission. The new aquaculture sites at Querrin have been configured to facilitate navigation, farming operations, and visual impact within the overall aquaculture area. The farm site layout for this application has been prepared and is suitable for advertising and attachment to any licence issued for the site.

Land Based Facilities / Site Access
The operator proposes to access the aquaculture site using an existing route from a public roadway and along the foreshore at Querrin. Details of the access route were included with the application.

Navigation
A group navigational marking scheme is in place for the adjacent aquaculture at Poulnasherry Bay and Cammoge. This scheme can be extended to include this site and provides safe system of navigation for all marine users. Please liaise with the local BIM officer.

Visual Impact
The Clare County Development Plan 2017-2023 indicates that Querrin is within a heritage landscape but it is not along a scenic route. The proposed farm layout and type of structures adhere to the best practices outlined in the Guidelines for Landscape and Visual Impact Assessment of Marine Aquaculture, 2001. The licence conditions will specify the orientation of the structures on the sites to minimise the visual impact.

Impact / Cumulative Impact
This new application is an extension of the overall oyster aquaculture industry in the North Shannon Estuary. The existing aquaculture at Poulnasherry and Cammoge has been in place for some time and there are no significant impacts due to this application. There is fishing and marine leisure in the area. The extension of the group marking scheme will reduce the impact of the aquaculture on navigation in the area. The 2018 report supporting Appropriate Assessment of Aquaculture in Lower River Shannon SAC (Site Code: 002165) concluded that aquaculture activities (intertidal oyster culture) do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC.

AFMD should ensure correct site details; OSI map and Admiralty chart are included in the licence if issued.

Marine Engineering Division has no objection to the licencing of this site subject to the above.

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Marine Engineering Division

Report on Aquaculture Licence Application

Application Reference No: T08/106C

Report Prepared By:	**Edwina Forde**
Date:	16th April 2018
Applicant	Moyasta Oysters Ltd. Thomas and Michael Galvin, Moyasta, Co. Clare
Location	Poulnasherry Bay, Shannon Estuary, Co. Clare
Applicant Type	Aquaculture/Foreshore Licence Application
Sites	C
Site Area (Ha)	4.18
Species	Pacific Oysters (crassostrea gigas)
Cultivation Method	Trestle and Bag, hanging baskets, floating bags and trestles
Intertidal/Non-Intertidal	Intertidal
Annual Production Estimates	80 Tonnes (Year 4)
Shellfish Waters Designation Reference:	Yes ☒ No ☐ S.I.55 of 2009 West Shannon / Poulnasherry Bay
Environmental Designation Reference:	Yes ☒ No ☐ River Shannon and River Fergus SPA (site code 004077) Lower River Shannon SAC (site code 2165)
Development Plans Reference:	Yes ☒ No ☐ Clare County Development Plan 2017-2023
Pre-Consultation Meeting	Yes ☒ No ☐ Date: 12/04/16

Drawing Validation Sheet

OSI Maps — **Yes** ☒ **No** ☐
Comment: 6" scale maps prepared by GIS Mapping Section.

BA Chart — **Yes** ☒ **No** ☐
Comment: BA Charts prepared by GIS Mapping Section.

Farm Layout Drawing — **Yes** ☒ **No** ☐

Directional Arrow	Yes	☒	No	☐
Scale	Yes	☒	No	☐
Title Block	Yes	☒	No	☐
Date	Yes	☒	No	☐

Comment: Drawings submitted are suitable.

Drawings of structures — **Yes** ☒ **No** ☐
Comment: Drawings submitted are suitable. Additional drawings for hanging baskets and floating bags submitted.

Details of Proposed Navigation Marking — **Yes** ☒ **No** ☐
Comment: Existing group navigation scheme in place.

Site Access Indicated — **Yes** ☒ **No** ☐
Comment: Site access maps prepared by GIS Mapping Section.

Site Co-Ordinates Indicated — **Yes** ☒ **No** ☐
Comment: Site co-ordinates indicated in application.

Site Overlap — **Yes** ☐ **No** ☒
Comment:

Oyster Fishery Order Overlap — **Yes** ☐ **No** ☒
Comment:

☒ **The application is submitted with each of the requirements listed and is therefore deemed to be a valid application.**

☐ **AFMD should be aware that insufficient details have been submitted as per above.**

Site Suitability Assessment

Site Location
Site location maps have been submitted with the application. The site is located at Poulnasherry Bay in Co Clare. Poulnasherry Bay is adjacent to the Shannon Estuary. The Bay is fed by 2 small streams from the Northeast at Moyasta and from the Northwest at Blackweir. The aquaculture at this location has been in existence for many years, which indicates that the hydrodynamic regime is suitable for this type of aquaculture. The consistency of the seabed at this location is soft intertidal mudflat with a firm substrate and suitable for the aquaculture proposed. The Wild Atlantic Way surrounds Poulnasherry Bay with a point of interest at the West Clare Railway and heritage centre.

Site Management
This application is for the renewal of existing aquaculture activity in Poulnasherry Bay, Co Clare. This site was surveyed over a period from 2015 to 2016 as part of the overall surveys of aquaculture activity at Poulnasherry Bay. The site is currently in use and is satisfactorily managed. This area was previously part of the West Clare Co-op.

Proposed Site Layout and Structures
The applicant proposes cultivating oysters using the bag and trestle method, including hanging baskets and floating bags. The aquaculture sites in Poulnasherry Bay have been configured to facilitate navigation, farming operations, and visual impact within the overall aquaculture area. The farm site layout and detail of structures to be licensed for this application have been prepared and are suitable for advertising and attachment to any licence issued for the site.

Land Based Facilities / Site Access
The operator proposes to access the site using an existing route to the aquaculture sites at Poulnasherry Bay from a public roadway and along the foreshore. Details of the access route were included with the application.

Navigation
A group navigational marking scheme is in place for the adjacent aquaculture at Poulnasherry Bay. The scheme provides a safe system of navigation for all marine users.

Visual Impact
The Clare County Development Plan 2017-2023 indicates there are scenic routes surrounding Poulnasherry Bay. As the landscape is relatively flat there are only obscured views of the water from the N67. The West County Railway is part of the heritage landscape for this area. In general, the views of this site are obscured and limited from scenic routes. The aquaculture in Poulnasherry Bay has been in place for some time and has become embedded in the landscape.
The proposed farm layout and type of structures adhere to the best practices outlined in the Guidelines for Landscape and Visual Impact Assessment of Marine Aquaculture, 2001. The licence conditions will specify the orientation of the structures on the sites to minimise the visual impact.

Impact / Cumulative Impact
This application is part of the overall oyster aquaculture industry within Poulnasherry Bay. This existing aquaculture has been in place for some time and there is no significant impact due to this application. There is fishing and marine leisure in the area. The group marking scheme reduces the impact of the aquaculture on navigation in the area.

The 2018 report supporting Appropriate Assessment of Aquaculture in Lower River Shannon SAC (Site Code: 002165) concluded that aquaculture activities (intertidal oyster culture) do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC. There is one protected structure (No. 324) at Moyasta Train Station which is in use as a visitor centre, however structures are only visible at low tide and do not impact on this monument.

AFMD should ensure correct site details; OSI map and Admiralty chart are included in the licence if issued.

Marine Engineering Division has no objection to the licencing of this site subject to the above.

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Marine Engineering Division

Report on Aquaculture Licence Application

Application Reference No: T08/106D

Report Prepared By:	**Edwina Forde**
Date:	16th April 2018
Applicant	Moyasta Oysters Ltd, Thomas and Michael Galvin, Moyasta, Co. Clare
Location	Cammoge, Shannon Estuary, Co. Clare
Applicant Type	Aquaculture/Foreshore Licence Application
Sites	D
Site Area (Ha)	8.30
Species	Pacific Oysters (crassostrea gigas)
Cultivation Method	Trestle and Bag, hanging baskets and floating bags
Intertidal/Non-Intertidal	Intertidal
Annual Production Estimates	80 Tonnes (Year 4)
Shellfish Waters Designation Reference:	Yes ☒ No ☐ S.I.55 of 2009 West Shannon / Poulnasherry Bay
Environmental Designation Reference:	Yes ☒ No ☐ River Shannon and River Fergus SPA (site code 004077) Lower River Shannon SAC (site code 2165)
Development Plans Reference:	Yes ☒ No ☐ Clare County Development Plan 2017-2023
Pre-Consultation Meeting	Yes ☒ No ☐ Date: 12/04/16

Drawing Validation Sheet

OSI Maps — **Yes** ☒ **No** ☐
Comment: 6" scale maps prepared by GIS Mapping Section.

BA Chart — **Yes** ☒ **No** ☐
Comment: BA Charts prepared by GIS Mapping Section.

Farm Layout Drawing — **Yes** ☒ **No** ☐

Directional Arrow	Yes	☒	No	☐
Scale	Yes	☒	No	☐
Title Block	Yes	☒	No	☐
Date	Yes	☒	No	☐

Comment: Drawings submitted are suitable.

Drawings of structures — **Yes** ☒ **No** ☐
Comment: Drawings submitted are suitable.

Details of Proposed Navigation Marking — **Yes** ☒ **No** ☐
Comment: Existing group navigation scheme in place.

Site Access Indicated — **Yes** ☒ **No** ☐
Comment: Site access maps prepared by GIS Mapping Section.

Site Co-Ordinates Indicated — **Yes** ☒ **No** ☐
Comment: Site co-ordinates indicated in application.

Site Overlap — **Yes** ☐ **No** ☒
Comment:

Oyster Fishery Order Overlap — **Yes** ☐ **No** ☒
Comment:

☒ **The application is submitted with each of the requirements listed and is therefore deemed to be a valid application.**

☐ **AFMD should be aware that insufficient details have been submitted as per above.**

Site Suitability Assessment

Site Location
Site location maps have been submitted with the application. The site is located south of Cammoge Point in Outer Poulnasherry Bay, Co Clare. Cammoge is adjacent to the Shannon Estuary. Cammoge is fed from the north by 2 small streams from the Northeast at Moyasta and from the Northwest at Blackweir. The upper portion of the point is used as a beach. The aquaculture at this location has been in existence for many years, which indicates that the hydrodynamic regime is suitable for this type of aquaculture. The consistency of the seabed at this location is soft intertidal mudflat with a firm substrate and suitable for the aquaculture proposed. The Wild Atlantic Way surrounds Poulnasherry Bay with a point of interest at the West Clare Railway and heritage centre but does not pass by Cammoge.

Site Management
This application is for new aquaculture activity in Cammoge, Shannon Estuary, Co Clare. This site was surveyed over a period from 2015 to 2016 as part of the overall surveys of aquaculture activity in the Shannon Estuary. No structures were present at time of survey. This area was previously part of the West Clare Co-op.

Proposed Site Layout and Structures
The applicant proposes cultivating oysters using the bag and trestle, floating bags and trestles and hanging baskets methods. The aquaculture sites in Poulnasherry Bay and Cammoge Point have been configured to facilitate navigation, farming operations, and visual impact within the overall aquaculture area. The farm site layout and detail of structures to be licensed for this application have been prepared and are suitable for advertising and attachment to any licence issued for the site.

Land Based Facilities / Site Access
The operator proposes to access the site using an existing route to the aquaculture sites at Cammoge Point from a public roadway and along the foreshore. Details of the access route were included with the application.

Navigation
A group navigational marking scheme is in place for the adjacent aquaculture at Poulnasherry Bay and Cammoge Point. The scheme provides a safe system of navigation for all marine users. This scheme should be extended to include the new sites a Cammoge South and Querinn.

Visual Impact
The Clare County Development Plan 2017-2023 indicates there are scenic routes surrounding Poulnasherry Bay. As the landscape is relatively flat there are only obscured views of the water from the N67. The West County Railway is part of the heritage landscape for this area. In general, the views of this site are obscured and limited from scenic routes. The aquaculture in Poulnasherry Bay and Cammoge has been in place for some time and has become embedded in the landscape. The proposed farm layout and type of structures adhere to the best practices outlined in the Guidelines for Landscape and Visual Impact Assessment of Marine Aquaculture, 2001. The licence conditions will specify the orientation of the structures on the sites to minimise the visual impact.

Impact / Cumulative Impact
The existing aquaculture at Poulnasherry and Cammoge has been in place for some time and there are no significant impacts due to this application. There is fishing and marine leisure in the area. The 2018 report supporting Appropriate Assessment of Aquaculture in Lower River

Shannon SAC (Site Code: 002165) concluded that aquaculture activities (intertidal oyster culture) do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC.

AFMD should ensure correct site details; OSI map and Admiralty chart are included in the licence if issued.

Marine Engineering Division has no objection to the licencing of this site subject to the above.

Farr, Brendan

From: Foley, Tina
Sent: 27 August 2019 09:18
To: Farr, Brendan
Cc: DAFM Queries
Subject: T08-106ABCD, [redacted]

Hi Brendan,
Further to your email below, Ros an Mhil Port have confirmed they have no further observations to make in respect of the above sites.
Kind regards
Tina

From: Farr, Brendan
Sent: 15 August 2019 12:34
To: Foley, Tina
Cc: Allison, James
Subject: T08-106ABCD, [redacted]
Hi Tina,
AFMD are currently preparing submissions for the Minister in relation to the Site References quoted above in the Shannon Estuary. We note there is SFPA correspondence on file in relation to these sites (dated 25/3/2013 and attached). While the comments refer mainly to the proposed reconfiguration of the sites and realigning of access routes which was pertinent at that time, AFMD now wish to clarify if the SFPA has any further observations to make on these Site References to reflect the current status of these applications in relation to the suitability of the waters and any possible effect on sea fishing operations including any food safety concerns.
We would be grateful for a response as soon as possible as it is expected that these licence applications will be determined shortly.
Regards & Thanks
Brendan

Brendan Farr
Executive Officer
Aquaculture and Foreshore Management Division
An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine
National Seafood Centre, Clonakilty, Co. Cork, P845 TX47
An Lárionad Bia Mara Náisiúnta, Cloich na Coillte, Corcaigh, P85 TX47
T +353 (0)23 8859514
www.agriculture.gov.ie

UCIM

An tÚdarás um Chosaint Iascaigh Mhara

Sea-Fisheries Protection Authority

INSPECTION REPORT

Site No. Inspected: [redacted]

T8 106A, B, C & D Tommy Galvin

[redacted]

Inspector(s): **J. Allison/G. Lynch** **Date of report: 25.3.2013**

Mr David Jennings,
Coastal Zone Management Division
Dept of Agriculture, Fisheries & Food,
Clogheen,
Clonakilty,
Cork.

25th March 2013

David

We received a copy of the above applications for an aquaculture and foreshore license.

We have inspected the sites and reviewed the license application for the above, along with its impact on the other bay users. Having spoken to many of the licensees in Poulnasherry Bay, there seems to be a problem with the mapping of their sites originating back to when the original co-operative site was split up in 2004. I spoke to [redacted] from BIM who indicated that she had mapped out the sites recently. However, discrepancies came to light between the areas being farmed and those licensed. While [redacted] expressed the opinion that the licensees should move to their licensed areas, it is my opinion that this would present difficulties in accessing the majority of the sites as the access road would now be part of a licensed area. This may lead to the licensee, if he so desired, preventing access to the other sites. Therefore it would be preferable if the entire area was remapped and the present situation resolved prior to the issuing of any further licenses.

I don't know whether you ever get to inspect the licenses in person, but it might not be a bad idea for you to come up and have a look at the area and to meet with ourselves and the other stakeholders involved. Let me know what you think.

Mise le meas

James Allison

Farr, Brendan

From: O'CALLAGHAN Tom [TomOCallaghan@dttas.gov.ie]
Sent: 01 August 2018 15:16
To: ODonovan, Geraldine
Cc: brendan.farr@agriculture.ie; info@sfpc.ie; 'info@irishlights.ie'; Donlon, Peter (Peter.Donlon@bim.ie)
Subject: Aquaculture site applications (oysters) in Shannon Estuary

Dear Ms O'Donovan,

Ref:

[redacted]

The proposed site is in a bay out of which Shannon Foynes Pilot boat operates; the proposed site should not interfere with their operations but Shannon Foynes Port should be consulted for their opinion.
The proposed site is in a bay out of which angling, fishing, dolphin watch activities take place; local stakeholders should be consulted for their opinions.

The site if licensed is required to position a special mark yellow pole at each of the south, south east and north most points of the proposed site; the poles to have a yellow St. Andrews Cross as topmark (the topmark to be visible at all stages of tide at a height of two metres above the water).

[redacted]

The site if licensed is required to position a special mark yellow pole at the three salient offshore points of the proposed site; the poles to have a yellow St. Andrews Cross as topmark (the topmark to be visible at all stages of tide at a height of two metres above the water).

T08 - sites within Poulnasheery Bay

[redacted], T08/106 A, C and D, [redacted], [redacted] T0[redacted]
The above proposed sites should be marked in accordance with the CLAMS/SUMS and conducive to safe navigation in the area.

Regards

Tom O'Callaghan (Capt.)
Nautical Surveyor
Marine Survey Office

An Roinn Iompair, Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport

Centre Park House, Bóthar Na Páirce Láir, Co. Corcaigh, T12 RKON
Centre Park House, Centre Park Road, Co. Cork, T12 RKON

T +353 (0)21 602 6323 Mob +353 87 7427712
tomocallaghan@dttas.gov.ie www.dttas.gov.ie

Farr, Brendan

From: Foreshore EPA Marine [fem.dau@chg.gov.ie]
Sent: 06 June 2018 08:52
To: Aquaculturelicensing
Subject: Aquaculture Licences T08-055A + 38
Attachments: ATT00001.txt; ATT00002.htm

RE: Aquaculture Licences [redacted] + 38 at Shannon Estuary, Co. Clare.

A chara,

Please find the nature conservation recommendations of the Department of Culture, Heritage, and the Gaeltacht for the above mentioned application.

The Department of Culture, Heritage and the Gaeltacht welcomes the opportunity to provide observations concerning the proposed licensing of aquaculture activities for the sites, namely [redacted] and 38 others listed in your communication on the 25th of April, 2018) at Lower River Shannon SAC (Site Code: 002165) and River Shannon and Fergus Estuaries SPA[1] (Site Code: 004077).

This is the first time this Department has issued comments on the appropriate assessment reports and draft conclusion statement for the above mentioned Natura 2000 sites.

The conclusion statement acknowledges that for the Lower River Shannon SAC (Site Code: 02165), the 15% disturbance threshold will be exceeded for two the Annex I marine habitats and a number of marine community types should applications be licensed. This Department's conservation objectives supporting document for marine habitats (NPWS, 2012) states "this Department takes the view that licensing of activities likely to cause continuous disturbance of each community type should not exceed an approximate area of 15%. Thereafter, an increasingly cautious approach is advocated. Prior to any further licensing of this category of activities, an inter-Departmental management review (considering *inter alia* robustness of available scientific knowledge, future site requirements, etc.) of the site is recommended." The Department would like to re-iterate this recommendation.

The in-combination effects of the aquaculture activities and activities within the Fisheries Order Areas exceed the 15% disturbance threshold for the Annex I habitats of Estuaries and Large shallow inlets and bays for which the site is designated. Similarly this disturbance threshold is exceeded for five of the constituent communities of these habitats.

Fishery Order areas overlap significantly with the well-documented critical habitat areas for Bottlenose dolphin, both spatially (>14.2%) and temporally. The potential for interactions which would be in conflict with the conservation objective targets for Bottlenose dolphin in the SAC can be reasonably concluded.

As the exact nature and level of current and proposed and activity within the Fisheries Order Area is considered unknown, this Department considers that further information is necessary before an Appropriate Assessment can be concluded. Data on the extent of the Fisheries Order Area to be utilised by current and proposed activities and the method by which restriction to this area alone will be regulated is a minimum requirement to enable adequate assessment of aquaculture activities within these Natura 2000 sites. In the event of no further information being available the precautionary principle must be evoked.

The draft Conclusion Statement as part of its mitigation measures and management actions have as a licence condition that further actions might be required in the event of deterioration of conservation status of the features at the site. However, the Nature Directives set a higher bar than this and require that deterioration should not be allowed to happen. Furthermore, there is no clear methodology on a monitoring and reporting framework to determine such deterioration.

This draft Conclusion Statement identifies the potential for significant displacement impacts for several of the listed bird species for the SPA. This Department has concerns about the potential effectiveness of the adaptive management plan as outlined in the draft Conclusion Statement and would welcome further information on how the precautionary principle is to be adhered to.

Mise le meas,

Connor Rooney
Development Applications Unit
Department of Culture, Heritage, and the Gaeltacht.
Newtown Road
Wexford

tel: 0539117464

An Roinn Cultúir,
Oidhreachta agus Gaeltachta
Department of Culture,
Heritage and the Gaeltacht

[1] Annex II Marine Institute Bird Studies River Shannon and Fergus Estuaries SPA: Appropriate Assessment of Aquaculture January 2018

Your Ref: T[redacted] T08/106, T[redacted]

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

Aquaculture and Foreshore Management Division,
Department of Agriculture, Food and the Marine,
National Seafood Centre
Clonakilty
Co Cork

Date: 06/06/2018

Re: Application for Aquaculture Licence

Dear Sirs,

We refer to your email notification of the 25/04/2018 regarding the above applications for aquaculture licences and make the following observations/objections.

We note that applications T[redacted] refers to developments that are wholly within designated shellfish waters while [redacted] T08/106, T[redacted] refers to developments that are not wholly within designated shellfish waters. For your information, we identify in Table 1 the coordinates of existing primary and secondary discharges operated by Irish Water discharging to this designated water, as well as those within 10 km of the proposed development.

Application No.	Within 10 km of non primary discharge point	X	Y	Within 10 km of primary discharge point	X	Y
[redacted]	No			No		
	Yes	88,265	159,658	Yes	86370	159511
	Yes	88288	159550	Yes	96873	167,316
		99264	154861		86370	159511
		98752	153990		97679	154060

[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
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[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
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[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			

[redacted]C-	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]D	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]E	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
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		98752	153990			
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		99264	154861		97679	154060
		98752	153990			
T[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]C	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			

[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
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		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060

		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
T08/106B	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
T08/106C	Yes	88288	159550	Yes	86370	159511

		99264	154861		97679	154060
		98752	153990			
T08/106D	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			
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		99264	154861		97679	154060
		98752	153990			
[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			

[redacted]	Yes	88288	159550	Yes	86370	159511
		99264	154861		97679	154060
		98752	153990			

The Department may wish to consider the proximity of wastewater discharges to the proposed aquaculture developments when making a decision on this application.

Yours faithfully,

P.P

Suzanne Dempsey
Spatial Planning Strategy Specialist
Irish Water

Farr, Brendan

From: ODonovan, Geraldine
Sent: 13 June 2018 17:38
To: Farr, Brendan
Subject: FW: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Hi Brendan,

This just came in from Mary Larkin!

Geraldine.

Sent from my Windows Phone

From: Mary Larkin
Sent: 13/06/2018 17:15
To: ODonovan, Geraldine
Subject: FW: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Dear Geraldine,
Please find below observations from IFI in relation to this applications:
IFI has no objection to the applications as per the listing included.
IFI would request that the following conditions would be included in the licence:

1. No fish other than native and pacific oysters shall be cultured or taken.
2. No other method of cultivation will take place.
3. That any disease in the fishery or any abnormal losses or mortalities are notified.
4. That disposals of all dead fish are by appropriate disposal methods and not back into the sea area.
5. That no substance is used which has a deleterious effect on the fishery environment and that biosecurity arrangements are in place.
6. That there is no unreasonable interference with fishing and navigation in the vicinity of the fishery.

Kind regards,
Mary
Mary Larkin
PA to Head of Operations
Inland Fisheries Ireland - Galway

Iascach Intíre Éireann
Inland Fisheries Ireland

Galway +353 (0)91 563118 Ext 8362
Mob +353 (0)87 7882082
Email mary.larkin@fisheriesireland.ie
Web www.fisheriesireland.ie
Teac Breac, Earl's Island, Galway, IRELAND.

Iascach Intíre Éireann
Inland Fisheries Ireland

From: Mary Larkin
Sent: 26 April 2018 18:15
To: Amanda Mooney
Subject: Fwd: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare
Hi Amanda.
Please see aquaculture applications. Can you review same and revert back with comments please so a response can be issued from here.
Regards
Mary
Sent from my Samsung Galaxy smartphone.
-------- Original message --------
From: "ODonovan, Geraldine" <Geraldine.ODonovan@agriculture.gov.ie>
Date: 26/04/2018 11:22 AM (GMT+00:00)
To: "'naturalenvironment@antaisce.org'" <naturalenvironment@antaisce.org>, "'dallaghan@bim.ie'" <dallaghan@bim.ie>, "'ocarroll@bim.ie'" <ocarroll@bim.ie>, "'murphym@bim.ie'" <murphym@bim.ie>, "'fem.dau@ahg.gov.ie'" <fem.dau@ahg.gov.ie>, "'fem.dau@chg.gov.ie'" <fem.dau@chg.gov.ie>, "'planning@failteireland.ie'" <planning@failteireland.ie>, Mary Larkin <Mary.Larkin@fisheriesireland.ie>, "'terry.mcmahon@marine.ie'" <terry.mcmahon@marine.ie>, "'foh@udaras.ie'" <foh@udaras.ie>, "'harry.duggan@irishlights.ie'" <harry.duggan@irishlights.ie>, "'mkennelly@sfpc.ie'" <mkennelly@sfpc.ie>, "'tduffy@clarecoco.ie'" <tduffy@clarecoco.ie>, "'foreshore@housing.gov.ie'" <foreshore@housing.gov.ie>
Cc: "Farr, Brendan" <Brendan.Farr@agriculture.gov.ie>
Subject: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare
Dear All,
Please see letter attached for your attention regarding the statutory consultation phase for aquaculture licence applications in the Shannon Estuary, Co. Clare. There is also a live web link below to the Department's website for details of the licence applications and all other relevant documentation.
https://www.agriculture.gov.ie/seafood/aquaculturefore shoremanagement/aquaculturelicensing/aquaculturefores horelicenceapplications/clare/
Grateful if any observations on these proposals could be forwarded to: Brendan.farr@agriculture.gov.ie within six weeks.
Kind Regards,

Geraldine O'Donovan
Administrative Officer

Aquaculture and Foreshore Management Division
Department of Agriculture, Food and the Marine
National Seafood Centre
Clonakilty
Co. Cork
P85 TX47

' (023) 8859539
✉ geraldine.odonovan@agriculture.gov.ie
Disclaimer:

Farr, Brendan

From: Michael Kennelly [mkennelly@sfpc.ie]
Sent: 09 May 2018 13:10
To: Farr, Brendan
Cc: geraldine.odonovan@agriculture.ie
Subject: Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary

Mr. Farr

Good afternoon Brendan,

E-mail from DAFM dated 26th April refers.

There are NIL observations in relation to the proposed applications from Shannon Foynes Port Company.

We are satisfied that the proposed locations do no impact on commercial shipping activities.

Many Thanks.

Michael Kennelly
Harbour Master
Shannon Foynes Port Company

Tel: +353 69 73103
Mob: +353 86 2208422

Farr, Brendan

From: Murphy, Mike [Mike.Murphy@bim.ie]
Sent: 06 June 2018 10:47
To: ODonovan, Geraldine
Cc: Farr, Brendan
Subject: RE: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Dear Geraldine,
Re: Licence Applications in the Shannon Estuary, Co. Clare;-

[redacted] T08/106 A,B,C,D; [redacted] for pacific and native oysters in bags an trestles, hanging baskets, floating bags and trestles.

Following internal consultation within BIM, the aquaculture division and our Regional Development Officer, BIM are satisfied that the proposed applications do not conflict with any aquaculture or inshore Fisheries interests in the area and we have no objection to the applications.

Regards,
Mike

Michael Murphy
Regional Aquaculture Development Manager
BIM

T +353 1 2144139
T +353 74 9732601
M +353 87 2476448
E murphym@bim.ie

Bord Iascaigh Mhara,
Crofton Road, Dún Laoghaire,
Co. Dublin, A96 E5A0

Ireland's Seafood Development Agency
bim.ie

From: ODonovan, Geraldine [mailto:Geraldine.ODonovan@agriculture.gov.ie]
Sent: 26 April 2018 11:22
To: 'naturalenvironment@antaisce.org'; Dallaghan, Ben; O'Carroll, Terence; Murphy, Mike; 'fem.dau@ahg.gov.ie'; 'fem.dau@chg.gov.ie'; 'planning@failteireland.ie'; 'mary.larkin@fisheriesireland.ie'; 'terry.mcmahon@marine.ie'; 'foh@udaras.ie'; 'harry.duggan@irishlights.ie'; 'mkennelly@sfpc.ie'; 'tduffy@clarecoco.ie'; 'foreshore@housing.gov.ie'
Cc: Farr, Brendan
Subject: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Dear All,

Please see letter attached for your attention regarding the statutory consultation phase for aquaculture licence applications in the Shannon Estuary, Co. Clare. There is also a live web link below to the Department's website for details of the licence applications and all other relevant documentation.

https://www.agriculture.gov.ie/seafood/aquaculturefores horemanagement/aquaculturelicensing/aquaculturefores horelicenceapplications/clare/

Grateful if any observations on these proposals could be forwarded to: Brendan.farr@agriculture.gov.ie within six weeks.

Kind Regards,

Geraldine O'Donovan
Administrative Officer

Aquaculture and Foreshore Management Division
Department of Agriculture, Food and the Marine
National Seafood Centre
Clonakilty
Co. Cork
P85 TX47

' (023) 8859539
✉ geraldine.odonovan@agriculture.gov.ie

An Taisce
The National Trust for Ireland

Department of Agriculture, Food & the Marine,
Aquaculture and Foreshore Management Division,
National Seafood Centre,
Clonakilty,
Co. Cork

[06/06/2018]

Submission pursuant to the provisions of Article 5 (2) of Directive 2011/92/EU

To Whom It May Concern:

Thank you for referring this notification to An Taisce in accordance with Section 10 of the Aquaculture (Licence Application) Regulations, 1998 (SI No 236 of 1998).

An Taisce has reviewed the applications [redacted] T08/106 A, B, C & D; [redacted] We would like to raise the following issues.

The proposed aquaculture project lies within the Lower River Shannon Special Area of Conservation (SAC), and River Shannon and River Fergus Estuaries Special Protection Area (SPA). The SAC marine area is designated for the Annex I habitats Sandbanks which are slightly covered by sea water all the time (1110), Estuaries (1130), Mudflats and sandflats not covered by sea water at low tide (1140), Coastal lagoons (1150), Large shallow inlets and bays (1160) and Reefs (1170). The bay supports a variety of sub-tidal and intertidal sedimentary and reef habitats. The area is also designated for marine mammals, Bottlenose Dolphin (*Tursiops truncates*) and Otter (*Lutra lutra*), fish, Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), and Atlantic Salmon (*Salmo salar*) (only in freshwater) and the Freshwater Pearl Mussel (*Margaritifera margaritifera*).

The River Shannon and River Fergus Estuaries SPA form the largest estuarine complex in Ireland. The site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in Co. Clare and Dooneen Point in Co. Kerry. The site has vast expanses of intertidal flats which contain a diverse macroinvertebrate community, e.g. Macoma-Scrobicularia-Nereis, which provides a rich food resource for the wintering birds. The site is both internationally important and the most important coastal wetland site in the country, regularly supporting in excess of 50,000 wintering waterfowl. It holds internationally important populations of four species, i.e. Light-bellied Brent Goose (*Branta bernicla hrota*), Dunlin (*Calidris alpine)*, Black-tailed Godwit (*Limosa limosa)* and Redshank (*Tringa tetanus*). It is also designated for, amongst others, Whooper Swan (*Cygnus cygnus*), Shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Teal (*Anas crecca*), Pintail (*Anas acuta*), Shoveler (*Anas clypeata*), Scaup (*Anas marila*), Cormorant (*Phalacrocorax carbo*), Golden

Plover (*Pluvialis apricaria*), Grey Plover (*Pluvialis squatarola*), Lapwing ((*Vanellus vanellus*), Ringed Plover (*Charadrius hiaticula*), Curlew (*Numenius arquata*), Bar-tailed Godwit (*Limosa lapponica*), Knot (*Calidris canutus*), Greenshank (*Tringa nebularia*), and Black-headed Gull (*Larus ridibundus*).

Issue 1: Bird Displacement

There is a significant risk of displacement to the Grey Plover and Bar-tailed Godwit with the proposed development of intertidal aquaculture sites in the Ballylongford/Bunaclugga, Poulnasherry/Kilrush and Aughinish/Foynes areas. However, in the Appropriate Assessment Conclusion Statement it is stated that the Appropriate Assessment conclusions are '*highly precautionary.*' An Taisce submit that this is implicit in the Habitats Directives, outlined in the Commission's COM (2000) 1 final 'Communication from the Commission on the precautionary principle,' which states that '*the use of the precautionary principle presupposes: ... a scientific evaluation of the risks which, because of the insufficiency of the data, their inconclusive or imprecise nature, makes it impossible to determine with sufficient certainty the risk in question (European Commission, 2000, p. 14).*' Thus, in our considered opinion, the findings must be assessed in light of this precautionary approach and not given less weight because of it.

The Ballylongford/Bunaclugga area is particularly important for Light-bellied Brent Goose and Ringed Plover, and also holds significant numbers of a number of other species. In the Appropriate Assessment Conclusion Statement they outline that in the case of the Ballylongford/Bunaclugga area the majority of the intertidal culture is to occur low in the intertidal area, thereby implying that it will have less of an impact. However, in section 7.44 of the SPA report (Annex II, p. 48) it is outlined that the true distribution of intertidal habitat in this area is unknown, and it is not possible to quantify the actual impact in terms of the percentage of the available habitat that will be affected under various tidal conditions. They propose licensing the area on these grounds, and monitoring Ringed Plover numbers (through IWeBs). However, An Taisce note that in Section 2 of the SPA report, they outline the limited use of the I-WeBs data as sufficient coverage is not always possible to achieve in a volunteer-based scheme, and the River Shannon and River Fergus Estuaries SPA is a particularly difficult site to cover due to its size and access issues in some of the major areas. Thus, in our considered option, we believe that this will not be an adequate method to survey for potential displacement effects.

Further, they suggest that in Poulnasherry/Kilrush, a winter low tide count survey focusing on shorebirds will be conducted to estimate site use in light of licensed aquaculture activities as well as in-combination effects with green algae cover on the shore. An Taisce submit that this is a post consent condition. An Taisce consider that leaving an assessment of the impacts of licensed aquaculture, and the creation of a management plan, to be addressed through the implementation of post consent condition is impermissible and could not be considered 'point of detail' conditions provided for under S.34(5) of the Planning and Development Act 2000 (as amended). In the case People Over Wind v An Bord Pleanala (2015) it was argued that, in

regard to post consent conditions, '*...in respect of which there would be no public consultation or participation, there would be no possibility for the examination, analysis and evaluation under Article 6(3). It would not be possible to establish, in advance of the consent to the development whether such mitigation measures would protect the integrity of the River Barrow and River Nore SAC,*' (Para. 202). An Taisce are of the belief that it is vital to categorically predict the impact to waterbird species in order to fully determine the impacts of the proposed aquaculture development prior to consent.

The possibility exists for significant disturbance impacts to high tide roosts used by Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot and Dunlin. It is outlined that for sites with Special Conservation Interests species covered by the Appropriate Assessment, significant disturbance from '*vessel activity associated with the development of sites in Ballylongford ...* ***cannot be excluded*** *due to a lack of information about the usage of high tide roost sites in these areas,*' [An Taisce emphasis added]. On the weight of this, An Taisce submit that licensing of the proposed aquaculture projects would clearly be in contravention of Article 6 (3) of the Habitats Directive. The legal basis for this is definitively outlined by the European Court of Justice (ECJ) in the Waddenzee Case (C-127/02), where the ECJ stated quite categorically that '*The competent national authorities, taking account of the appropriate assessment of the implications ... are to authorise such an activity only if they have made certain that it will not adversely affect the integrity of that site. This is the case where* ***no reasonable scientific doubt remains*** *as to the absence of such effects,*' [An Taisce emphasis added].

In addition, the potential for cumulative impacts from this vessel activity in combination with other vessel activity in these areas also needs to be considered. In keeping with the Precautionary Principle, and Article 6(3) of the Habitats Directive, in our considered opinion further information should be sought in regard to roosting behaviour prior to licensing.

The same argument applies to Scaup. It is outlined in the findings of the Appropriate Assessment in relation to Bird Species that aquaculture sites in the Poulnasherry/Kilrush AQUA may cause significant impacts to the availability of suitable foraging habitat for Scaup, and this cannot be excluded due to lack of knowledge about the effects of oyster trestles on Scaup foraging behaviour. In our considered opinion, the Precautionary Principle must be in effect, as outlined above in the Waddenzee Case.

Issue 2: Marine Mammals

The Lower River Shannon SAC is one of two designated SAC's in Ireland for the Bottlenose Dolphin (*Tursiops truncatus*, 1349), and it supports the largest resident population of the species known to occur in Ireland. They occur throughout the year and it is also an important calving area. Two distinct areas have been identified within the SAC as being important and are considered critical habitat for the overall welfare and health of the populations at the site (Figure 3, AA SAC report). The AA report outlines that the aquaculture production activities

within the SAC spatially overlap with dolphin critical habitat area, with a 14.73% overlap, very close to the 15% threshold (Table 3 of AA SAC report), and that these activities may have negative effects on the range and distribution of populations of the species. They outline that the presence of subtidal mussel fixed structures associated with the suspended subtidal culture of shellfish operations may act as a barrier restricting the range and movement of the species within the critical habitat area. They outline that the activities are potentially disturbing, but unlikely to happen. As outlined above, the licensing authority must be certain, beyond reasonable doubt that no adverse impacts will occur. Given the critical habitat this area provides, An Taisce submit that further ecological information/studies should be requested prior to licensing to ascertain the aquaculture activities will not negatively impact this QI species, in fulfilment of Article 6(3) of the Habitats Directive.

In addition, subtidal bottom cultured mussels are not considered disturbing to dolphins, but dredging is proposed as a method of harvesting for adult mussels. It has been shown that the dredging activities for mussels in subtidal areas may change marine ecosystems in relation to benthic organisms and substrate and may induce cascade effects on higher trophic levels, including birds (Dolmer 2012). Thus, An Taisce submit that further consideration should be given, and further information sought, regarding the risks to dolphins prior to licensing. If adequate mitigation measures cannot be furnished, it is our considered opinion that the licensing body should consider refusal of subtidal mussel culture aquaculture where it overlaps with the critical habitat.

Issue 3: Fisheries Orders

It is unclear to An Taisce how Fishery Orders are being addressed in this Natura 2000 assessment. They significantly overlap with Estuaries (17.11%) (Table 3 SAC Annex 1 report), inclusive of the following communities: Subtidal sand to mixed sediment with Nucula nucleus community complex (64.16%), Fucoid-dominated intertidal reef community complex (28.57%), Faunal turf-dominated subtidal reef community (17.24%), Anemone-dominated subtidal reef community (77.65%), Laminaria-dominated community complex (98.01%) (Section 8.4, SAC Annex 1 report).

Similar for Large Shallow Inlets and Bays (1160) where the Fishery Order overlaps 10.8% of this feature (Table 3 SAC Annex 1 report), and a number of community types recorded within this feature (Table 8): Subtidal sand to mixed sediment with Nucula nucleus community complex (44.3%), Fucoid-dominated intertidal reef community complex (15.5%), Faunal turf-dominated subtidal reef community (10.5%), Anemone-dominated subtidal reef community (25%).

Reefs (1170) are also affected. The Fishery Order overlaps 9.44% of this feature (Table 3 SAC Annex 1 report), as well as some community types recorded within this feature: Fucoid-dominated intertidal reef community complex (22.36%), Anemone-dominated subtidal reef community (75.27%).

Conclusion 1 of the SAC Annex 1 report outlines that aquaculture activities (bottom mussel, suspended mussel and bottom oyster culture) in combination with Fishery Order areas do pose a significant risk of disturbance to a number of qualifying interests in the SAC. However, the information available regarding the extent of usage and type of culture occurring within the Fishery Order Areas is sparse. They state that the spatial extents listed are the maximum areas the Fishery Order covers, however the area may not be fully utilised by the operators. An Taisce submit that there is uncertainty regarding the level of impact posed by the Fishery Orders. Given that the 15% threshold is exceeded for Estuaries, and for several of the constituent communities of the different habitat types, An Taisce would submit that any cumulative impact assessment, required by law under the Habitats Directive, must concede that the level of impact of the proposed aquaculture, when viewed in conjunction with the Fishery Orders, will exceed the level of allowable impact, and thus will pose a significant threat to the integrity of the SAC. In our considered opinion, further clarification regarding the extent of current and planned aquaculture activities within the Fishery Order areas should be sought prior to licensing.

Issue 4: Water Quality

Within the Shannon Estuary, there are a total of 60 aquaculture sites, covering a total of 631 Ha. While An Taisce supports the sustainable development of aquaculture, the granting of licenses must be in keeping with other objectives for the area and developed in a balanced manner, which is not degrading to the site or the water quality, thus ensuring the local habitats, flora and fauna are not adversely impacted.

An Taisce would highlight that coastal and transitional waters are subject to the legal obligations of the Water Framework Directive (WFD) (2000/60/EC), which requires that all water bodies reach good status by 2021. They are also protected by the Marine Strategy Framework Directive (MSFD), which aims to achieve good ecological status (GES) of the EU's marine waters by 2020 and to protect the resources on which marine-related economic and social activities depend. The Shannon Estuary is currently only at moderate status (EPA, 2016), and as such we are obliged to bring it to good status by 2021 under the WFD. Filter feeders excrete organic matter as pseudofaeces to the water column. Although it is generally assumed that organic outputs from suspended aquaculture activities fall to the sea floor directly beneath the trestles, and only cause localised enrichment, this is for small scale projects, and it is difficult to accurately predict the impacts of aquaculture as it intensifies and expands, as encouraged to do under the Harvesting our Ocean's Wealth plan and the Foodwise 2025 policy. Although Foodwise 2025 does mention the need to assess the carrying capacity of bays for aquaculture, no Strategic Environmental Assessment has been carried out for the aquaculture industry as a whole. Studies suggest that the environmental effects associated with oyster cultivation, such as increase in organic and silt composition become more severe in areas of large-scale cultivation as the water velocity can be decreased by the presence of the trestles (Nugues et al. 1996).

Given that this application is for seven renewal sites with a total area of 112 Ha, and 53 application sites with a total area of 520 Ha, An Taisce feel that the potential impact of these proposed licences on water quality must be considered. It appears, from the submitted paperwork, that the potential risk to water quality from granting all of the proposed licences was not considered. This is particularly pertinent when considering cumulative impact, both within the various aquaculture projects proposed for the estuary, in conjunction with the Fishery Orders, but also when considering them alongside point source outfalls from Wastewater Treatment Plants and septic tanks. An Taisce have concerns that there is a real risk of a cumulative impact on the water quality of the estuary, in contravention of the WFD and the MSFD, and this threat is also echoed in the EPA State of the Environment Report (2016) which states that: '*The main issues in relation to aquaculture are the effects of discharges of uneaten fish-food material and fish waste from fish farms... inputs to the aquatic environment associated with this industry include feedstuffs, veterinary medicines and anti-fouling agents. A certain portion of these may be lost to the waters and sediments in the vicinity of the fish farms.*'

We should be grateful if you would take account of these concerns in considering this application. If approved, An Taisce maintains the right to appeal this application should we be dissatisfied with the approval and/or any conditions attached.

We should be grateful if you would provide to us in due course: an acknowledgement of this submission; the nature of the decision; the date of the decision; in the case of a decision to grant an approval, any conditions attached thereto, and the main reasons and considerations on which the decision is based; and, where conditions are imposed in relation to any grant of approval, the main reasons for the imposition of any such conditions.

Is mise le meas,

Elaine McGoff,
Natural Environment Office,
An Taisce – The National Trust for Ireland

References

Dolmer, P., Christensen, H.T., Hansen, B.W. & Vismann, B. (2012) 'Area-intensive bottom culture of blue mussels Mytilus edulis in a micro-tidal estuary,' *Aquaculture Environment Interactions*, Vol. 3, No. 1, pp. 81-91.

EPA (2016) State of the Environment.

European Commission (2000) Communication from the Commission on the precautionary principle. Available at: https://publications.europa.eu/en/publication-detail/-/publication/21676661-a79f-4153-b984-aeb28f07c80a/language-en.

Nugues, M.M., Kaiser, M.J., Spencer, B.E. and Edwards, D.B. (1996) 'Benthic community changes associated with intertidal oyster cultivation,' *Aquaculture Research*, Vol. 27 pp. 913-924.

People Over Wind v An Bord Pleanala (2015) IEHC 271.

Farr, Brendan

From: Sheila Downes [SDownes@clarecoco.ie]
Sent: 23 May 2018 11:46
To: Farr, Brendan
Subject: RE: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Brendan,

We received the statutory consultation notification as outlined below in relation to the aquaculture licence applications in the Shannon Estuary which is welcomed. The preparation of the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary identified the preparation or absence of the Appropriate Assessments for these licenced areas as a key challenge and set out objectives to support their preparation and to assess any information that may arise in relation to these. See http://www.shannonestuarysifp.ie/wp-content/uploads/2016/03/volume_ils.pdf and specifically Objectives SIFP CFA 1.1 to 1.9 and in particular 1.1, 1.2 & 1.3.

What I thought might be useful is if someone involved in the preparation of these assessments could make a short presentation to the SIFP Steering Group which consists of representatives from the 3 Local Authorities on the estuary, SFPC, Shannon Group, EPA, NPWS and other key stakeholders. The next meeting is scheduled to take place on the 19th of June at 14.30 here in Clare County Council.

Of particular interest to the group would be the proposed monitoring as per the mitigation measures for winter low tide counts as the SIFP Steering Group commissioned in 2017 a complete survey of the Shannon Estuary over a 12 month period which was completed in April with the final output and presentation due also at this Steering Group meeting in June. The central storage of such information and circulation for use to others is a key point that would merit discussion. Equally the Adaptive Management Plans which are proposed within these documents would be an area the group would be interested in.

If you think this is something which could be accommodated I would greatly appreciate it and perhaps you could let me know once you have had a chance to think about it,

Kind Regards
Sheila

From: ODonovan, Geraldine [mailto:Geraldine.ODonovan@agriculture.gov.ie]
Sent: 26 April 2018 11:22
To: 'naturalenvironment@antaisce.org'; 'dallaghan@bim.ie'; 'ocarroll@bim.ie'; 'murphym@bim.ie'; 'fem.dau@ahg.gov.ie'; 'fem.dau@chg.gov.ie'; 'planning@failteireland.ie'; 'mary.larkin@fisheriesireland.ie'; 'terry.mcmahon@marine.ie'; 'foh@udaras.ie'; 'harry.duggan@irishlights.ie'; 'mkennelly@sfpc.ie'; tracy duffy; 'foreshore@housing.gov.ie'
Cc: Farr, Brendan
Subject: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Dear All,

Please see letter attached for your attention regarding the statutory consultation phase for aquaculture licence applications in the Shannon Estuary, Co. Clare. There is also a live web link below to the Department's website for details of the licence applications and all other relevant documentation.

https://www.agriculture.gov.ie/seafood/aquaculturefore shoremanagement/aquaculturelicensing/aquaculturefores horelicenceapplications/clare/

Grateful if any observations on these proposals could be forwarded to: Brendan.farr@agriculture.gov.ie within six weeks.

Kind Regards,

Geraldine O'Donovan
Administrative Officer

Aquaculture and Foreshore Management Division
Department of Agriculture, Food and the Marine
National Seafood Centre
Clonakilty
Co. Cork
P85 TX47

☎ (023) 8859539
✉ geraldine.odonovan@agriculture.gov.ie

ODonovan, Geraldine

From: Sheila Downes [SDownes@clarecoco.ie]
Sent: 29 May 2018 09:37
To: ODonovan, Geraldine
Cc: Farr, Brendan
Subject: RE: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Geraldine,

Many thanks for your email,

Kind Regards
Sheila

From: ODonovan, Geraldine [mailto:Geraldine.ODonovan@agriculture.gov.ie]
Sent: 25 May 2018 18:52
To: Sheila Downes
Cc: Farr, Brendan
Subject: FW: Re. Statutory Consultation on Aquaculture Licence Applications in the Shannon Estuary, Co. Clare

Dear Sheila,

Thank you for your message below.

Applications for aquaculture licences are considered in accordance with the provisions of the 1997 Fisheries (Amendment) Act, the 1933 Foreshore Act and related national and EU legislation. As you know, the legislation provides for a period of statutory and general public consultation. In the cases you refer to, this period of consultation is currently ongoing. You will appreciate, therefore, that it is incumbent on the Department to engage with statutory consultees by reference only to the procedures set out in the applicable legislation. As the applications are currently in this statutory process, it would not be appropriate to comment further or to make a presentation to statutory consultees pending the conclusion of this process.

However, as a general matter and outside the parameters of specific licence applications, the Department would be very happy to engage with the Council on any aquaculture related issues.

If you have any questions, please do not hesitate to get in touch.

I hope you find this helpful.

Kind Regards,

Geraldine.

Geraldine O'Donovan
Administrative Officer

Aquaculture and Foreshore Management Division
Department of Agriculture, Food and the Marine
National Seafood Centre
Clonakilty
Co. Cork
P85 TX47

COMMISSIONERS OF IRISH LIGHTS

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Operations & Navigation Services Department

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Mr. David Jennings
Aquaculture and Foreshore Management Division
Department of Agriculture, Fisheries and Food
Clogheen
Clonakilty
Co. Cork

Your Reference:
T08/106A, B, C & D
Our Reference:
LA0489.0135
Date:25/01/2013

LL: LA0489.0135, LA0489.0140, LA0489.0145, LA0489.0150.
Applicant: Thomas and Michael Galvin
Site: Poulnasherry Bay, Co. Clare

Dear Mr. Jennings,

Thank you for your letter advising us of this application.

Based on the information supplied, there appears to be **no objection** to the development. It is important to ensure that no navigable inter-tidal channels are impeded by any structures.

If a licence is granted, all structures must be clearly marked as required by Regulations and Licensing Permit conditions and to the approval of the Nautical Surveyor with the Marine Survey Office.

We would request that you include the following terms in the licence–

- That the applicant secures Statutory Sanction from the Commissioners of Irish Lights for the aids to navigation that may be required by the Marine Survey Office. These aids should be in place before development on the site commences.

- The size and specification of aids to navigation should be of the design and specification approved by the Marine Survey Office and must be agreed in advance with the Commissioners of Irish Lights.

It is recommended that local fishing and leisure interests be consulted prior to a decision being made.

Furthermore, if a licence is granted, the UK Hydrographic Office at Taunton must be informed of the development's geographical position in order to update nautical charts and other nautical publications.

Yours sincerely,

D Lane

Deirdre Lane
***for* Director of Operations and Navigation Services**

cc Capt. N. Forde, Dept. of Transport, Marine Survey Office

Rinville,
Oranmore,
Co. Galway
Tel: 091 387200
Date: 15 May 2018

Brendan Farr
Aquaculture and Foreshore Management Division
Department of Agriculture, Food and the Marine
Clogheen,
Clonakilty
Co. Cork.

Advice on Aquaculture Licence Application

Applicant	**Moyasta Oysters Ltd**
Application type	**New**
Site Reference No	**T08/106 A, B, C and D**
Species	**Pacific oysters and native oysters – Bags and Trestles / Hanging baskets and trestles**
Site Status	**Located within the Lower River Shannon SAC (Site Code 002165) and the River Shannon and River Fergus SPA (Site Code 004077)** **Located within the West Shannon Poulnasherry Shellfish Growing Waters Area.**

Dear Brendan

This is an application for a new aquaculture licence for the cultivation of pacific oysters (*Crassostrea gigas*) and native oysters (*Ostrea edulis*) using bags and trestles / hanging baskets and trestles at Sites T08/106 A, B, C and D on the foreshore at Poulnasherry Bay, Shannon Estuary Co. Clare. The area of foreshore at Site T08/106A is 0.673Ha, the area of foreshore at Site T08/106B is 1.42Ha, the area of foreshore at Site T08/106C is 3.96Ha, while the area of foreshore at Site T08/106D is 8.3Ha.

The sites are located within the West Shannon Poulnasherry Shellfish Growing Waters Area.

Oysters in this area currently have a "A" Classification under Annex II of EU Regulation 854/2004.

The cultivation of shellfish at these sites will produce faeces and pseudofaeces. Any impact will be limited to the area of the sites. The build-up of excess organic matter beyond the footprint of the sites is not considered likely. On the basis of targeted research[1], the impact of intertidal oyster cultivation using bags and trestles on the majority of community types is considered not significant.

No chemicals or hazardous substances will be used during the production process.

Sites T08/106 A, B, C and D are located within the Lower River Shannon SAC and the River Shannon and River Fergus SPA. We note the findings of the Appropriate Assessments reports [2]and the Department's draft Natura conclusion statement[3] in regard to the impacts on the Conservation Objectives within the Lower River Shannon SAC and the River Shannon and River Fergus SPA.

[1] Forde, J., F. O'Beirn, J. O'Carroll, A. Patterson, R. Kennedy. 2015. Impact of intertidal oyster trestle cultivation on the Ecological Status of benthic habitats. Marine Pollution Bulletin 95, 223–233.

[2] http://agriculture.gov.ie/media/migration/seafood/aquacultureforeshoremanagement/aquaculturelicensing/appropriateassessments/clare/1ShannonEstAppAssessment240418.pdf

[3] http://agriculture.gov.ie/media/migration/seafood/aquacultureforeshoremanagement/aquaculturelicensing/appropriateassessmentconclusionstatement/DraftAppAssessmenConStateAquacultureActivitiesLowerRiver240418.pdf

In making the final determination with respect to this application it is recommended that DAFM take full account of the conclusions and recommendations of the Appropriate Assessment report and the proposed mitigation measures set out in the Department's draft Natura Conclusion Statement.

Information on the source of stock for the sites has not been given in the application documentation provided. The Marine Institute recommends that this be clarified by the applicant prior to any final licence determination being made.

In order to be able to assess and manage the potential risk of the introduction of invasive non-native species the MI recommends that the initial source of seed and other sources which may be used at any point in the future should be approved by the Minister. This approval should be a specific condition of any licence that may issue. It should be noted that the control of alien species is a separate issue to the control of diseases in the context of the current Fish Health legislation.

Notwithstanding the recommendation outlined above, and in the event that an Aquaculture Licence is granted, the movement of stock in and out of the site should follow best practice guidelines as they relate to the risk of introduction of invasive non-native species (e.g. Invasive Species Ireland). In this regard it is recommended that, prior to the commencement of operations at the sites, the applicant be required to draw up a contingency plan, for the approval of DAFM, which shall identify, *inter alia*, methods for the removal from the environment of any invasive non-native species introduced as a result of operations at this site. If such an event occurs, the contingency plan shall be implemented immediately.

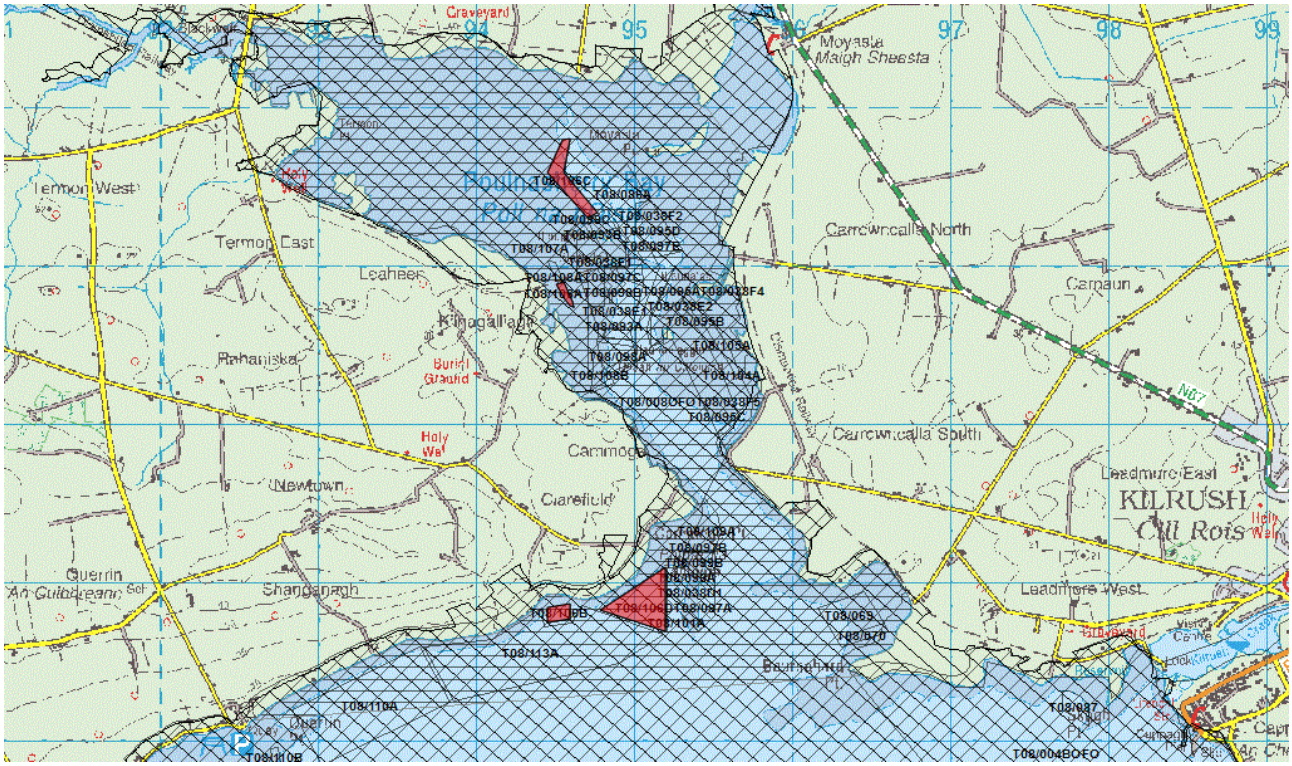
In the event that invasive non-native species are introduced into a site as a result of aquaculture activity the impacts may be bay -wide and thus affect other aquaculture operators in the bay. In this regard, therefore, the Marine Institute considers that the CLAMS process may be a useful and appropriate vehicle for the development and implementation of alien species management and control plans.

It is statutory requirement that a Fish Health Authorisation as required under Council Directive 2006/88/EC be in place prior to the commencement of the aquaculture activities proposed.

Kind regards,

_____

Dr. Terry McMahon
Section Manager, Marine Environment and Food Safety Services,
The Marine Institute.



☑ Shellfish Waters Directive Area

☑ Aquaculture Site

☑ Special Area of Conservation

☑ Special Protection Areas

Appropriate Assessment Conclusion Statement by the Licensing Authority for aquaculture activities in the Lower River Shannon SAC (Site Code: 002165) and River Shannon and Fergus Estuaries SPA (Site Code: 004077) (Natura 2000 sites) – July 2019

This Conclusion Statement outlines how it is proposed to manage and license aquaculture activities in the above Special Area of Conservation (SAC) and Special Protection Area (SPA) in compliance with the EU Habitats and Birds Directives. Aquaculture projects in these Natura 2000 sites will, if approved, be licensed in accordance with the standard terms and conditions as set out in the aquaculture licence templates. These are available for inspection on the Department's website at:- https://www.agriculture.gov.ie/seafood/aquacultureforeshoremanagement/aquaculturelicensing/aquacultureandforeshorelicencetemplates/. Furthermore, any proposed licences may incorporate specific conditions to accommodate Natura 2000 requirements, as appropriate, in accordance with the principles set out in this document.

The Appropriate Assessment reports for aquaculture in the SAC and SPA have been prepared by the Marine Institute in relation to marine habitats and Atkins Ecology/Marine Institute in relation to bird species, on behalf of the Department of Agriculture, Food and the Marine (available on the Department's website). The Article 6(3) Appropriate Assessment considered the potential ecological impacts of aquaculture activities on Natura 2000 features in both the SAC and the SPA. The information upon which the Appropriate Assessment is based is the definitive list of applications for aquaculture available at the time of assessment. This information was provided by the Department of Agriculture, Food and the Marine.

Aquaculture activity in the SAC and SPA

Aquaculture activity in the SAC and SPA relates to the production of shellfish (oysters and mussels). The main aquaculture activity involves the cultivation of Pacific oysters (*Crassostrea gigas*) on trestles in intertidal areas. The mussel culture includes subtidal suspended (longlines) and bottom culture.

The majority of the sites are contained in inner Poulnasherry Bay where aquaculture activity has been carried out for many years. There are aquaculture applications in outer Poulnasherry Bay and there are existing and proposed aquaculture activities in the Carrigaholt, Rinevella, Ballylongford/Bunaclugga and Aughinish/Foynes areas of the Shannon Estuary.

In addition, there are three areas within the Shannon Estuary covered by Fishery Orders. Whilst these Orders do not come under the remit of the Department of Agriculture, Food and Marine, they are included as part of the in-combination assessment.

The Lower River Shannon SAC

The Lower River Shannon SAC is a very large site (120km) which stretches along the Shannon valley from Limerick City in the upper reaches out to the mouth of the Shannon, covering an area between Loop Head (Co. Clare) in the north and Kerry Head (Co. Kerry) in the south. The mouth of the estuary is over 15 km wide, narrowing to just over 3 km between Kilcredaun and Kilconly Headlands. The site thus encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head.

Qualifying Interests

The Lower River Shannon SAC is designated for the marine Annex I qualifying interests of Sandbanks which are slightly covered by sea water all the time (1110), Estuaries (1130), Mudflats and sandflats not covered by seawater at low tide (1140), Coastal lagoons (1150), Large shallow inlets and bays (1160) and Reefs (1170).

The Annex I habitats 1130 and 1160 are large physiographic features that may wholly or partly incorporate other Annex I habitats including Reefs, Sandbanks and Mudflats and Sandflats within their areas. A number of coastal habitats can also be found in the SAC, including Mediterranean salt meadows (*Juncetalia maritime*, 1410), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), Salicornia and other annuals colonizing mud and sand (1310), Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*, 1330), Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, 3260), *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*, 6410), Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*, 91E0).

The area is also designated for a number of Annex II species including the Common Bottlenose Dolphin (*Tursiops truncatus*, 1349), the Otter (*Lutra lutra*, 1355), Freshwater Pearl Mussel (*Margaritifera margaritifera*, 1029), Sea Lamprey (*Petromyzon marinus*, 1095), Brook Lamprey (*Lampetra planeri*, 1096), River Lamprey (*Lampetra fluviatilis*, 1099) and the Atlantic Salmon (*Salmo salar*, 1106) only in fresh water).

An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur. Within the Lower River Shannon SAC, the qualifying habitats/species considered subject to potential disturbance and carried further in the Appropriate Assessment were:-

- 1130 Estuaries;
- 1140 Mudflats and sandflats not covered by sea water all the time;
- 1160 Large shallow inlets and bays;
- 1170 Reefs;
- 1349 Bottlenose Dolphin *(Tursiops truncates);*
- 1355 Otter *(Lutra lutra).*

Once spatial overlap was identified, subsequent disturbance and the persistence of disturbance were considered. Effects were deemed to be significant when, cumulatively, the risk posed by those aquaculture activities (i.e. bottom mussel, suspended mussel and bottom oyster culture) in-combination with other activities considered disturbing, that would likely lead to long term change (persistent disturbance) in broad habitat features (or constituent communities). The threshold for such a level of disturbance is 15% of any habitat or community type. Intertidal oyster trestle culture is considered non-disturbing to the majority of the habitat features.

The Fishery Orders overlap four habitat features (1130, 1140, 1160 and 1170) and two additional community types (Faunal turf-dominated subtidal reef community and *Laminaria*-dominated community complex) found within the qualifying interests of the SAC. On the basis of the activities i.e. primarily bottom oyster culture at the larger Fishery Order sites (T08/004A and T08/004B) there is potential habitat disturbance due to the culture of a high density of single species and the physical disturbance associated with harvesting.
A single Fishery Order site (T08/008) near Poulnasherry is used for the intertidal culture of oysters and is considered non-disturbing to habitat features.

The long residence time in the Lower River Shannon SAC increases the likelihood of successful recruitment of alien species *(Crassostrea gigas)* and further impacts are likely, due to the uncontained placement of this species on the seafloor.

Conservation Objectives for the Lower River Shannon SAC

The Conservation Objectives for the qualifying interests in the Lower River Shannon SAC were identified in NPWS (2012a). 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.

Screening of adjacent SACs for *ex-situ* effects

In addition to the Lower River Shannon SAC, there are a number of other Natura 2000 sites proximate to the proposed activities. A screening was carried out on the likely interaction with aquaculture activities based primarily upon the likelihood of spatial overlap. As it was deemed that there are no *ex-situ* effects and no effects on features in adjacent Natura 2000 sites, all qualifying features were screened out.

Assessment of the effects of aquaculture activity on the Conservation Objectives for Habitat features in the Lower River Shannon SAC

Estuaries (1130):

Habitat Area

It is considered unlikely that the proposed aquaculture activities will reduce the overall extent of permanent habitat within the feature, Estuaries. The habitat area is likely to remain stable.

Community Distribution

Aquaculture activities overlap the following Estuaries (1130) marine community types - Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex, Subtidal sand to mixed sediment with *Nucula nucleus* community complex, Subtidal sand to mixed sediment with *Nephtys* spp. community complex and Fucoid-dominated intertidal reef community complex. The combined aquaculture activities overlap with 1.34% of the habitat feature, Estuaries.

Fishery Orders overlap 17.11% of the feature, Estuaries. However, this assumes 100% occupancy of the Fishery Order areas by fisheries activity. The in-combination effects of Fishery Order activities and likely disturbing aquaculture activities (i.e. bottom mussel, suspended mussel and bottom oyster culture) are significant for the feature, Estuaries as well as four community types. Intertidal oyster trestle culture is considered non-disturbing to the feature, Estuaries.

Mudflats and sandflats not covered by seawater at low tide (1140):

Habitat Area

It is considered unlikely that the proposed aquaculture activities 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.

Community Distribution

This attribute considered interactions of aquaculture operations with two community types - Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community and Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex. The combined aquaculture activities overlap with 1.33% of the habitat feature, Mudflats and sandflats not covered by seawater at low tide (1140).

Fishery Orders overlap 2.27% of the feature, Mudflats and Sandflats not covered by seawater at low tide. However, this assumes 100% occupancy of the Fishery Order areas by fisheries activity. Significant in-combination effects of Fishery Order activities and likely disturbing aquaculture activities (i.e. bottom mussel, suspended mussel and bottom oyster culture) are not considered likely.

Intertidal oyster trestle culture is considered non-disturbing to the feature, Mudflats and sandflats not covered by seawater at low tide.

Large Shallow Inlets and Bays (1160)

Habitat Area

It is considered unlikely that the proposed aquaculture activities will reduce the overall extent of permanent habitat within the feature, Large Shallow Inlets and Bays. The habitat area is likely to remain stable.

Community Distribution

The combined aquaculture activities overlap with 0.79% of the habitat feature, Large Shallow Inlets and Bays (1160).

This attribute considered interactions between aquaculture activities and the following community types - Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. Community, Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex, Subtidal sand to mixed sediment with *Nephtys* spp. community complex, Fucoid-dominated intertidal reef community complex, Mixed subtidal reef community complex and Anemone-dominated subtidal Reef community. Specifically, one aquaculture activity (bottom oyster culture) overlaps with 28.4% of Anemone-dominated subtidal Reef community within the qualifying feature, Large Shallow Inlets and Bays, which is considered disturbing.

Fishery Orders overlap 10.8% of the feature, Large Shallow Inlets and Bays. However, this assumes 100% occupancy of the Fishery Order areas by fisheries activity. The in-combination effects of Fishery Order activities and likely disturbing aquaculture activities (i.e. bottom mussel, suspended mussel and bottom oyster culture) are significant for four community types within the feature, Large Shallow Inlets and Bays. Intertidal oyster trestle culture is considered non-disturbing to the feature, Large Shallow Inlets and Bays.

Reefs (1170)

Habitat area

The habitat area of Reef is unlikely to be changed as a consequence of aquaculture activities and is considered stable.

Community Distribution

The identified community types - Fucoid-dominated intertidal reef community complex and Anemone-dominated subtidal reef community will be exposed to differing ranges of pressure from aquaculture activities. This was considered during the assessment process and may result in more chronic and long-term changes in community composition. The combined aquaculture activities overlap with 0.09% of the habitat feature, Reefs.

Fishery Orders overlap 9.44% of the feature, Reefs. However, this assumes 100% occupancy of the Fishery Order areas by fisheries activity. The in-combination effects of Fishery Order activities and likely disturbing aquaculture activities (i.e. bottom mussel, suspended mussel, bottom oyster and intertidal oyster culture) are significant for two community types within the feature, Reefs.

Bottlenose dolphin (*Tursiops truncatus*)

The following aquaculture production activities within the SAC spatially overlap with dolphin critical habitat area:-

Suspended Intertidal Oyster Culture

Given the intertidal location of the structures and activities associated with this form of oyster culture, it is unlikely that marine mammals will have any negative interaction with this culture method. Ancillary activities at sites, i.e. site services and human, boat and vehicular traffic may increase the risk of minor disturbance to

marine mammals. However, these impacts can be discounted as interactions are likely to be short term, temporary and localised.

Subtidal Bottom Shellfish (Mussel, Oyster) Culture
Given that this culture type does not entail any structures, it would not act as a barrier to movement of the dolphin throughout its habitat range, including the critical habitat area. However, biological effects of such aquaculture may alter the natural condition of the critical habitat. The schedule of operations may also cause disturbance, however, this is likely to be limited to seasonal activities i.e. seeding, grading and harvesting, which should not coincide with the more sensitive periods for marine mammals. These impacts can, therefore, be discounted.

Suspended Subtidal Mussel Culture
Given the presence of subtidal fixed structures associated with the suspended subtidal culture of shellfish operations i.e. longlines, there is a possibility that their presence may act as a barrier restricting the range and movement of the dolphin within the critical habitat area. Ancillary activities at sites, i.e. site services and human and boat traffic, may increase the risk of disturbance to marine mammals. However, the dolphin has the ability to avoid structures and they may act as fish aggregation devices which may benefit this marine mammal. Recent studies have shown increased bottlenose dolphin occurrence near mussel farm locations and in waters close to aquaculture zones. Given the low level of overlap (0.26%) and limited levels of this activity in the SAC, allied with the potential benefits of the structures, impacts from suspended subtidal mussel culture can be discounted.

Fishery Order Areas
Given that Fishery Orders overlap at an almost significant level (14.23%) with the critical habitat area of the dolphin, and that the exact nature and level of activities proposed and ongoing are unknown, there is potential for interactions to occur. The biological effects of oyster dredging may alter the natural condition of the critical habitat. The operations at Fishery Order sites i.e. seeding, grading and harvesting may also cause disturbance. However, this assumes 100% occupancy of the Fishery Order areas by fisheries activity.

Otter (*Lutra lutra*)
The following aquaculture production activities within the SAC spatially overlap with otter critical habitat area:-

Suspended Intertidal Oyster Culture
Given the intertidal location of the structures and activities associated with this form of oyster culture, it is unlikely that the marine mammals will have any negative interaction with this culture method. Therefore, impacts can be discounted.

Suspended Subtidal Mussel Culture
The otter will likely forage in and around mussel lines. The lines are typically large in diameter and the risk of entanglement is minimal. Given that otter foraging is primarily crepuscular, interactions with mussel culture operators are likely to be minimal. It is unlikely that mussel culture poses a risk to otter populations within the SAC, impacts can therefore be discounted.

Subtidal Shellfish (Mussels, Oyster) Culture
Given that this culture type does not entail any structures and all operations are likely to be carried out in daylight hours, while otter foraging is primarily crepuscular, the interaction between the otter and aquaculture operations is likely to be minimal. It is unlikely that these culture types pose a risk to otter populations in the SAC and impacts can be discounted.

Fishery Order Areas:
Given that all operations are likely to be carried out in daylight hours, and that otter foraging is primarily crepuscular, the interaction with culture operations is likely to be minimal. Structures may be used within these areas but it is unlikely they would pose a risk to otter populations within the SAC. Therefore, impacts can be discounted.

River Shannon and Fergus Estuaries SPA

The Appropriate Assessment considered the potential impacts of aquaculture activity on the Special Conservation Interests (SCIs) of the River Shannon and Fergus Estuaries Special Protection Area (SPA) and on the SCIs of other SPAs where these SCIs may have connectivity with the Shannon Estuary.

All the sites within the River Shannon and Fergus Estuaries SPA are located in the lower part of the Shannon Estuary downstream of the Fergus Estuary. There are also a number of existing and proposed aquaculture sites located outside the River Shannon and Fergus Estuaries SPA in Carrigaholt and Rinevella Bays.

Qualifying Features
The SCIs of the River Shannon and Fergus Estuaries SPA covered by the Appropriate Assessment are: Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank and Black-headed Gull.

The SCIs of other SPAs covered by the assessment are: the Fulmar SCI of the Kerry Head SPA, the Kittiwake and Guillemot SCIs of the Loop Head SPA, and the Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit SCIs of the Ballyallia Lough SPA.

Core Conservation Objective for the River Shannon and Fergus Estuaries SPA
The core Conservation Objective is to maintain the favourable conservation condition of the SCI species in the SPA.

Findings of the Appropriate Assessment in relation to Bird Species

Stand alone effects:

Intertidal habitat
At the SPA and Lower Shannon scales, there is potential for substantial displacement to the Grey Plover and Bar-tailed Godwit in the Aughinish/Foynes area and also for the Grey Plover in the Poulnasherry/Kilrush area. Some moderate displacement of the Ringed Plover is predicted in the Ballylongford/Bunaclugga area.

The potential for intertidal oyster cultivation in the Poulnasherry/Kilrush aquaculture area to cause significant impacts to the availability of suitable foraging habitat for Scaup cannot be excluded due to a lack of knowledge about the effects of oyster trestles on Scaup foraging behaviour.

Intertidal aquaculture is unlikely to significantly affect the daytime habitat use by the River Shannon and Fergus Estuaries SPA Whooper Swan population, but due to a lack of information, possible impacts on nocturnal roost sites used by the Whooper Swan cannot be discounted.

Vessel activity associated with the development of sites in the Ballylongford/Bunaclugga area may cause significant disturbance impacts to important high tide roost sites for the SCI species covered by the Appropriate

Assessment. This possibility cannot be excluded due to a lack of information about the usage of high tide roost sites in these areas.

Subtidal habitat
There are four aquaculture sites that occupy predominantly subtidal or only subtidal habitat within the River Shannon and River Fergus Estuaries SPA. Although there is no information available on the location of nocturnal roost sites used by the River Shannon and River Fergus Estuaries SPA Whooper Swan population, any such roost sites in subtidal habitat are likely to be located in sheltered waters. Therefore, the mussel longline sites (T06/394A and T06/394B) in the Ballylongford/Bunaclugga aquaculture area and the bottom mussel site in the Aughinish/Foynes area (T07/014A) are unlikely to provide suitable roost sites. However, the bottom mussel site in the Ballylongford/Bunaclugga aquaculture area (T06/233) could potentially provide suitable roosting habitat.

In-combination effects:

Fishery Orders
Fishery Order T08/008 is located within Poulnasherry Bay and includes approximately 28 hectares of intertidal habitat. Full utilisation of the Fishery Order, combined with full development of the aquaculture sites, would significantly increase the percentage occupancy of intertidal habitat by oyster trestle cultivation in Poulnasherry Bay. Therefore, the cumulative effects of oyster trestle cultivation in Fishery Order T08/008 in combination with oyster trestle cultivation in existing and proposed aquaculture sites in Poulnasherry Bay could potentially cause substantial impacts to the Grey Plover and impact negatively on other species.

Oyster trestle cultivation in Poulnasherry Bay may also cause a reduction in the availability of foraging habitat for Scaup. The recorded distribution of Scaup in the Waterbird Survey Programme counts was in the outer part of the bay (subsite 0H520), outside the area occupied by Fishery Order T08/008. However, from general knowledge of Scaup habitat usage and distribution patterns, it seems likely that they would, at times, come into the lower part of the inner bay. Therefore, there is potential for the cumulative effects of oyster trestle cultivation in Fishery Order T08/008 in combination with oyster trestle cultivation in existing and proposed aquaculture sites in Poulnasherry Bay to cause increased impacts to Scaup.
Vessel activity associated with subtidal aquaculture activity in Fishery Orders T08/004A and T08/004B could cause disturbance to various waterbird species. However, the likelihood of disturbance is considered small, given there is a single operator likely operating a single vessel.

Other activities:

The main concentration of activity in the intertidal zone is likely to be in the beach recreation areas at Beale Strand and Cappa Beach. While this will presumably mainly occur during summer, it may overlap with the build-up of significant numbers of some of the SCI species in late summer/early autumn. The sandy areas likely to be favoured for recreational activities at Beale Strand appear to hold relatively few waterbirds.

Shellfish gathering and bait digging will also involve activity in the intertidal zone. However, the levels of these activities appear to be low and they are unlikely to cause significant disturbance impacts.

Wildfowling causes direct mortality of quarry species, as well as wider disturbance impacts. The quarry species include Wigeon, Teal, Mallard, Pintail, Shoveler, Scaup and Golden Plover. However, it is not possible to assess the potential cumulative impacts of wildfowling in-combination with aquaculture activities in the River Shannon and Fergus Estuaries SPA due to the lack of detailed information on the distribution and intensity of wildfowling activity within the SPA.

Boat activity will generally not affect waterbirds in intertidal and shallow subtidal habitat. However, some types of recreational watersport activities can occur in very shallow waters and have been observed to cause disturbance to waterbirds. Given the nature and distribution of the main intertidal areas within the River Shannon and Fergus Estuaries SPA, it seems unlikely that such activities would overlap with significant numbers of waterbirds.

Boat traffic to and from quays and marinas may also cause disturbance to waterbirds roosting in shoreline areas or islands at high tide. The locations of the marinas and yacht clubs at Foynes, Kilrush and Limerick City indicate that boat traffic to and from these facilities are unlikely to pass close to sensitive roost sites.

Given the size of the River Shannon and Fergus Estuaries SPA, and the fact that any impacts to waterbird populations from upgrades in wastewater treatment are likely to be localised to the immediate vicinity of the existing outfall locations, it is unlikely that such upgrades would have measurable impacts to populations at the SPA scale. Therefore, it is not necessary to consider potential in-combination effects of such upgrades with the aquaculture activities covered in the Appropriate Assessment.

Assessment of impacts on core SPA Conservation Objective

The possibility of intertidal or subtidal aquaculture development affecting nocturnal roost sites used by the Whooper Swan cannot be discounted as there is no information available on the location of these roost sites.

There is a high potential for significant displacement impacts to the Grey Plover and Bar-tailed Godwit in the Aughinish/Foynes area, to the Grey Plover in the Poulnasherry/Kilrush area and moderate displacement impacts to the Ringed Plover in the Ballylongford/Bunaclugga area arising from intertidal aquaculture.

The potential for intertidal oyster cultivation in the Poulnasherry/Kilrush aquaculture area to cause significant impacts to the availability of suitable foraging habitat for Scaup cannot be excluded due to the lack of knowledge about the effects of oyster trestles on Scaup foraging behaviour.
The potential for cumulative impacts from the development of aquaculture sites in combination with oyster trestle cultivation in Fishery Order T08/008 and/or bottom oyster cultivation in Fishery Orders T08/004A and T08/004B also warrants consideration.

There is potential for further significant cumulative impacts on some bird species from the development of aquaculture sites in combination with oyster trestle cultivation in Fishery Order T08/008, development of the area of opportunity for tidal energy in Tarbert Bay, and/or development of the area of opportunity for aquaculture in Clonderlaw Bay.

Significant displacement impacts to Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Lapwing, Curlew, Black-tailed Godwit, Knot and Dunlin are considered to be unlikely.

None of the aquaculture activities covered by the Appropriate Assessment are likely to cause significant impacts to the availability of suitable foraging habitat for Cormorant, or to cause significant disturbance impacts to Cormorant.

The potential impact of intertidal aquaculture on the Black-headed Gull cannot be assessed at this stage, due to a lack of data on Black-headed Gull distribution within the River Shannon and Fergus Estuaries SPA at the time of its likely peak usage of the area. Therefore, the likelihood of any negative impact occurring on the Black-headed Gull is uncertain.

None of the aquaculture activities covered by the Appropriate Assessment are likely to cause significant impacts to the availability of suitable subtidal foraging habitat for the Black-headed Gull, or to cause significant disturbance impacts to the Black-headed Gull roosting in subtidal habitat.

Findings and Recommendations of the Article 6(3) Appropriate Assessment of Lower River Shannon SAC (Site Code: 002165) and River Shannon and Fergus Estuaries SPA (Site Code: 004077)

- Intertidal oyster trestle culture activities do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC with one exception (Marine Community type – Anemone-dominated subtidal Reef community (28.4%) which is above the threshold (15%) within the qualifying feature, Large Shallow Inlet and Bays.

- Aquaculture activities (bottom mussel, suspended mussel and bottom oyster culture) in-combination with Fishery Order areas may pose a significant risk of disturbance to a number of qualifying interests in the SAC.

- The risk posed by the culture of diploid Pacific oyster (*Crassostrea gigas*) cannot be discounted given the long residence time in the Lower River Shannon SAC and considering the recruitment of the non-native oyster, *Crassostrea gigas*, is ongoing. This risk is further exacerbated by the culture of these oysters on the seabed. It is recommended that all oyster culture be carried out using triploid oysters and that the subtidal culture of *Crassostrea gigas* uncontained on the seafloor be reviewed in light of the findings.

- Mussel seed stock input into existing licensed mussel areas is collected locally at present. If seed is sourced outside of this area in the future, the risk posed by this activity, through the introduction of invasive non-native species, cannot be discounted. It is recommended that acceptable sources of seed (in terms of alien species assessment) are identified for all shellfish culture operations.

- The movement of stock in and out of the Lower River Shannon SAC should adhere to relevant fish health legislation and follow best practice guidelines (e.g. http://invasivespeciesireland.com/cops/aquaculture/).

- It is recommended that there be strict adherence to the access routes identified in order to minimise habitat disturbance.

- The current and proposed levels of aquaculture activities individually and in-combination with activities in Fishery Order areas are considered non-disturbing to otter conservation features.

- The current and proposed levels of subtidal suspended and bottom culture are unlikely to cause disturbance to the bottlenose dolphin conservation features. The bottlenose dolphin is unlikely to have any negative interaction with intertidal oyster culture.

- There is a risk of significant disturbance to a number of bird species as a consequence of a combination of pressures including, among others, aquaculture (existing and proposed) and green algal accumulations (eutrophication) in intertidal areas.

- There is potential for the development of intertidal aquaculture sites in the Poulnasherry/Kilrush area to cause substantial displacement to the Grey Plover, as this species is a visual feeder and may also avoid areas of heavy algal growth.

- The existing and proposed intertidal aquaculture sites in the Carrigaholt and Rinevella areas are outside the River Shannon and Fergus Estuaries SPA and significant utilisation of these areas by the SCI species is unlikely to occur.

- The development of intertidal aquaculture sites in the Ballylongford/Bunaclugga area may cause moderate displacement to the Ringed Plover. This area holds a relatively high proportion of the total SPA Ringed Plover population, however, the birds may be widely spread across the full extent of intertidal habitat within the area.

- There is potential for development of intertidal aquaculture sites in the Aughinish/Foynes area to cause substantial displacement impacts to the Grey Plover and Bar-tailed Godwit.

- There is potential for further significant cumulative impacts on some of the bird species from the development of aquaculture sites in combination with oyster trestle cultivation in the Fishery Order T08/008, which covers part of Poulnasherry Bay.

- The possibility of significant disturbance impacts to high tide roosts used by Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot and Dunlin from vessel activity associated with the development of sites in the Ballylongford/Bunaclugga and Aughinish/Foynes areas cannot be discounted due to a lack of information about the usage of high tide roost sites in these areas. The potential for cumulative impacts from this vessel activity in combination with other vessel activity in these areas also warrants further consideration.

- The possibility of intertidal or subtidal aquaculture developments affecting nocturnal roost sites used by the Whooper Swan cannot be discounted as there is no information available on the location of these roost sites.

Summary of Management Actions and Mitigation Measures that are being implemented as a consequence of the Findings in the Appropriate Assessment Process and following Observations received during the Statutory and Public Consultation Process

Taking account of the recommendations of the Appropriate Assessment process, as well as additional technical/scientific observations, the following measures are being taken in relation to the proposed licensing of aquaculture in these Natura 2000 sites:-

- On the basis of the Appropriate Assessment findings, it is not proposed to license bottom oyster culture sites (due to the long residence time in the Lower River Shannon SAC increasing the likelihood of successful recruitment of the non-native oyster, *Crassostrea gigas)*.

- The findings of the Appropriate Assessment process indicate that certain aquaculture activities (i.e. bottom mussel, suspended mussel and bottom oyster culture) in-combination with Fishery Order areas may pose a significant risk of disturbance to a number of qualifying interests in the SAC. It should be noted, however, that this assumes 100% occupancy of the Fishery Order areas by fisheries activity. As it is not proposed to license bottom oyster culture activities, further information on the specific levels of site use within Fishery Order areas would help to clarify the likely impact of some aquaculture activities, i.e. bottom culture of mussels and suspended intensive culture of mussels on these qualifying interests.

- There is potential for development of intertidal aquaculture sites in the Poulnasherry/Kilrush and Aughinish/Foynes areas to cause substantial displacement impacts to the Grey Plover, however, it should be noted that the Appropriate Assessment conclusions in this regard are highly precautionary.

- In the Poulnasherry/Kilrush area, a winter low tide count survey for shorebirds (including Scaup) was initiated in 2018 to consider bird use in the area in light of existing aquaculture activity as well as assessing the in-combination effects with green algae cover on the shore. It is anticipated that this monitoring will establish a summary of site use by the shorebird species while also providing observations on the likely interactions with aquaculture activities and other pressures specifically relating to the species distribution within the survey area. An Adaptive Management Plan will be applied based on the results of this targeted monitoring programme of shorebirds. In the event of increased or significant levels of displacement of shorebirds being observed, specific management actions (with a view to reducing disturbance effects) will be implemented (these will be operationalised by way of licence conditions).

- The use of all existing and proposed intertidal aquaculture sites in the Ballylongford/Bunaclugga area may cause moderate displacement to the Ringed Plover. On this basis, it is proposed to license existing aquaculture in the area and monitor the Ringed Plover numbers (through IWebs) to assess their long-term site use. Where licensing for intertidal oyster culture occurs in Ballylongford Bay, conditions will apply in relation to access and interactions with night roosts of some bird species. The subtidal bottom culture of mussels may be licensed in Ballylongford Bay with certain conditions relating to the extent and timing of activities. Given that existing aquaculture is confined to the eastern portion of the bird count survey area near Bunaclugga Bay, these sites should not adversely impact on bird distribution. The licensing of proposed aquaculture in this area may not occur on the basis that a moderate risk of disturbance (particularly on Ringed Plover) is anticipated if all activities are licensed. Ongoing bird monitoring (through IWeBS) for this area will determine if consideration can be given to any future licence applications.

- Full occupation of the aquaculture sites is predicted to have significant, or near significant, displacement impacts on the Grey Plover and the Bar-tailed Godwit in the Aughinish/Foynes area. On the basis of the Appropriate Assessment findings, it is proposed not to license site T07/012A for the cultivation of mussels using bouchot poles. There are no clear mitigation measures available to prevent the risk of disturbance to these shorebirds from the proposed activity at this site.

- The possibility of significant disturbance impacts to high tide roosts used by the SCI species covered by the Appropriate Assessment from vessel activity associated with the development of sites T06/233, T06/394A, T06/394B, T07/007, T07/012A and T07/014A cannot be discounted due to a lack of information about the usage of high tide roost sites in these areas. It is however, unlikely, given the small number of proposed operators for these areas that the levels of vessel activities are such that will result in significant disturbance to roosting SCI species. Travel to intertidal sites will occur outside of the period of high water and the subtidal sites will have limited access for maintenance and harvesting. Furthermore, the large bottom mussel site (T06/233) will be accessed from outside of the Shannon Estuary (Dingle Bay) and not Salleen Pier (from where the greatest disturbance might occur).

- The possibility of intertidal or subtidal aquaculture development affecting nocturnal roost sites used by the Whooper Swan cannot be discounted. Any night time activity occurring in site T06/233 could reduce the potential suitability of this site as a Whooper Swan nocturnal roost site. In the event of licensing aquaculture in this area, licence conditions will specify that no night time aquaculture activity be carried out.

- The combined activities are unlikely to cause disturbance to the bottlenose dolphin on the basis of the shallow and predominantly intertidal nature of the activities.

- All aquaculture licences are subject to standard licence conditions, which cover, among other things, any further actions that may be required in the event of deterioration in the conservation status of species/habitats/birds at site level that is directly attributable to shellfish culture operations.

- Licence conditions requiring strict adherence to the identified access routes over intertidal habitat in order to minimise habitat disturbance will apply.

- Licence conditions requiring that the Source of Seed must be approved by the Department of Agriculture, Food and the Marine will apply.

- Licence conditions requiring that Triploid Oysters be used for oyster culture to be carried out in the Lower River Shannon SAC and River Shannon and Fergus Estuaries SPA will apply.

- Licence conditions requiring full implementation of the measures set out in the draft Marine Aquaculture Code of Practice prepared by Invasive Species Ireland. Licensees will be required to prepare Contingency Plans for the approval of the Department of Agriculture, Food and the Marine which should identify, inter alia, methods for the removal from the environment of any non-target species introduced as a result of aquaculture operations.

- The use of updated and enhanced Aquaculture and Foreshore Licences containing terms and conditions which reflect the environmental protection required under EU and National law.

Conclusion

The Licensing Authority is satisfied that, given the conclusions and recommendations of the Appropriate Assessment process, the implementation of the above measures will mitigate certain pressures on Natura 2000 features.

From a Natura 2000 perspective, consideration can be given to licensing existing intertidal oyster trestle culture along with limited proposed intertidal oyster activity and subject to other licensing criteria and considerations. Other aquaculture activities (i.e. bottom mussel, suspended mussel and bottom oyster culture) in-combination with Fishery Order areas may pose a significant risk of disturbance to a number of qualifying interests in the Lower River Shannon SAC. Although this assumes 100% occupancy of the three Fishery Order areas in the Shannon Estuary, the precautionary principle applies and the proposed licensing of bottom mussel and suspended mussel culture is dependent on further information on the specific levels of site use. It is not proposed to license bottom oyster culture sites due to the long residence time in the SAC increasing the likelihood of successful recruitment of the non-native oyster, *Crassostrea gigas*. The licensing of mussel cultivation using bouchot poles is also not being considered as the risk of disturbance to shorebirds from this activity cannot be discounted.

It is acknowledged that existing intertidal oyster trestle culture and limited proposed intertidal oyster activities may be licensed in the Poulnasherry/Kilrush area subject to the ongoing monitoring of bird use in the bay and other licensing criteria and considerations. The outputs and conclusions of monitoring efforts will provide the basis for any subsequent management actions and will inform continued/proposed licensing in this area.

Existing and proposed intertidal aquaculture sites in the Carrigaholt and Rinevella areas, which are outside the River Shannon and Fergus Estuaries SPA, may be licensed subject to other licensing criteria and considerations.

A moderate risk of disturbance arises, particularly on the Ringed Plover, if all existing and proposed aquaculture were to be licensed in the Ballylongford/Bunaclugga area. Consideration can be given to licensing existing aquaculture in this area subject to other licensing criteria and considerations. The Ringed Plover numbers will be monitored through IWebs to assess their long-term site usage. Ongoing bird monitoring will determine if consideration can be given to any future licence applications.

In the Aughinish/Foynes area, existing intertidal oyster culture may be licensed. The proposed aquaculture activities in this area should be considered in conjunction with the potential significant disturbance to birds and the cumulative impacts to seabed habitats.

Accordingly, the Licensing Authority concludes that the licensing of certain aquaculture activities in the Shannon Estuary, along with specific management actions and mitigation measures, is not likely to have a significant effect on the integrity of the Lower River Shannon SAC and the River Shannon and Fergus Estuaries SPA. However, certain proposed aquaculture activities cannot be authorised as the risk of disturbance to the integrity of the relevant Natura 2000 sites from these activities cannot be discounted given the conclusions and recommendations of the Appropriate Assessment process.

July 2019

Marine Institute
Foras na Mara

Date: **April 9th, 2019**

To: **Geraldine O'Donovan AFMD-DAFM**

From: **Francis O'Beirn, Marine Institute**

CC: **Terry McMahon, Jeff Fisher – MI; Kevin Hodnett-AFMD**

Re: **MI observation on Statutory Consultee submission from the Department of Culture, Heritage and the Gaeltacht to Shannon Aquaculture licencing**

The Department of Culture, Heritage and the Gaeltacht (DCHG) in it's submission has provided observations on the existing and proposed activities in the Shannon Natura sites (i.e., Lower Shannon River SAC and the Shannon and Fergus Estuaries SPA). In addition to Nature conservation observations, it has have identified that an underwater archaeological impact assessment (UAIA) should be completed. This is beyond the remit of the MI and will not be addressed further in this note.

In their submission, DCHG have noted that the 15% threshold for a number of community types have been exceeded and that based upon their own advice that a precautionary approach be adapted in future licencing decisions. In addition, they highlight the risk to Bottlenose Dolphin habitat.

MI Response: The AA report for the Aquaculture activities within the Lower Shannon River SAC, prepared by the MI, acknowledges the unknown nature and extent of the activities within the Oyster Fishery Order Areas. To this end, a precautionary approach was employed such that any aquaculture activities likely to result in disturbance on the seafloor was considered in-combination with those as likely to occur in the OFOs. On this basis, it was advised that caution be employed when considering if these aquaculture activities were to be licenced. Identifying the extent of the activities within the OFO was not possible for the assessment. Also, management of these areas is within the remit of the Department of Communications, Climate Action and Environment therefore, it is not possible to dictate the extent of activity that may/may not be permitted within the OFO. Therefore, we assumed 100% occupancy/utility of the sites.

In relation to Bottlenose dolphin, it not entirely clear if bottom dredging of shellfish will result in damage to dolphin habitat. The unknown nature of the activities and their extent within the OFOs meant that we assumed full occupancy of the sites and assumed disturbance to this habitat type. In our assessment, we therefore, identified those activities that may act in-combination with other disturbing activities. Notwithstanding these conservative assumptions, we note the recent publication on interactions between dolphin and floating structures used in the culture of shellfish (rafts)[1] . The study concluded that shellfish farms appeared to have a positive impact on dolphin occurrence, with increased bottlenose dolphin occurrence at mussel farm locations and in waters close to the aquaculture zones.

DCHG also, make reference to the likely disturbance of shorebird species from aquaculture activities and request clarification on the adaptive management plan proposed for a number of areas.

MI Response: I refer to the previous correspondence with DAFM (06/03/2019) wherein the MI clarify the conclusions drawn in relation to interactions with shorebirds in a number of specific locations within the SPA. These conclusions are summarized below and specify specific actions, address the concerns highlighted in the DCHG communication.

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[1] Díaz López, B. & Methion, S. (2017) The impact of shellfish farming on common bottlenose dolphins' use of habitat. Marine Biology 164: 83. doi:10.1007/s00227-017-3125-x

The output of the AA reports for the SPA indicated that there is, in a number of areas within the SPA, a risk of significant disturbance to a number of bird species as a consequence of a combination of pressures including, among others, aquaculture (licenced, applications) and green algal accumulations (eutrophication) in intertidal areas.

It is important to note that these conclusions are based on an assessment within, what is in relation to the SPA overall, relatively small but important areas for bird conservation features. (The assessment examined interactions with bird species in these arbitrary locations (aquaculture zones) in the SPA which are not specific zones used in the current monitoring of birds within the SPA.) Furthermore, it should be noted that these were conservative conclusions (highly precautionary) that considered the likely pressures resulting from all aquaculture activities as well as any other pressures likely to act on the conservation features, e.g., eutrophication – green algae in Poulnasherry Bay. On this basis, the initial management responses will be similarly precautionary.

In Poulnasherry Bay, it is advised that (re)licencing of existing intertidal oyster culture activities proceed and be subject to ongoing monitoring of bird use in the bay. The monitoring would consider bird use at the site in light of existing aquaculture activities in-combination with, among others, the pressure caused by the presence of large accumulations of green algae in the inner-Bay. The output of the monitoring will present a summary of site-use by the shorebird species while also providing a commentary on the likely interactions with aquaculture activities and other pressures specifically, as it relates to species distribution at within the survey area. The outputs and conclusions of monitoring efforts will provide the basis for any subsequent management actions.

Given the existing licences are confined to the eastern portion of the bird count sector near Bunaclugga Bay it is proposed that renewal of existing licences ([redacted]) will not adversely impact on bird distribution. It is advised that new applications in this area ([redacted] would not be licenced on the basis that a moderate risk of disturbance (particularly on Ringed Plover) was concluded if all activities are licenced. Review of ongoing bird monitoring (IWeBS) for this sector will determine if consideration can be given to any future applications. In Ballylongford Bay, it is recommended that intertidal oyster culture can be licenced with conditions relating to access and interactions with night roosts of some bird species. Subtidal bottom culture of mussels might be licenced with certain conditions relating to timing of activities and site extent.

In the Askeaton area, the existing licenced oyster culture site ([redacted]) can continue with normal conditions. The AA report recommended that new licences of extensive areas should be licenced on the basis of potential significant disturbance to birds ([redacted]) and cumulative impact of seabed habitats ([redacted]).

Finally, DCHG raise concerns in relation to the generic wording proposed as part of the licence conditions.

While we understand that the wording (in the conditions) is meant to convey that negative interactions with Natura features will not be tolerated, there is a certain lack of clarity as it specifically relates to the licence decisions within the Shannon Natura sites. We suggest the response above as it relates to specific management actions, might help clarify some of the ambiguity and address the concerns of DCHG.

Marine Institute
Foras na Mara

Date: April 9th, 2019

To: Geraldine O'Donovan AFMD-DAFM

From: Francis O'Beirn, Marine Institute

CC: Terry McMahon, Jeff Fisher – MI; Kevin Hodnett-AFMD

Re: MI observation on Statutory Consultee submission from An Taisce to Shannon Aquaculture licencing

---

An Taisce in it's submission has provided observations on the existing and proposed activities in the Shannon Natura sites (i.e., Lower Shannon River SAC and the Shannon and Fergus Estuaries SPA). Four specific areas of concern are highlighted, which are identified below with the MI response following. In the communication, An Taisce cite precedence from Case law. It is important to note that it is beyond the remit of the MI to comment on An Taisce's interpretation of these rulings.

Bird Displacement:

In previous correspondence with DAFM (06/03/2019) the MI has attempted to provide some clarity regarding the conclusions drawn in relation to interactions with shorebirds in a number of specific locations within the SPA that might be provided in the Conclusion statement. These conclusions are summarized below and specify specific actions which we believe will address the concerns highlighted in the An Taisce communication.

The output of the AA reports for the SPA indicated that there is, in a number of areas within the SPA, a risk of significant disturbance to a number of bird species as a consequence of a combination of pressures including, among others, aquaculture (licenced, applications) and green algal accumulations (eutrophication) in intertidal areas.

It is important to note that these conclusions are based on an assessment within, what is in relation to the SPA overall, relatively small but important areas for bird conservation features. (The assessment examined interactions with bird species in these arbitrary locations (aquaculture zones) in the SPA which are not specific zones used in the current monitoring of birds within the SPA.) Furthermore, it should be noted that these were conservative conclusions (highly precautionary) that considered the likely pressures resulting from all aquaculture activities as well as any other pressures likely to act on the conservation features, e.g., eutrophication – green algae in Poulnasherry Bay. On this basis, the initial management responses will be similarly precautionary.

In Poulnasherry Bay, it is advised that (re)licencing of existing intertidal oyster culture activities proceed and be subject to ongoing monitoring of bird use in the bay. The monitoring would consider bird use at the site in light of existing aquaculture activities in-combination with, among others, the pressure caused by the presence of large accumulations of green algae in the inner-Bay. The output of the monitoring will present a summary of site-use by the shorebird species while also providing a commentary on the likely interactions with aquaculture activities and other pressures specifically, as it relates to species distribution at within the survey area. The outputs and conclusions of monitoring efforts will provide the basis for any subsequent management actions.

Given the existing licences are confined to the eastern portion of the bird count sector near Bunaclugga Bay it is proposed that renewal of existing licences [redacted] will not adversely impact on bird distribution. It is advised that new applications in this area ([redacted]) would not be licenced on the basis that a moderate risk of disturbance (particularly on Ringed Plover) was concluded if all activities are licenced. Review of ongoing bird monitoring (IWeBS) for this sector will determine if consideration can be given to any future applications. In Ballylongford Bay, it is recommended that intertidal oyster culture can be licenced with conditions relating to

access and interactions with night roosts of some bird species. Subtidal bottom culture of mussels might be licenced with certain conditions relating to timing of activities and site extent.

In the Askeaton area, the existing licenced oyster culture site [redacted] can continue with normal conditions. The AA report recommended that new licences of extensive areas should be licenced on the basis of potential significant disturbance to birds [redacted]) and cumulative impact of seabed habitats [redacted].

Marine Mammals:

The importance of the site for Bottlenose Dolphin is acknowledged. It not entirely clear if bottom dredging of shellfish will result in damage to dolphin habitat. The unknown nature of the activities and their extent within the OFOs meant that we assumed full occupancy of the sites and assumed disturbance to this habitat type. In our assessment, we therefore, identified those activities that may act in-combination with other disturbing activities. Notwithstanding these conservative assumptions, we note the recent publication on interactions between dolphin and floating structures used in the culture of shellfish (rafts)[1] . The study concluded that shellfish farms appeared to have a positive impact on dolphin occurrence, with increased bottlenose dolphin occurrence at mussel farm locations and in waters close to the aquaculture zones. In summary, it would appear that the observations from An Taisce reflect broadly what has been concluded in the Assessment Report and subsequent Conclusion Statement.

Fishery Orders:

The AA report for the Aquaculture activities within the Lower Shannon River SAC, prepared by the MI, acknowledges the unknown nature and extent of the activities within the Oyster Fishery Order Areas. To this end, a precautionary approach was employed such that any aquaculture activities likely to result in disturbance on the seafloor was considered in-combination with those as likely to occur in the OFOs. On this basis, it was advised that caution be employed when considering if these aquaculture activities were to be licenced. Identifying the extent of the activities within the OFO was not possible for the assessment. Also, management of these areas is within the remit of the Department of Communications, Climate Action and Environment therefore, it is not possible to dictate the extent of activity that may/may not be permitted within the OFO. Therefore, we assumed 100% occupancy/utility of the sites.

Water Quality:

The Marine Institute is fully aware of the goals of both WFD and the MSFD. We note that An Taisce have reverted to using dated and inappropriate literature as it relates to interaction of intertidal shellfish culture with sedimentary habitats. We identify more recent publications that support our conclusions with regard to shellfish aquaculture and environmental interactions[2]. The relevance of the quote taken from the EPA State of the Environment Report is questionable. The quote specifically relates to finfish culture and has little or no bearing on shellfish culture which is not a 'fed' aquaculture practice. We feel there is nothing substantive in these water quality comments that requires further comment.

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[1] Díaz López, B. & Methion, S. (2017) The impact of shellfish farming on common bottlenose dolphins' use of habitat. Marine Biology 164: 83. doi:10.1007/s00227-017-3125-x

[2] Forde, J., F. O'Beirn, J. O'Carroll, A. Patterson, R. Kennedy. 2015. Impact of intertidal oyster trestle cultivation on the Ecological Status of benthic habitats. Marine Pollution Bulletin 95, 223–233.

O'Carroll J, et al. 2016. Impact of prolonged storm activity on the Ecological Status of intertidal benthic habitats within oyster (*Crassostrea gigas*) trestle cultivation sites. Marine Pollution Bulletin. 110: 460-469

Mallet A.L. et al. 2006. Impact of suspended and off-bottom Eastern oyster culture on the benthic environment in eastern Canada. Aquaculture 255:362-373

Farr, Brendan

From: Farr, Brendan
Sent: 20 June 2018 15:43
To: ODonovan, Geraldine
Subject: FW: Irish Water Correspondence
Attachments: water discharge points Poulnasherry.pdf

From: Crowley, Raphael
Sent: 20 June 2018 15:17
To: Farr, Brendan
Cc: Forde, Edwina
Subject: Irish Water Correspondence

Brendan
Please see attached map indicating the location of the Irish Water discharge locations in relation to the aquaculture applications and the Shellfish Water Designation Area at Poulnasherry.
A number of the discharges are on the west coast of Clare and are of no significance to these aquaculture applications.
The nearest relevant discharge is located approximately 2 kilometres away and given the flow of water/tidal exchange in the Shannon Estuary, I do not see any issue with the licencing of the aquaculture at Poulnasherry.
I suggest AFMD circulate the Irish Water correspondence and the MED map to SFPA and MI for comment.
Regards
Raphael

Raphael Crowley
Chartered Engineer - Marine Engineering Division

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Pointe Uí Rinn, Cathair Uí Mhóráin, Trá Lí, Co. Chiarraí, V92 X2TK
Reen Point, Blennerville, Tralee, Co. Kerry, V92 X2TK

M +353 (0)87 2336425 T +353 (0)66 7149344 www.agriculture.gov.ie

---

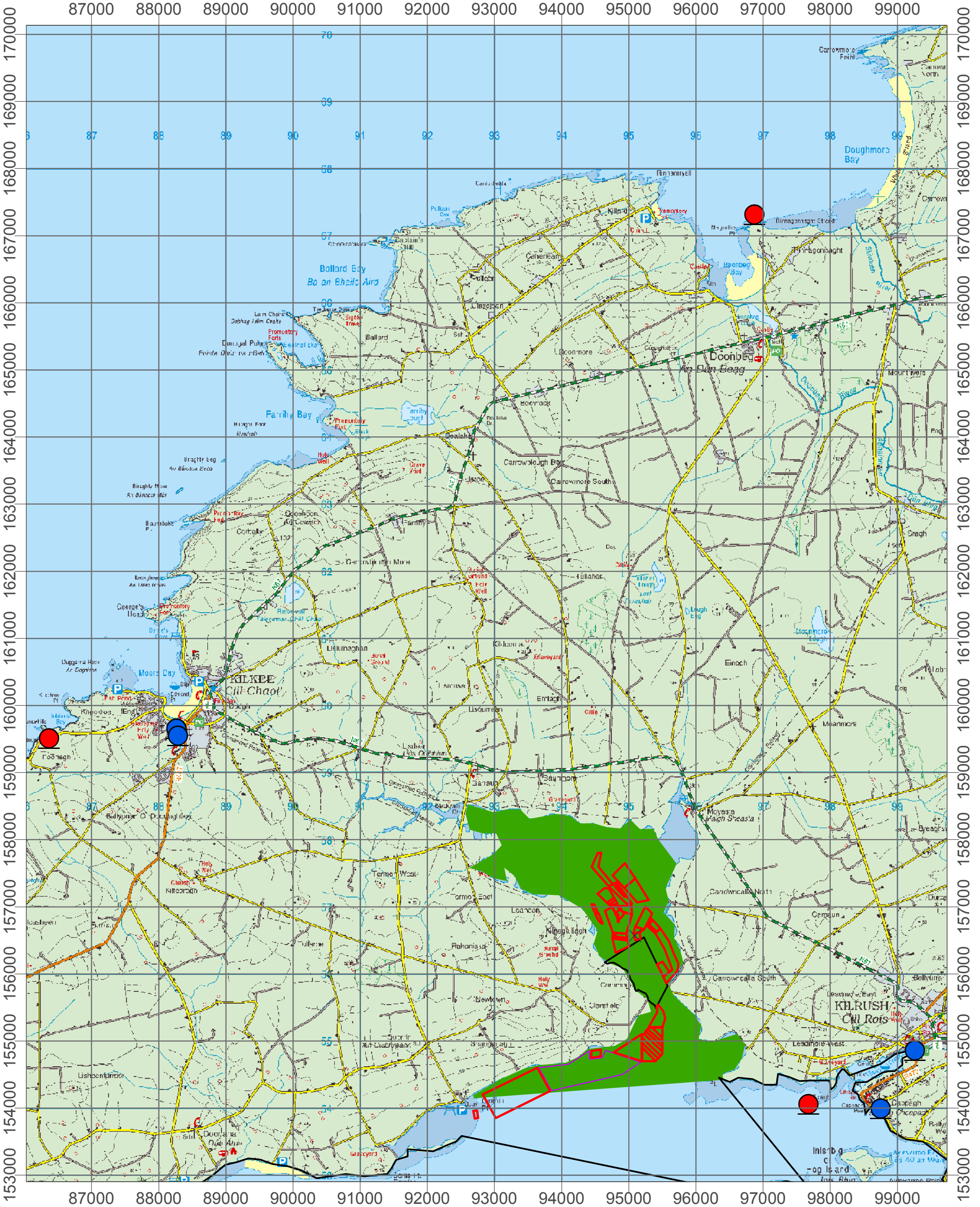
From: Farr, Brendan
Sent: 19 June 2018 12:07
To: Forde, Edwina
Cc: Crowley, Raphael
Subject:

Hi Edwina,

Please see attached correspondence submitted by Irish Water at Statutory Consultation stage of Shannon Estuary, Co.Clare applications . I would be grateful for your obs on same.

Regards & Thanks
Brendan

Brendan Farr
Aquaculture & Foreshore Management Division,
National Seafood Centre, Clonakilty, Co.Cork



Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

Farr, Brendan

From: Terry McMahon [Terry.McMahon@Marine.ie]
Sent: 29 June 2018 12:35
To: Farr, Brendan
Subject: RE:
Attachments: Poulnasherrry Shellfish Growing Waters Area.pdf; Applications - Poulnasherry Bay area.pdf

Brendan

Thanks for forwarding the submission from Irish Water. A number of comments

1. The information on the discharge locations provided is useful and is relevant to the consideration of the licence applications.
2. Currently, under Annex II of EU Regulation 854/2004 oysters in Poulnasherry Bay have a "A" Classification, which indicates, from a microbiological perspective, that this area is suitable for oyster production and that the product can be placed directly on the market without the need for purification.
3. Considering the current classification status of the area, the location of the current discharges would not indicate that the risk of significant microbiological contamination of shellfish in this area would be such that a negative determination of licence applications would be warranted.
4. Irish Water has referred to applications at Sites T0[redacted] T08/106; T[redacted] as being "not wholly within designated shellfish waters". Based on the information available the MI does not agree with this comment and is of the view that the location of the all these sites are within the boundaries of the West Shannon Poulnasherry Bay Shellfish Growing waters Area. The boundaries of this designated area and the location of the sites within this area are shown in the attached documents.

Terry

From: Farr, Brendan [mailto:Brendan.Farr@agriculture.gov.ie]
Sent: 21 June 2018 17:14
To: DAFM Queries; Terry McMahon
Cc: Nolan, Brian; Foley Tina; Duane, Paul
Subject:

Dear All,

Please see attached the Irish Water submission on the Poulnasherry/Shannon Estuary Applications, I have also attached a map showing the discharge points in relation to the applications.

Marine Engineering Division have made the following comments re the Irish Water submission.

"A number of the discharges are on the west coast of Clare and are of no significance to these aquaculture applications.
The nearest relevant discharge is located approximately 2 kilometres away and given the flow of water/tidal exchange in the Shannon Estuary, I do not see any issue with the licencing of the aquaculture at Poulnasherry.
I suggest AFMD circulate the Irish Water correspondence and the MED map to SFPA and MI for comment."

If you have any further additions to MED's observations I would be grateful if they could be forwarded to this division in the next 2 weeks.

Regards & Thanks
Brendan

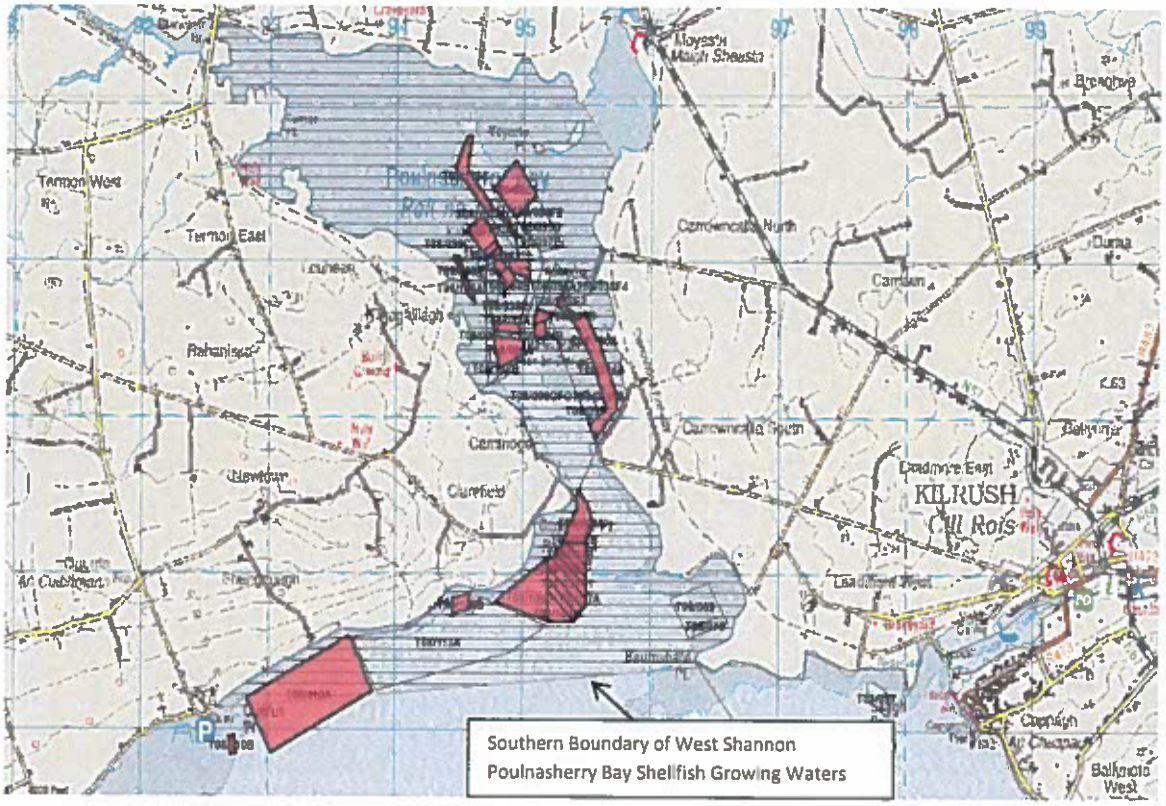
Map 6: West Shannon Poulnasherry Bay

Date: December 2008

1:50,000

Designated Shellfish Water

With the exception of [redacted] which is partly within the West Shannon Poulnasherry Shellfish Growing Waters Area and T[redacted] which is outside this designated area, Sites T[redacted] C[redacted]; T08/106 A, B, C, D; T[redacted] and T08/109A are all located within the boundaries of the West Shannon Poulnasherry Shellfish Growing Waters Area. The location of these sites and the boundaries of the Shellfish Growing Waters Area are shown in the map below



Moyasta

Kilrsuh

Co Clare

16/12/2015

Dear David,

Can you please amended the application name on all of the following licence submissions below to the following name ' Moyasta Oysters Ltd.'

T8/106 A,B,C,D

[redacted]

In addition can you change the Production Method to state the following

'Bag /Trestle and Hanging Basket/ Trestle'

Yours sincerely

Thomas Galvin

Thomas Galvin

Michael Galvin

Michael N Galvin

Hey Brendan

[redacted]

T8-106A
T8-106B
T8-106C
T8-106D

[redacted]

Crassostrea Gigas (Pacific Oyster) and Ostrea Edulis (Native flat Oyster) for moyasta oysters Ltd.

Regards

Thomas

Thomas + Michael Galvin
Moyasta Shellfish.

AQUACULTURE - LICENSING UNDER

FISHERIES (AMENDMENT) ACT, 1997 and

FORESHORE ACT, 1933

SHELLFISH AND FINFISH

Aquaculture and Foreshore Licence Application Form

Poulnasherry Bay
4 Sites Apply For.

Important Note

Section 4 of the Fisheries and Foreshore (Amendment) Act, 1998 (No. 54) prohibits any person making an application on or after 10 December 1998 for an Aquaculture Licence from commencing aquaculture operations until duly licensed under the Fisheries (Amendment) Act, 1997 (No. 23), and provides that a breach of that prohibition will cause the application to fail.

Aquaculture & Foreshore Management Division
Department of Agriculture, Food and the Marine.
National Seafood Centre,
Clonakilty, Co. Cork

Fax: (023) 8821782

AQUACULTURE AND FORESHORE LICENSING APPLICATION FORM, for purposes of FISHERIES (AMENDMENT) ACT, 1997 and FORESHORE ACT, 1933

Accompanying Guidance Notes should be read before completing this form.

Note: Details provided in Parts 1 and 2 will be made available for public inspection.
Details provided in Part 3 are confidential and are not for public disclosure.

USE BLOCK CAPITALS IN BLACK INK

For Office Use
Application Ref. No.
Date of receipt, (Dept. Stamp): 12 NOV 2012
T8/106

COASTAL ZONE MANAGEMENT DIVISION
DEPT. OF AGRICULTURE, FISHERIES & FOOD

PART 1: PRELIMINARY DETAILS

Name(s) of Applicant(s) in full:
1.A THOMAS & MICHAEL GALVIN T/A MOYASTA SHELLFISH
1.B

Address(es) of Applicant(s) in full:

1.A	1.B
MOYASTA KILRUSH CO CLARE	

RSI/PPS No:/VAT No*:

Tel: [redacted] x: | Tel: Fax:

* Limited Companies must include their VAT No.

1.C TYPE OF APPLICATION

Indicate the relevant type of application: Insert X in relevant box

-(i) Aquaculture Licence	✓
-(ii)Trial Licence	
-(iii)Review of Aquaculture Licence	
-(iv)Renewal of Aquaculture Licence	
-(v) Foreshore Licence	

POULNASHERRY BAY
PACIFIC OYSTERS USING
BAGS AND TRESTLE.

(This Application Form is valid for each type of application.)

1.D TYPE OF AQUACULTURE

Indicate the relevant type of application:

-(i) Land-based	
-(ii) Marine-based	✓
-Shellfish	
(iii) - extensive	
(iv) – intensive	✓
-(v) Finfish	

1.E DOCUMENTS ENCLOSED WITH THIS APPLICATION BIM MAPS WITH CORDINATES

The following documents are enclosed with this application:

(1) - Ordnance Survey Map (Scale of 1: 10,560, ie, a six inch map) *OBLIGATORY* ☑

(2) - British Admiralty Chart (largest available scale) ☐

(3) - Decision of planning authority under Planning Acts ☐

(4) - Copy of licence under Section 4 of Local Government Water Pollution) Act, 1977 ☐

(5) - Environmental Impact Statement ☐

(6) - Drawing of the structures to be used and/or the layout of the farm *OBLIGATORY* ☑

(7) - Water Quality Analysis Report (required for Land-based sites only) ☐

(8) - Application Fee OBLIGATORY ☑

(9) - Other (specify):

PART 2: DETAILS RELATING TO PROPOSED AQUACULTURE PROJECT

2.A Employment, Qualifications, Experience, Etc.

(i) Details of Applicant's qualifications and experience in aquaculture: THOMAS & MICHAEL GALVIN HAVE 20YRS EXPERIENCE IN GROWING OYSTERS IN BALLINASHERRY BAY

(ii) Other relevant experience (courses attended, etc):

(iii) Details of projected employment creation during first four years of proposed development: LICENCE RENEWAL FOR EXISTING SITES AND APPLYING FOR 4 NEW SITES. THIS INCREASE CAPACITY WILL ENSURE 4 FULL TIME & A FURTHER 8 PART TIME DURING SUMMER MONTHS.

(iv) Projected employment (number of persons):

Year 1:	4FT 6PT	Year 2:	4FT 8PT	Year 3:	4FT 8PT	Year 4:	4FT 8PT

2.B Aquaculture Site Details

Indicate type of site:

- (i) Land-based ☐
- (ii) Marine-based ☑

2.C Land-Based Site

(To be completed if appropriate)

(i) State species to be farmed: _____

(ii) State proposed system of culture e.g., pond, raceway, circular tank or other method: _____

(iii) Full address of proposed site including Townland and County: _____

(iv) Tonnage to be produced:

Year 1:		Year 2:		Year 3:		Year 4:	

(v) Proposed source of stock: _____

(vi) Name of river(s) supplying site with water: _____

(vii) Estimate drought flow in gallons per minute: _____

(viii) Is there a fall of 1.5 metres in the water level at this site or can this be obtained by damming the river without giving rise to flooding of your own or neighbour's land upstream of the site? _____

(ix) Area of proposed site (hectares): _____

(x) Details of services available on the site e.g., main road access, electricity: _____

(xi) Are there at present any possible sources of pollution upstream of the site, e.g. discharge from sewerage plant, farmyard, sheep dip facility, silage effluent, quarry, sandpit or factory? YES ☐ NO ☐

(xii) If yes, supply details: _____

Land-based Site (continued)

2.D The following must be supplied:

- (i) Sketch of the layout of the site in relation to the river(s), road(s) and buildings;
- (ii) Water quality Analysis Report, which should be drawn up in accordance with the parameters set out in Annex C of the Guidance Notes.

2.E The following conditions must be met in order to allow for consideration of licensing of land-based aquaculture:

- (i) the buildings and equipment must be put in place to the Department's satisfaction; an
-(i) the operation must comply with Local Authority requirements.

2.F Marine-based Site(s)
(To be completed if appropriate)

Location -(i) Bay: Poulnasherry Bay

-(ii) County: Clare

(iii) OS Map No: _____

(iv) Site Co-ordinates Enclosed with Maps

(v) Size (hectares):

_____

(vi) Species (common and scientific name):

C Gigas

-Aquatic Plant(s)
-Any form of aquatic food suitable for the nutrition of fish

(vi) Method of culture (e.g., nets, ropes, tanks, trestles, etc.)_____

Bag and Trestle

(vii) Drawings of structures to be used in method of culture should be enclosed.

(viii) If cages or tanks are proposed, state:

-(a) Number:_____

-(b) Type and shape:_____

-(c) Cubic Capacity:_____

-(d) Depth:_____

(ix) Proposed specific site locations (with reasons): Accessability to each site is good and increase production

(x) Describe proposed purification facilities to be used, where appropriate:_____

Marine-based Site(s) (continued)

2.G Give details of any special requirements relating to the health of the proposed project and the wider matters of public health and safety:

FISH HEALTH AUTHORISATION WILL BE APPLIED FOR. THE SITES WILL BE APPROPRIATELY MARKED ACCORDING TO LICENCE TERMS

2.H Tonnage to be produced:

Species (To state)	Year 1:	Year 2:	Year 3:	Year 4:
C. GIGAS	0	0	40 TON	80 TON

2.I Reasons for selection of site(s): ACCESSIBILITY TO EACH SITE IS VERY GOOD. EACH SITE IS WELL SHELTERED. CONTROL SECURITY OF EACH SITE IS GOOD.

Note: The proposed access route to the site(s) from public road across tidal foreshore area Must be indicated on the OS map accompanying the application.

2.J Environmental Impact Statement (EIS).

A copy of an EIS, if required, should be enclosed with the application. The EIS should contain the information specified in Annex B of the Guidance Notes.

2.K Trial Licence.
(To be completed if appropriate)

Describe experimental or investigative nature of the proposed project:

[Use separate page if required – to be signed and dated]

B. MARKETING (continued)

3. Will the product be processed or packaged? YES ☐ NO ☑

4. If yes, give details: _____

I/We hereby declare the information provided in Parts 1, 2 and 3 above to be true to the best of my/our knowledge. I/We enclose an application fee* of €95-23 with this application.

Signature(s) of Applicant(s): Thomas Galvin

Michael N. Galvin

Date: 8 Nov 2012

*Preferred method of payment is by cheque or bank draft. The fee should be made payable to the Department of Agriculture, Food and the Marine.

This form should be forwarded, with the required documents and application fee, to:

Aquaculture Licensing
Aquaculture & Foreshore Management Division
Department of Agriculture, Food and the Marine
National Seafood Centre,
Clonakilty,
Co. Cork

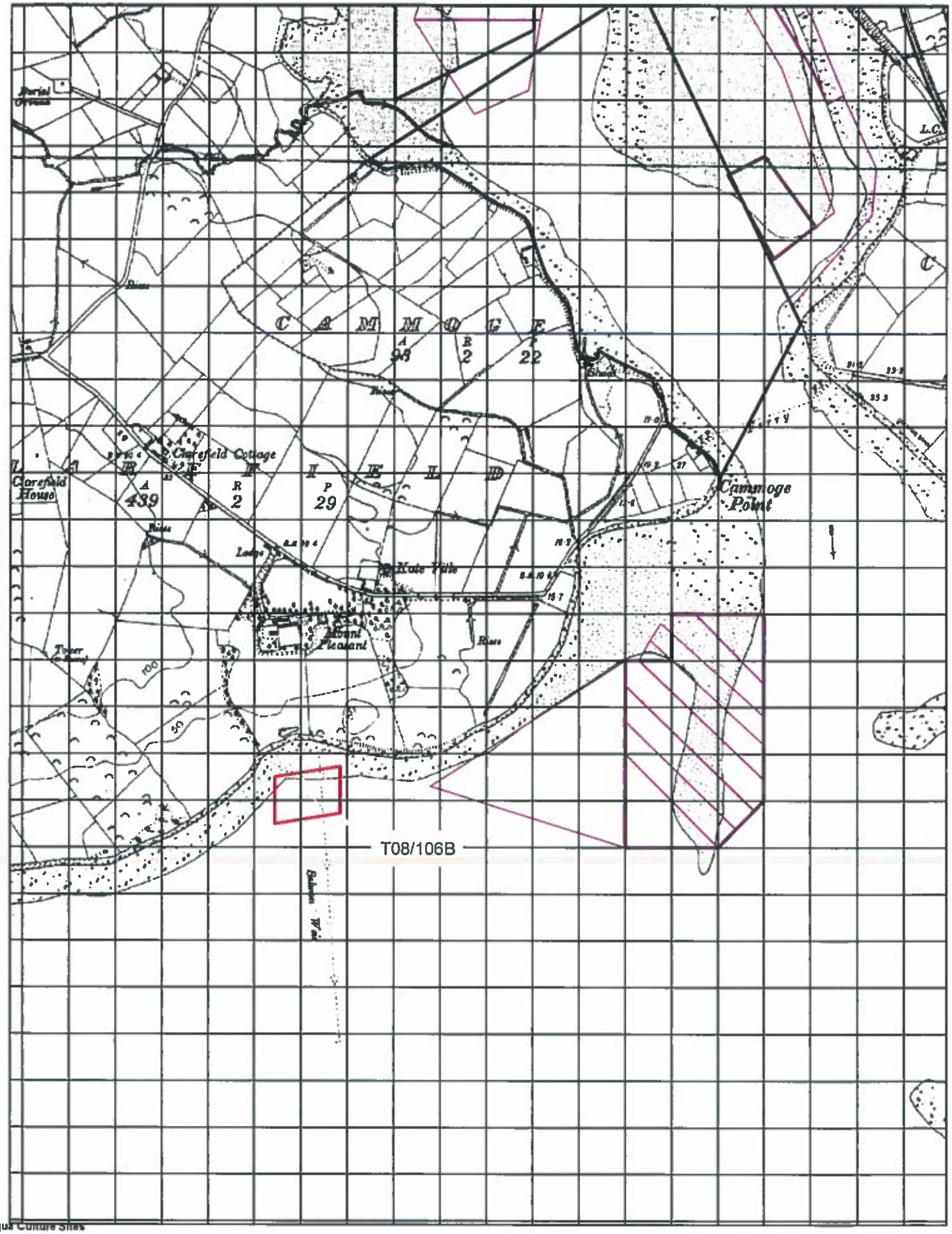
1 NO. SITE AT POULNASHERRY BAY CO.CLARE

Co-ordinates & Area

Site T08/106B (1.42 Ha)

The area seaward of the high water mark and enclosed by a line drawn from Irish National Grid Reference point

094443, 154850 to Irish National Grid Reference point
094585, 154872 to Irish National Grid Reference point
094585, 154772 to Irish National Grid Reference point
094443, 154750 to the first mentioned point.



Aqua Culture Sites

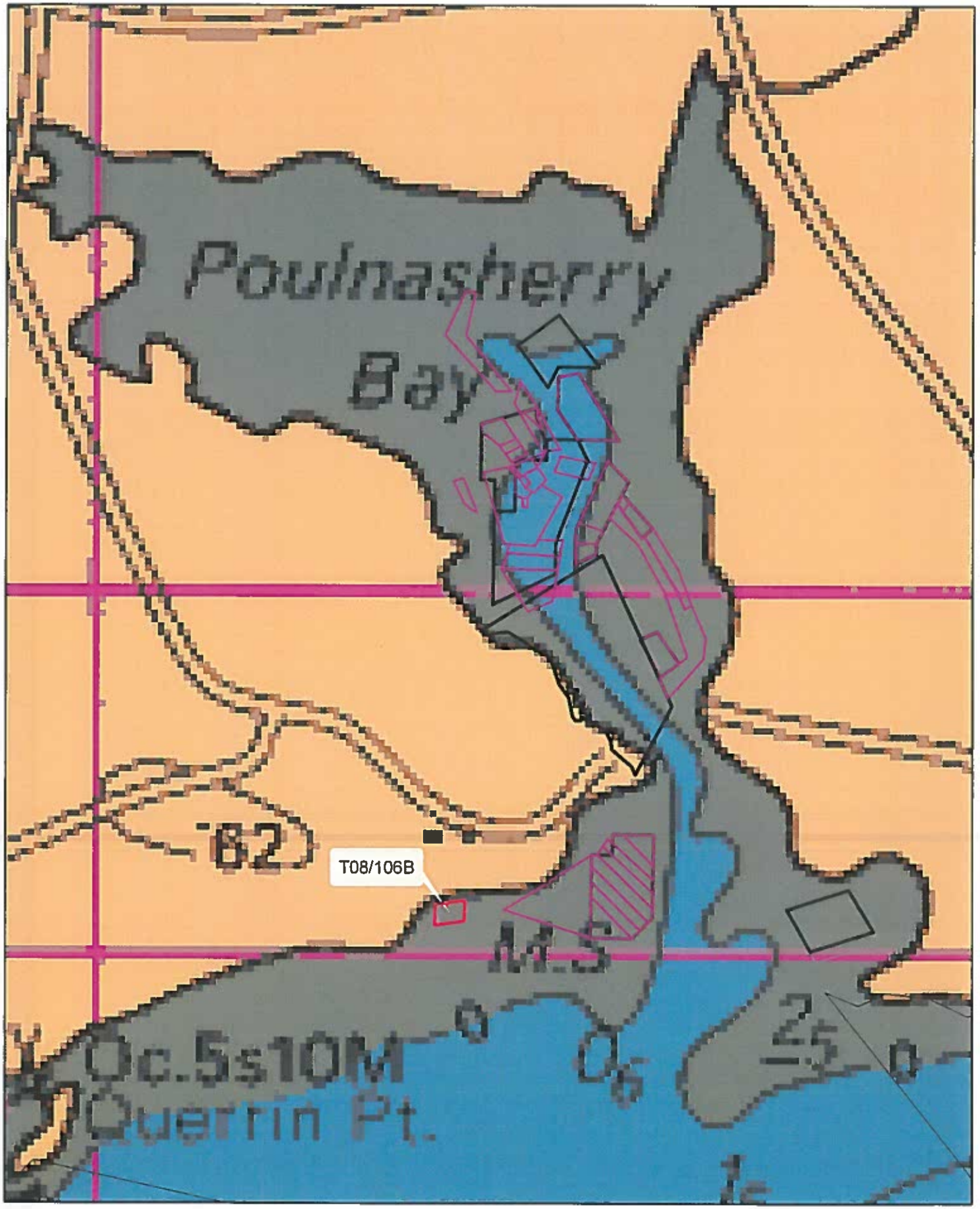
Site_Status

- Application
- Application Lapsed
- Application Refused
- Application Renewal
- Withdrawn
- License Altered
- License Revoked
- License Surrendered
- Licensed
- Unknown
- Unlicensed
- 100 Meter Reference Grid

1:10,560

Site Highlighted in red denotes Application

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara



Aqua Culture Sites
Site_Status

- Application
- Application Lapsed
- Application Refused
- Application Renewal
- Withdrawn
- License Altered
- License Revoked
- License Surrendered
- Licensed
- Unknown
- Unlicensed

1:24,000

Site Highlighted in red denotes Application

Part of Admiralty Chart No 2254-0
Not to be used for Navigation.

Department of
Agriculture,
Food and the Marine
An Roinn
Talmhaíochta,
Bia agus Mara

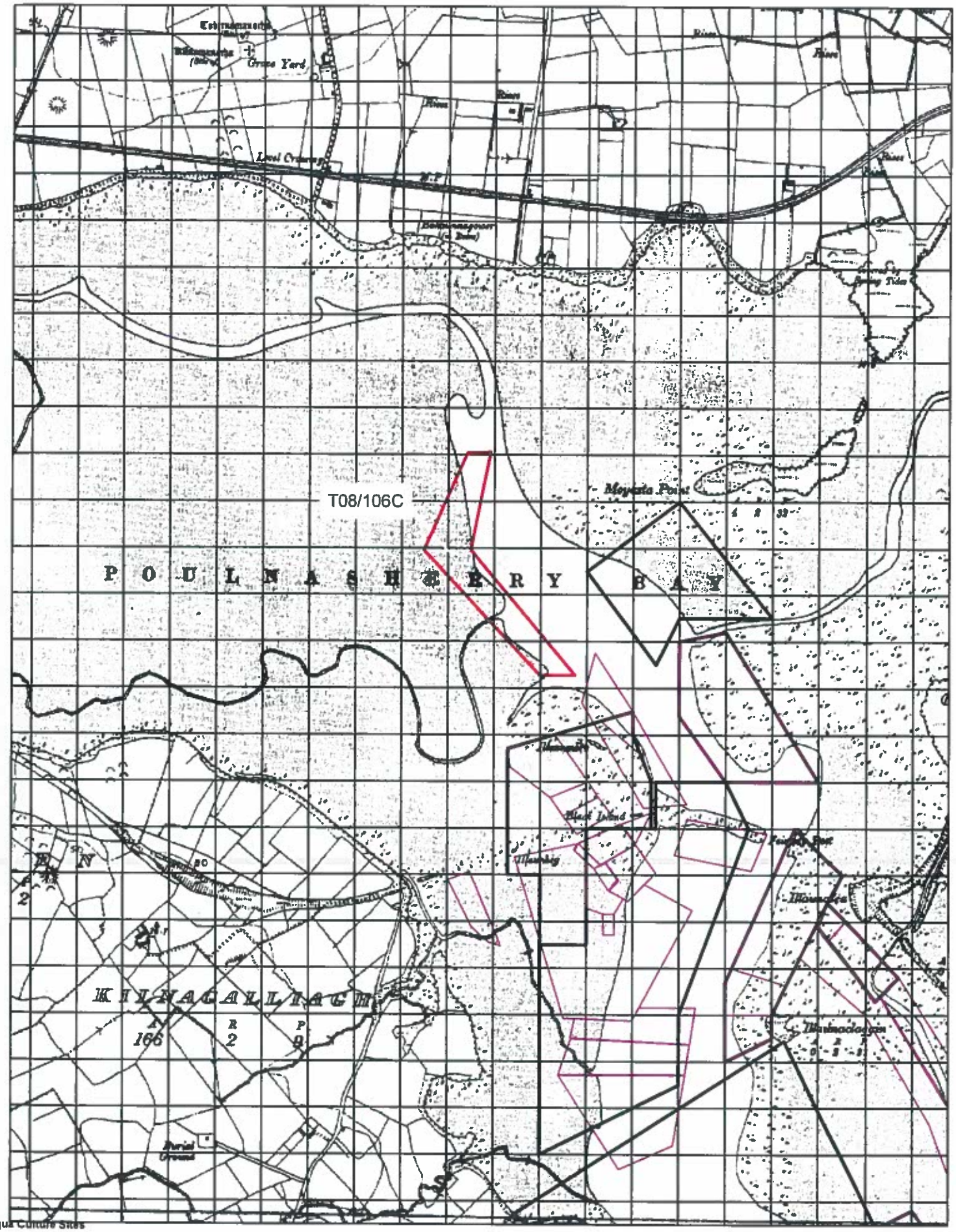
1 NO. SITE AT POULNASHERRY BAY CO.CLARE

Co-ordinates & Area

Site T08/106C (3.96 Ha)

The area seaward of the high water mark and enclosed by a line drawn from Irish National Grid Reference point

094502, 157804 to Irish National Grid Reference point
094592, 157805 to Irish National Grid Reference point
094549, 157596 to Irish National Grid Reference point
094774, 157328 to Irish National Grid Reference point
094698, 157328 to Irish National Grid Reference point
094448, 157595 to the first mentioned point.



Aqua Culture Sites

Site_Status

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- Withdrawn
- License Altered
- License Revoked
- License Surrendered
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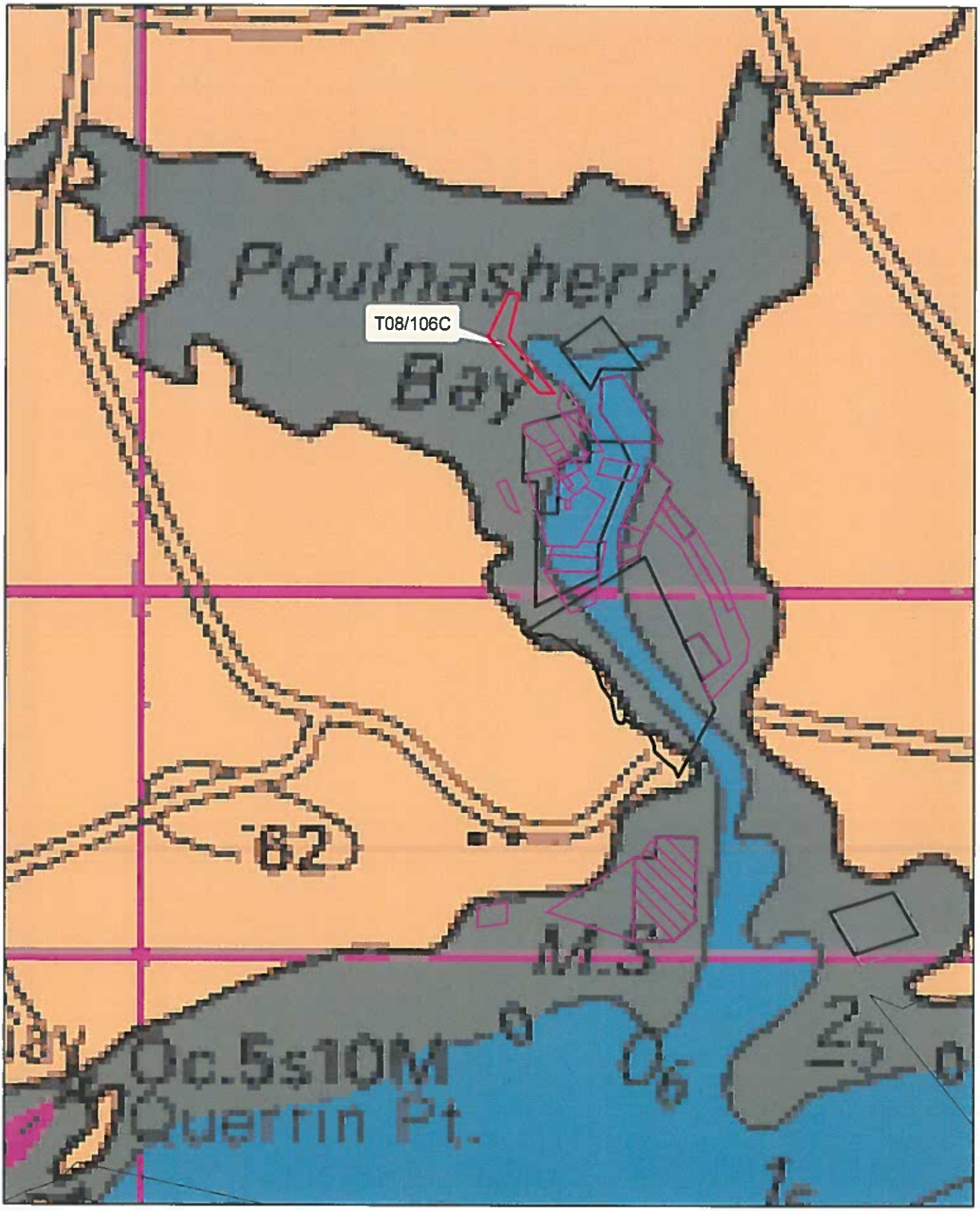
- Unknown
- Unlicensed
- 100 Meter Reference Grid

1:10,560

Site Highlighted in red denotes Application

Department of Agriculture, Food and the Marine

An Roinn Talmhaíochta, Bia agus Mara



Aqua Culture Sites
Site_Status

- Application
- Application Lapsed
- Application Refused
- Application Renewal
- Withdrawn
- License Altered
- License Revoked
- License Surrendered
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- Unknown
- Unlicensed

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Site Highlighted in red denotes Application

Part of Admiralty Chart No 2254-0
Not to be used for Navigation.

Department of
Agriculture,
Food and the Marine
An Roinn
Talmhaíochta,
Bia agus Mara

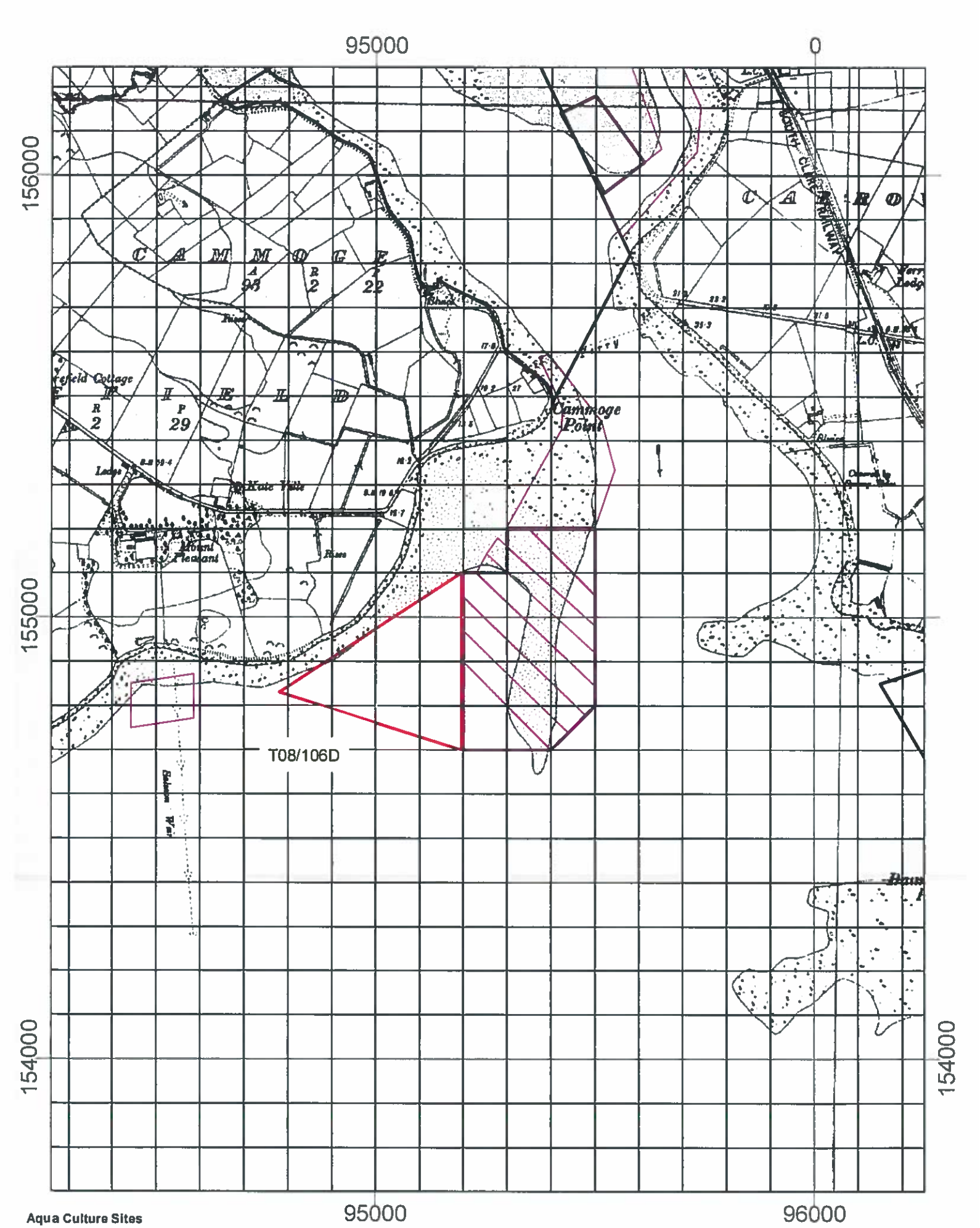
1 NO. SITE AT POULNASHERRY BAY CO.CLARE

Co-ordinates & Area

Site T08/106D (8.3 Ha)

The area seaward of the high water mark and enclosed by a line drawn from Irish National Grid Reference point

094780, 154830 to Irish National Grid Reference point
095195, 155100 to Irish National Grid Reference point
095195, 154700 to the first mentioned point.



Aqua Culture Sites

<all other values>

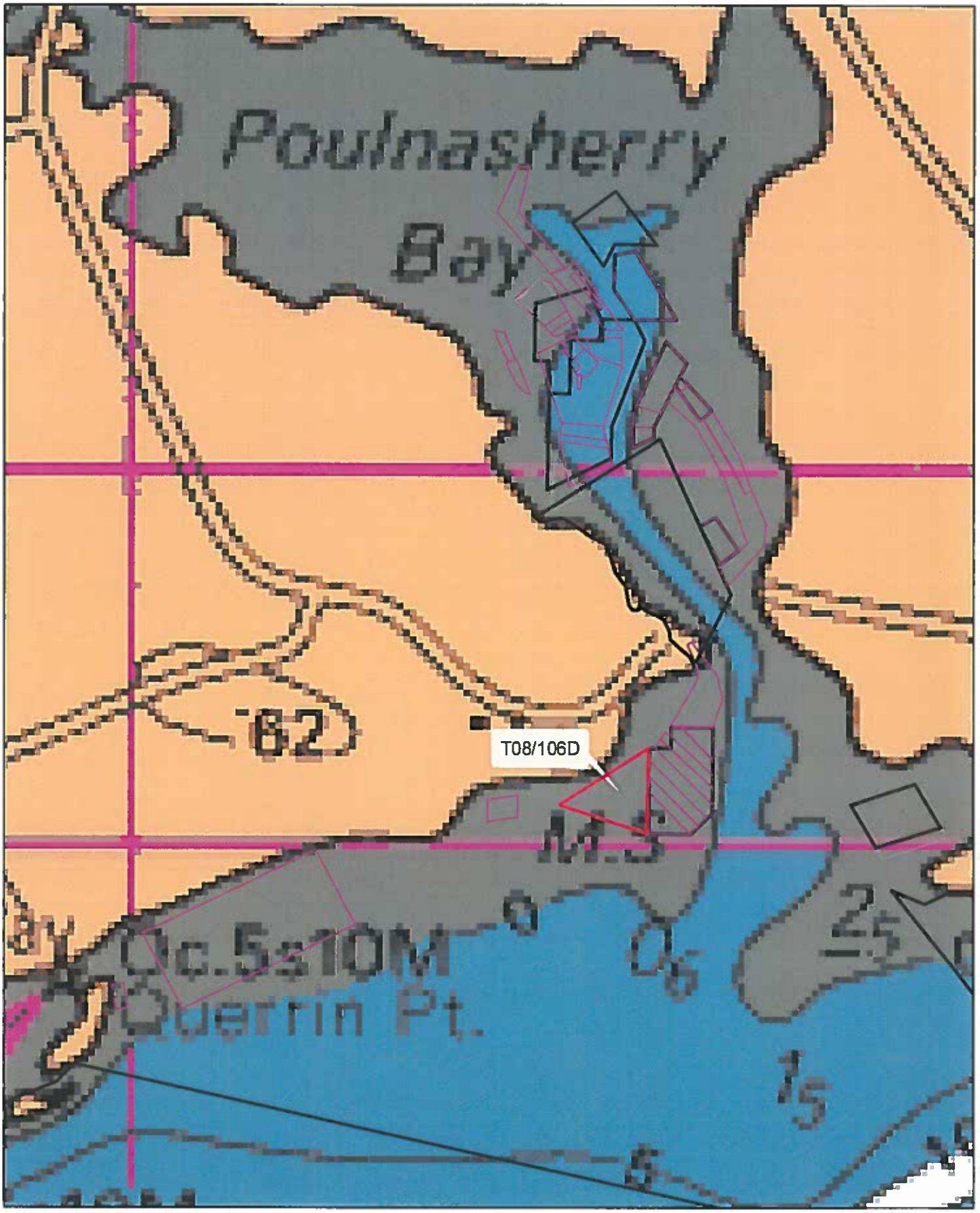
Site_Status

- Application
- Lapsed
- Licensed
- Refused
- Renewal
- Revoked
- Surrendered
- Withdrawn
- 100 Meter Reference Grid

1:10,560

Sites highlighted in red denotes Application

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara



Aqua Culture Sites

<all other values>

Site_Status

- Application
- Lapsed
- Licensed
- Refused
- Renewal
- Revoked
- Surrendered
- Withdrawn

1:24,000

Sites highlighted in red denotes Application

Part of Admiralty Chart No =2254-0
Not to be used for Navigation

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

2010 Aquaculture and Foreshore Licence application and an updated 2018 version which includes supplemental information. These applications must be read in tandem.

T6/360 - New Application.

AQUACULTURE - LICENSING UNDER FISHERIES (AMENDMENT) ACT, 1997 and FORESHORE ACT, 1933

SHELLFISH AND FINFISH

Aquaculture and Foreshore Licence Application Form

Important Note

Section 4 of the Fisheries and Foreshore (Amendment) Act, 1998 (No. 54) prohibits any person making an application on or after 10 December 1998 for an Aquaculture Licence from commencing aquaculture operations until duly licensed under the Fisheries (Amendment) Act, 1997 (No. 23), and provides that a breach of that prohibition will cause the application to fail.

Aquaculture & Foreshore Management Division
Department of Agriculture, Fisheries & Food
Clogheen
Clonakilty, Co. Cork

Fax: (023) 8821782

AQUACULTURE AND FORESHORE LICENSING APPLICATION FORM, for purposes of FISHERIES (AMENDMENT) ACT, 1997 and FORESHORE ACT, 1933

Accompanying Guidance Notes should be read before completing this form.

Note: Details provided in Parts 1 and 2 will be made available for public inspection.
Details provided in Part 3 are confidential and are not for public disclosure.

USE BLOCK CAPITALS IN BLACK INK

For Office Use
Application Ref. No. T6/360.
Date of receipt, (Dept. Stamp):

COASTAL ZONE MANAGEMENT DIVISION
6 OCT 2010
DEPT. OF AGRICULTURE, FISHERIES & FOOD

PART 1: PRELIMINARY DETAILS

Name(s) of Applicant(s) in full:
KUSH SEAFARMS LTD.

Address(es) of Applicant(s) in full:

O'SHEA HOUSE	Agents
NEW ROAD	**CRONIN MILLAR CONSULTING ENGINEERS**
KENMARE	**THE MEWS, 7 COPPERFIELDS**
CO. KERRY	**COBH, CO. CORK**
[redacted]	

1.C TYPE OF APPLICATION

Indicate the relevant type of application:

Insert X in relevant box

-(i) Aquaculture Licence X

-(ii)Trial Licence

-(iii)Review of Aquaculture Licence

KILMAKILLOGE HARBOUR
MUSSELS ON LONGLINES

-(iv)Renewal of Aquaculture Licence

-(v) Foreshore Licence

(This Application Form is valid for each type of application.)

1.D TYPE OF AQUACULTURE

Indicate the relevant type of application:

-(i) Land-based

-(ii) Marine-based X

-Shellfish

(iii) - extensive

(iv) – intensive X

-(v) Finfish

1.E DOCUMENTS ENCLOSED WITH THIS APPLICATION

The following documents are enclosed with this application:

(1) - Ordnance Survey Map (Scale of 1: 10,560, ie, a six inch map) *OBLIGATORY* [X]

(2) - British Admiralty Chart (largest available scale) [X]

(3) - Decision of planning authority under Planning Acts [ ]

(4) - Copy of licence under Section 4 of Local Government Water Pollution) Act, 1977 [ ]

(5) - Environmental Impact Statement [ ]

(6) - Drawing of the structures to be used and/or the layout of the farm *OBLIGATORY* [X]

(7) - Water Quality Analysis Report (required for Land-based sites only) [ ]

(8) - Application Fee OBLIGATORY [X]

(9) - Other (specify):_____

_____

_____

PART 2: DETAILS RELATING TO PROPOSED AQUACULTURE PROJECT

2.A Employment, Qualifications, Experience, Etc.

(i) Details of Applicant's qualifications and experience in aquaculture:_____

KUSH SEAFARMS IS A RECOGNISED, EXPERIENCED AQUACULTURE OPERATOR

(ii) Other relevant experience (courses attended, etc

BIM PURIFICATION COURSE
MARKETING COURSE (POST GRAD) - FÁS
BUSINESS DIPLOMA
EXPORT VISITS – HOLLAND, FRANCE, ITALY

(iii) Details of projected employment creation during first four years of proposed development

EMPLOYMENT FIGURES FOR WHOLE COMPANY, OPERATING A NUMBER OF AQUACULTURE SITES:
6 FULL TIME
4 PART TIME
4 CASUAL

NEW SITES WILL GENERATE EFFICIENCIES OF SCALE.

~~(iv) Projected employment~~ (number of persons):

~~Year 1:~~		Year 2:		Year 3:		Year 4:	

2.B Aquaculture Site Details

Indicate type of site:

- (i) Land-based ☐
- (ii) Marine-based ☒

2.C .Land-Based Site

(To be completed if appropriate)

(i) State species to be farmed: _____

_____

(ii) State proposed system of culture e.g., pond, raceway, circular tank or other method: _____

_____

_____

(iii) Full address of proposed site including Townland and County: _____

_____

(iv) Tonnage to be produced:

Year 1:		Year 2:		Year 3:		Year 4:	

(v) Proposed source of stock: _____

(vi) Name of river(s) supplying site with water: _____

_____

(vii) Estimate drought flow in gallons per minute: _____

(viii) Is there a fall of 1.5 metres in the water level at this site or can this be obtained by damming the river without giving rise to flooding of your own or neighbour's land upstream of the site? _____

_____

(ix) Area of proposed site (hectares): _____

(x) Details of services available on the site e.g., main road access, electricity: _____

_____

_____

(xi) Are there at present any possible sources of pollution upstream of the site, e.g. discharge from sewerage plant, farmyard, sheep dip facility, silage effluent, quarry, sandpit or factory? YES ☐ NO ☐

(xii) If yes, supply details: _____

_____

_____

Land-based Site (continued)

2.D The following must be supplied:

- (i) Sketch of the layout of the site in relation to the river(s), road(s) and buildings;
- (ii) Water quality Analysis Report, which should be drawn up in accordance with the parameters set out in Annex C of the Guidance Notes.

2.E The following conditions must be met in order to allow for consideration of licensing of land-based aquaculture:

- (i) the buildings and equipment must be put in place to the Department's satisfaction; an
-(i) the operation must comply with Local Authority requirements.

2.F Marine-based Site(s)
(To be completed if appropriate)
Location -(i) Bay: **KILMAKILLOGE HARBOUR**

-(ii) County: **KERRY**

(iii) OS Map No: **KY108 (1:10,560)**

(iv) Site Co-ordinates: **(1) 74100,59000 (2) 74300, 59000 (3) 74300, 58900 (4) 74100, 58900**

(v) Size (hectares): **2 (200 x 100m)**

(vi) Species (common and scientific name): **MUSSELS (MYTILUS EDULIS)**
-Aquatic Plant(s)
-Any form of aquatic food suitable for the nutrition of fish

(vi) Method of culture (e.g., nets, ropes, tanks, trestles, etc.)

SURFACE LONGLINE SUSPENSION SYSTEM (DOUBLE HEADROPE) WITH 12mm DROPPERS OR CONTINUOUS LOOPED ROPE

(vii) Drawings of structures to be used in method of culture should be enclosed. **(DRAWING ENCLOSED)**

(viii) If cages or tanks are proposed, state: **N/A**

-(a) Number: _____

-(b) Type and shape: _____

-(c) Cubic Capacity: _____

-(d) Depth: _____

(ix) Proposed specific site locations (with reasons): _____

_____

(x) Describe proposed purification facilities to be used, where appropriate: **N/A**

Marine-based Site(s) (continued)

2.G Give details of any special requirements relating to the health of the proposed project and the wider matters of public health and safety:

NO HEALTH IMPLICATIONS OR ISSUES

2.H Tonnage to be produced:

Species (To state)	Year 1:	Year 2:	Year 3:	Year 4:
MUSSELS (MYTILUS EDULIS)	**60Tonnes**	**60Tonnes**	**60Tonnes**	**60Tonnes**

2.I Reasons for selection of site(s):

1. **EXISTING SITES**
2. **PROXIMITY TO LANDSIDE ACCESS**
3. **PRODUCTION HISTORY OF SITE**

Note: The proposed access route to the site(s) from public road across tidal foreshore area Must be indicated on the OS map accompanying the application.

2.J Environmental Impact Statement (EIS). **N/A**

A copy of an EIS, if required, should be enclosed with the application. The EIS should contain the information specified in Annex B of the Guidance Notes.

2.K Trial Licence.
(To be completed if appropriate)

Describe experimental or investigative nature of the proposed project: _____

_____

_____

_____

_____

[Use separate page if required – to be signed and dated]

[redacted]

I/We hereby declare the information provided in Parts 1, 2 and 3 above to be true to the best of my/our knowledge. I/We enclose an application fee* of **€95.23** with this application.

Signature(s) of Applicant(s): _____ **(AGENT)**

Adam Cronin B.Eng., M.Sc., C.Eng., MIEI
Chartered Engineer

Date: **12 SEPTEMBER 2010**

*Preferred method of payment is by cheque or bank draft. The fee should be made payable to the Department of Agriculture, Fisheries and Food.

This form should be forwarded, with the required documents and application fee, to:

Aquaculture Licensing
Aquaculture & Foreshore Management Division
Clogheen
Clonakilty,
Co. Cork

Department of
Agriculture,
Food and the Marine
An Roinn
Talmhaíochta,
Bia agus Mara

UPDATE/ADDITIONAL INFORMATION FORM

FILL IN THE YELLOW HIGHLIGHTED SECTIONS

AQUACULTURE - LICENSING UNDER

FISHERIES (AMENDMENT) ACT 1997 as amended

and

FORESHORE ACT 1933 as amended

Application Form for an Aquaculture and Foreshore Licence for a single specific site.
If a Licence is required for more than one site a separate application form must be completed for each site.

Important Note

Section 4 of the Fisheries and Foreshore (Amendment) Act, 1998 (No. 54 of 1998) prohibits any person making an application for an Aquaculture Licence from commencing aquaculture operations until duly licensed under the Fisheries (Amendment) Act, 1997 (No. 23 of 1997), and provides that a breach of that prohibition will cause the application to fail.

A copy of an Environmental Impact Statement and Natura Impact Statement should be enclosed, if required, with all new, review and renewal applications. See Guidance Notes Section 3.

**Aquaculture & Foreshore Management Division,
Department of Agriculture, Food and the Marine,
National Seafood Centre,
Clonakilty, Co. Cork, P85 TX47
Telephone: (023) 8859500
Fax: (023) 8821782**

AQUACULTURE AND FORESHORE LICENCE APPLICATION FORM, for purposes of FISHERIES (AMENDMENT) ACT, 1997 and FORESHORE ACT, 1933

NB: The accompanying Guidance Notes should be read before completing this form.

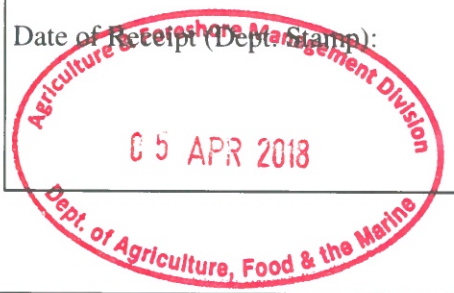
Note: Details provided in Parts 1 and 2 will be made available for public inspection. Details provided in Parts 3 and 4 and any other information supplied will not be released except as may be required by law, including the Freedom of Information Act 1997 as amended.

USE BLOCK CAPITALS IN BLACK INK PLEASE

For Office Use

Application Ref. No. T6/360

Date of Receipt (Dept. Stamp):



Type of Applicant (tick one)		
Sole Trader		
Partnership		
Company		X
Co-Operative		
Other	Please specify-	

PART 1: PRELIMINARY DETAILS

Applicant's Name(s)
1.
Address:
2.
Address:
3.
Address:
4.
Address:

Contact in case of enquiries (if different from above)	
Contact Name	
Organisation Name (if applicable)	
Address	

PART 1: PRELIMINARY DETAILS

TYPE OF APPLICATION – please indicate relevant type of application
This Application Form is valid for each type of application - ***See Guidance Note 3.1***

(i) Aquaculture Licence ☐

(ii) Trial Licence ☐

(iii) Foreshore Licence, if Marine Based ☐

(iv) Review of Aquaculture Licence ☐

(v) Renewal of Aquaculture Licence ☐

TYPE OF AQUACULTURE *See Guidance Note 3.2*

Indicate the relevant type of application with a tick.

(i) MARINE-BASED

Finfish		☐	Go to Parts 2.1 and 2.1A
Shellfish	*Subtidal*	☒	Go to Parts 2.2 and 2.2A
	Intertidal	☐	Go to Parts 2.2 and 2.2A
Seaweed/Aquatic Plants/Aquatic Fish Food		☐	Go to Parts 2.3 and 2.3A

(ii) LAND-BASED

Finfish ☐ **Shellfish** ☐ Go to Parts 2.4 and 2.4A

Aquatic Plants ☐ **Aquatic Fish Food** ☐ Go to Parts 2.4 and 2.4A

(iii) TRIAL LICENCE ☐ Go to appropriate Parts as above **and** to Part 2.5.

2.2 MARINE-BASED SHELLFISH AQUACULTURE

When filling out this section refer also to 2.2A and Guidance Note 3.3 for information on Conditions and Documents required with this application type

Proposed Site Location

(i) Bay:_____

(ii) County: _____

(iii) OS Map No: _____

(iv) Co-ordinates of Site: (please specify coordinate reference system used e.g. Irish Grid (IG) or Irish Transverse Mercator (ITM) or Latitude/Longitude [in which case specify whether ETRS89 or WG84 etc.]

_____

_____

_____

(v) Size of Site (hectares): _____

(vi) Species (common and scientific name) and whether native or non-native species: (see Guidance Notes 3.3.1)

_____

(vii) Whether production will be sub-tidal or inter-tidal?

_____ SUB TIDAL

(viii) Please supply details of (a) source of seed e.g. wild hatchery and location and (b) means of collection and introduction to culture.

_____ Natural Hatchery _____

_____

NB Importation of seed into the State or movement of seed within the State requires notification to the Marine Institute as per the Fish Health Authorisation Regulations – See Guidance Notes Section 6

(ix) Method of culture (rope, trestles – intensive; bottom – extensive; other)_____

(x) Proposed number of lines/ropes/trestles as per site layout drawing

_____

(xi) Proposed Production Tonnage:

Year 1	0	Year 2	20	Year 3	20	Year 4	20	Year 5	20

(xii) (a) Please outline the reasons for site selection:

_____

_____

(b) If using trestles please outline the physical characteristics of the site which make it suitable for using trestles

(xiii) Is it intended that the product is for direct human consumption or half grown? Please specify

The product will be sold to factories or dive processing plants for further packaging

(xiv) How will the visual impact issues of the flotation devices for the proposed application be addressed?

The barrels will be battleship grey

(xv) Is the site located in Designated Shellfish Waters Area? (Refer to Guidance Note 3.3.2)

Yes [V] No [ ]

If **yes** give details.

Kilmakilloge is CLASS A JAN/FEB and B for the remainder of the year

If **no** outline the reasons why you believe the site suitable for the proposed aquaculture, notwithstanding its location outside Designated Shellfish Waters Area?

(xvi) Has the area been classified under Food Safety Legislation? (For Bivalve Molluscs) What is the current classification of the area for the proposed species applied for?

A JAN/FEB - B for the remainder of the year

(xvii) Is the site located in/adjacent to a sensitive area e.g. SPA (Special Protection Area) or SAC (Special Area of Conservation) i.e. a Natura 2000 site? (Refer to Guidance Note 3.3.1- Natura 2000 sites)

Yes

(xviii) Are there known sources of pollution in the vicinity e.g. sewage outfall? Yes / No
If yes please give full details.

No

(xix) Methods used to harvest the shellfish and details of any subsequent processing of shellfish

The Company has its own harvesting vessel and sell to process fresh or cooked

(xx) Describe any proposed purification facilities to be used:

None planned

(xxi) What are the main predators of the species to be cultivated?

No known predators, possibly starfish

(xxii) Describe the method(s) which will be used to control them

picking by hand as harvested

See Part 2.2A for details of documentation to be included with this application type

2.2A DOCUMENTATION REQUIRED FOR MARINE-BASED SHELLFISH AQUACULTURE

(to be included separately with a Licence Application for a new site or for a renewal or review of an existing Licence)

1. **An appropriate Ordnance Survey Map (recommendation is a map to the Scale of 1:10,000/1:10,560, i.e. equivalent to a six inch map).** Note: The proposed access route to the site from the public road across tidal foreshore must also be shown on the map.

2. **Scale drawing of the structures to be used and the layout of the farm.**
   The proposed site drawings must illustrate all site structures above and below the water including mooring blocks. (recommended scales normally 1:100 for structures and 1:200 for layout) (See Guidance Note 3.3.2)

3. **The prescribed application fee (See Guidance Note Section 4)**

4. **If the applicant is a limited Company within the meaning of the Companies Act 1963. as amended, the Certificate of Incorporation and Memorandum and Articles of Association**

5. **If the applicant is a Co-operative, the Certificate of Incorporation and Rules of the Co-operative Society**

6. **Environmental Impact Statement (if required) in certain cases- See Guidance Notes Section 3.3.1**

7. **Alien Species dossier (where required) – See Guidance Notes Section 3.3.1**

NOW COMPLETE PARTS 2.6, 3, 4 AND 5 PLEASE

PART 3 D. LIMITED COMPANY

Company Name: KUSH SEAFARMS LTD

Address: O'SHEA HOUSE, NEW ROAD

KENMARE, CO. KERRY

Company Registered No. (CRO No.)_____

VAT No. [redacted]

Phone No.

Mobile No.

E-mail Add

Please list below the names and Personal Public Service No's of the Directors of the Company

Name: JOHN HARRINGTON Personal Public Service No. [redacted]

Name: FIOR HARRINGTON Personal Public Service No.

Name: _____ Personal Public Service No. _____

Name: _____ Personal Public Service No. _____

Please list below the names and Personal Public Service No.'s of the Shareholders in the Company and the percentage shareholding held in each case

Name: JOHN HARRINGTON Personal Public Service No. [redacted]

% Shareholding: 50

Name: FIOR HARRINGTON Personal Public Service No.

% Shareholding: 50

Name: _____ Personal Public Service No. _____

% Shareholding: _____

Name: _____ Personal Public Service No. _____

% Shareholding: _____

PART 5: APPLICATION DOCUMENTATION

The following documents are enclosed with this application:
NB: Refer to Guidance Note Section 3.3 – Guidance on Application Documentation

No.	DOCUMENTATION	YES	NO	N/A
1a	**An appropriate Ordnance Survey Map (recommendation is a map to the scale of 1:10,000/10:10,560, i.e., equivalent to a six inch map)**	✓		
1b	The proposed access route to the site from the public road across tidal foreshore must also be shown	✓		
2a	**Scale drawing of the structures to be used** (recommended scale normally 1:100 for structures).	✓		
2b	**Scale drawing of farm layout** (recommended scale normally 1:200 for layout)	✓		
3	**The prescribed application fee**	✓		
4	**Environmental Impact Statement (EIS), if required**			
4a	**Natura Impact Statement (NIS), if required**			
5	**Water Quality Analysis Report, if appropriate**			
6	**Decision of Planning Authority under the Planning Acts, if required**			
7	**Copy of Licence under Section 4 of the Local Government (Water Pollution) Act, 1977 – Effluent Discharge, if required**			
8	**If the applicant is a limited Company within the meaning of the Companies Act 1963, as amended, a copy of the Certificate of Incorporation and Memorandum and Articles of Association.**	✓		
9	**If the applicant is a Co-operative, a copy of the Certificate of Incorporation and Rules of the Co-operative Society**			
10	**Integrated Pest Management Plan, if required**			
11	**Alien Species documentation, if required.**			

PART 5: DECLARATION AND SIGNING

NB: Refer to Guidance Note Section 3.5 and Section 4 - Guidance on Declaration and Signing and Annual Aquaculture and Foreshore Licence Fees

If this is a renewal/review have you met all licence conditions of the existing aquaculture licence? If applicable, explain why you have not complied with all conditions:

I/We hereby declare the information provided in Parts 1, 2, 3 and 4 above to be true to the best of my/our knowledge and that I am over 18 years of age. I/We enclose an application fee* of €_____ with this application.

Signature(s) of Applicant(s): John Heaney MD
(Please state capacity of persons signing on behalf of a Company/Co-op) Rust Seafarms Ltd

Date: 26th March 2018

NB All persons named on this licence application must sign and date this application form.
Only the existing licence holder(s) can apply for the renewal/review of an Aquaculture Licence.

*Preferred method of payment is by cheque or bank draft. The fee should be made payable to the Department of Agriculture, Food and the Marine.

Refer to Guidance Note Section 4 - Guidance on Aquaculture and Foreshore Licence Fees

The application form should be forwarded, with the required documents and application fee, to:

Aquaculture Licensing
Aquaculture & Foreshore Management Division
Department of Agriculture, Food and the Marine
National Seafood Centre
Clonakilty
Co. Cork
P85 TX47

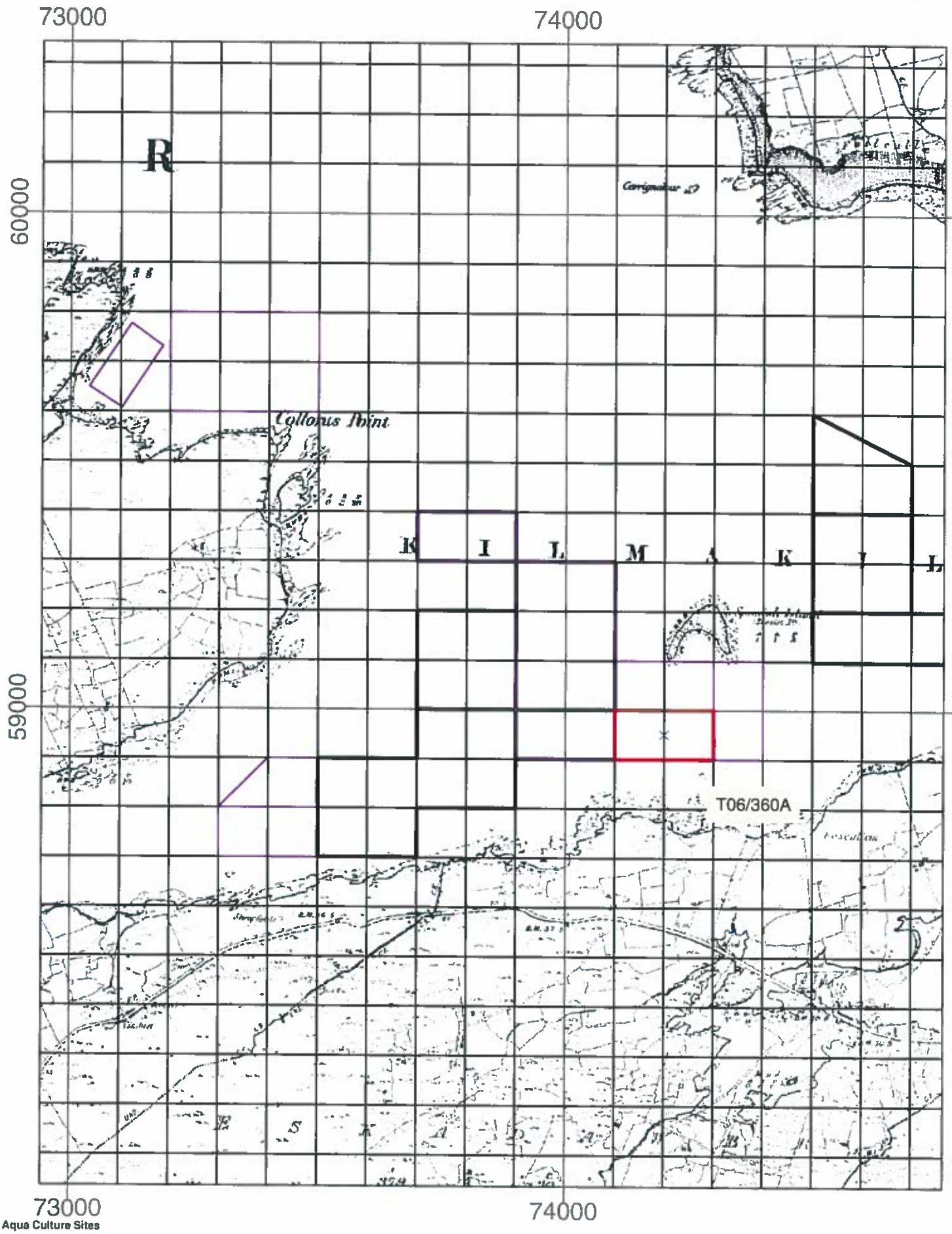
1 NO. SITE AT KILMAKILLOGE HARBOUR CO.Kerry

Co-ordinates & Area

Site T06/360A (2 Ha)

The area seaward of the high water mark and enclosed by a line drawn from Irish National Grid Reference point

074100, 059000 to Irish National Grid Reference point
074300, 059000 to Irish National Grid Reference point
074300, 058900 to Irish National Grid Reference point
074100, 058900 to the first mentioned point.



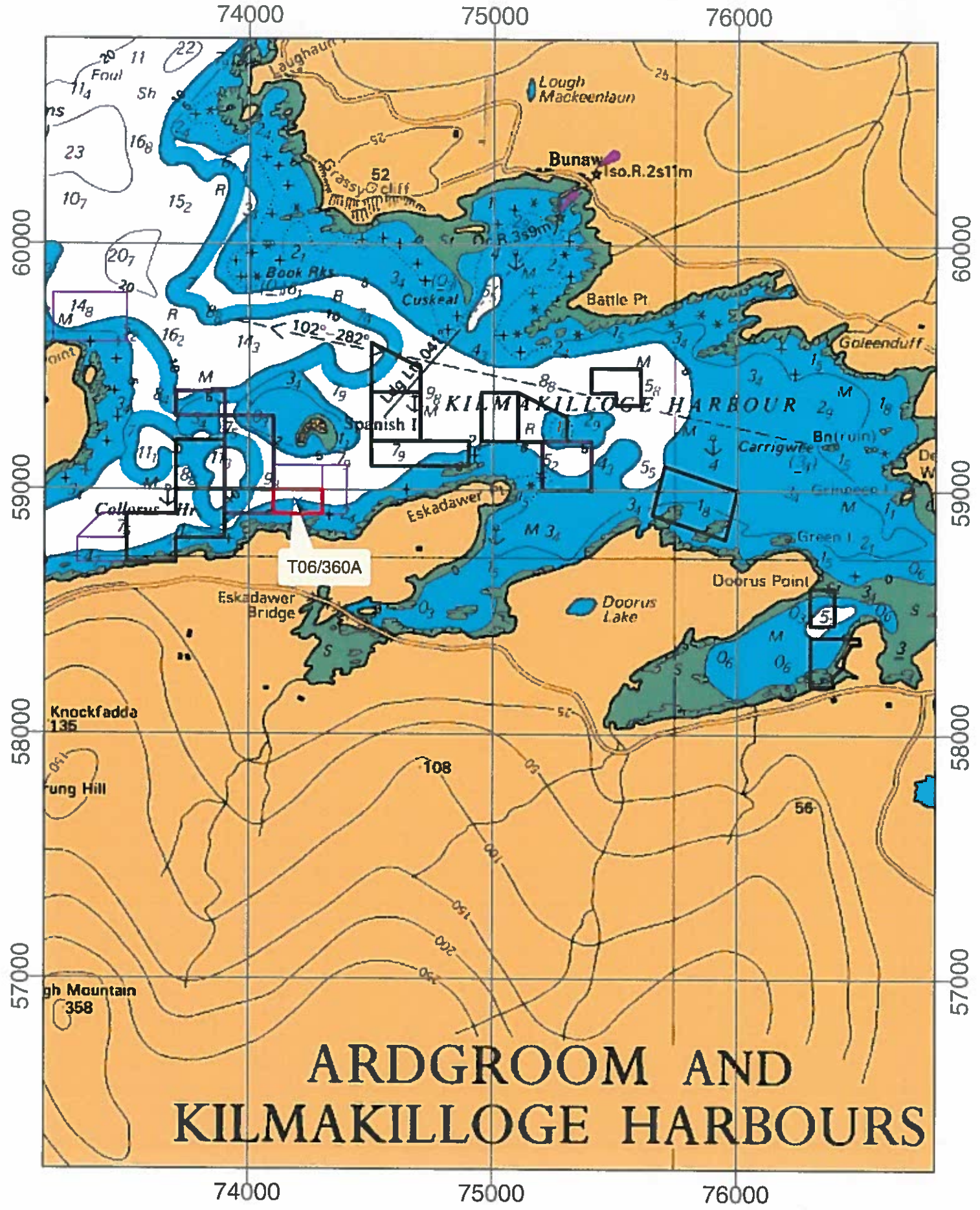
Aqua Culture Sites

Site_Status

- Application
- Application Lapsed
- Application Refused
- Application Renewal
- Application Withdrawn
- License Altered
- License Revoked
- License Surrendered
- Licensed
- Unknown
- Unlicensed
- 100 Meter Reference Grid

1:10,000

Site highlighted in red denotes application



Aqua Culture Sites
Site_Status
Application
Application Lapsed
Application Refused
Application Renewal
Application Withdrawn
License Altered
License Revoked
License Surrendered
Licensed
Unknown
Unlicensed

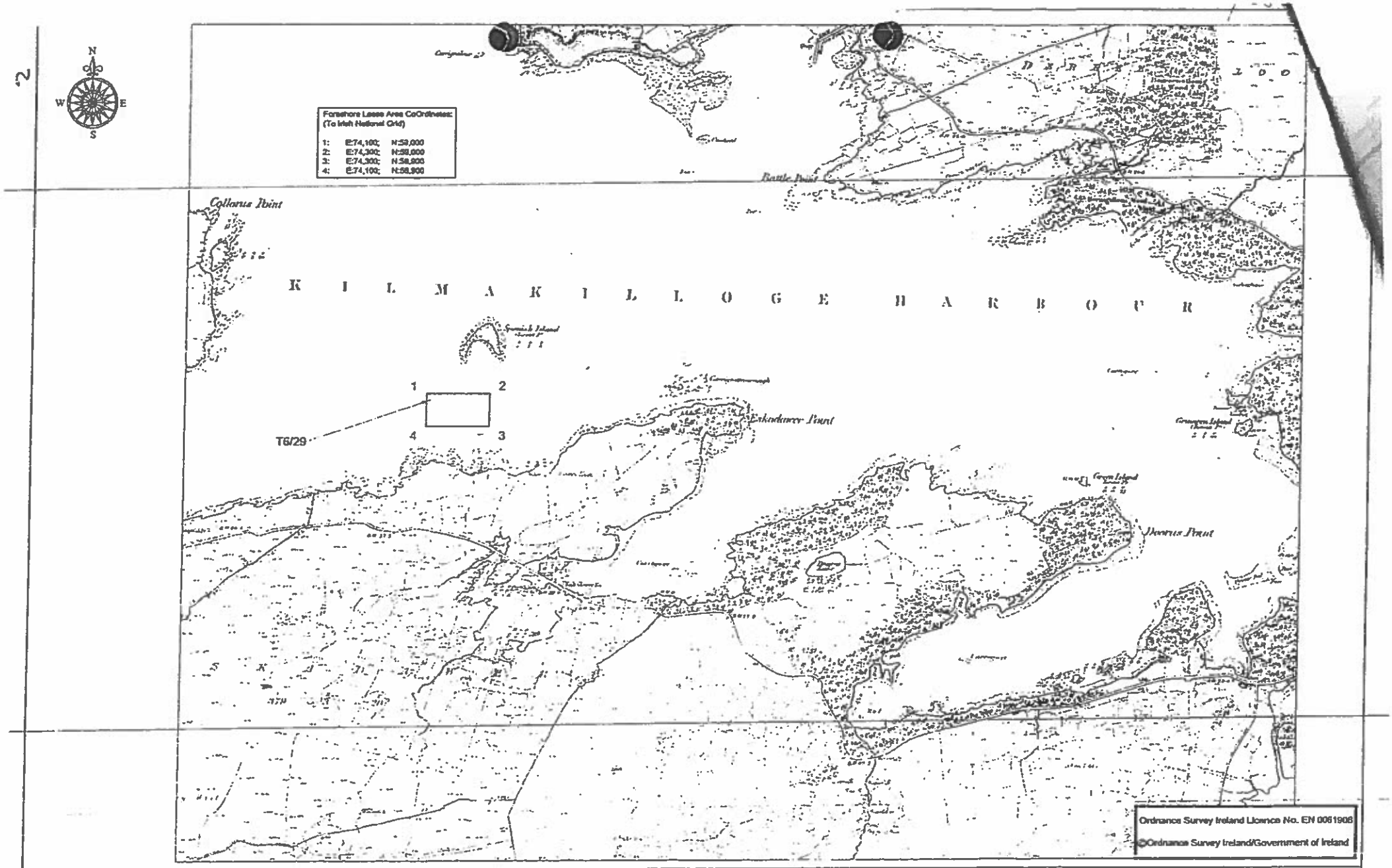
1:20,000

Site highlighted in red denotes application

Part of Admiralty Chart No. 2495-3
Not to be used for Navigation.

COASTAL ZONE MANAGEMENT DIVISION
25 FEB 2011
DEPT. OF AGRICULTURE, FISHERIES & FOOD

Department of Agriculture, Fisheries and Food
An Roinn Talmhaíochta, Iascaigh agus Bia



Cronin Millar Consulting Engineers
Civil Marine Structural Environmental

The Mews
7 Copperfields
Cobh
Co. Cork

Tel: 021 4815441
email: cobh@cmce.ie
website: www.cmce.ie

Rev	Description:	Date:	Drawn:	Checked:
A	Aquaculture Licence Application	21/09/10	CC	AC

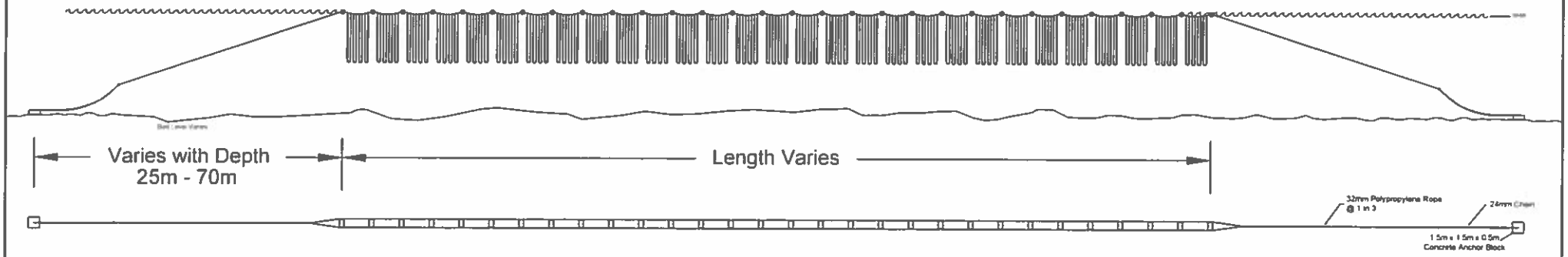
Client: Kush Seafarms Ltd.

Project: Aquaculture Licence Application ~~(T6/29)~~ (T06/360)

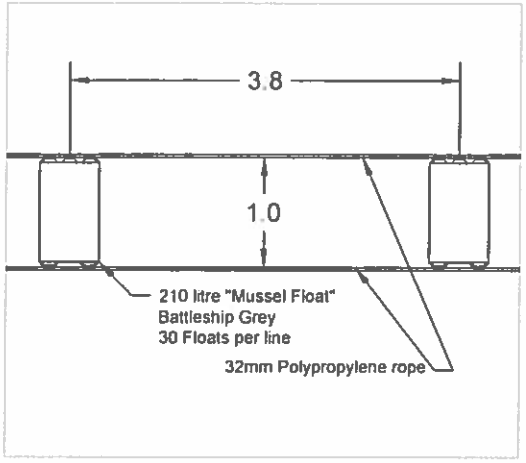
Title: 1:10560 Location Map

Scale:	Sheet Size:	Date:
1:10560	A3	21/09/2010

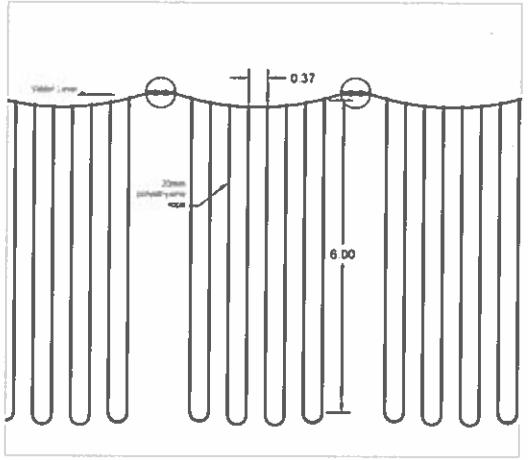
Drawn By:	Checked By:	Drawing No:	Revision:
CC	AC	C518/A/1	A



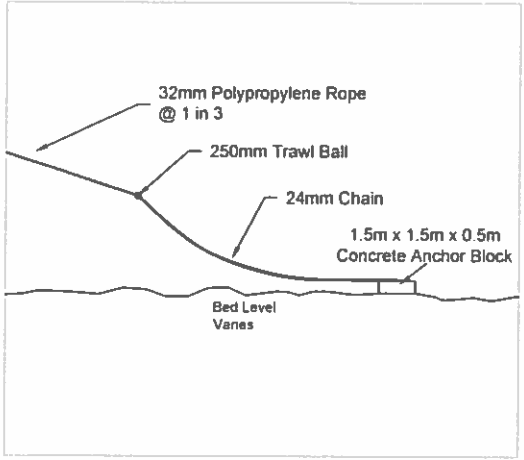
Typical Longline Section & Plan Detail
Scale 1:500



Typical Float & Rope Plan Detail
Scale 1:50



Typical Float & Rope Section Detail
Scale 1:100



Typical Anchorage Section Detail
Scale 1:200

Notes:

The anchorage details shown are indicative only.

Project	Aquaculture Drawings Mytilus Edulis				
Title	Inshore Mussel Farm Longline Layout Double Headrope Longline				
		Rev.	Date	Description	by / chk'd / app
Scale	As Shown @ A3	Drg. No.		Rev.	
Drawn	Jan 2019	-			
Checked					

Appropriate Assessment Report of Aquaculture in: Lower River Shannon SAC (Site code: 2165) and River Shannon and Fergus Estuaries SPA (Site Code: 4077)

Marine Institute

Version: April 2018

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Preface

In Ireland, the implementation of the Habitats Directive in relation to aquaculture and certain fisheries activities that occur within designated sites is achieved through Article 6(3) of the Directive whereby such activities, which are licenced by the Department of Agriculture, Food and the Marine (DAFM) or Department of Communications, Energy and Natural Resources (DCENR), are viewed as plans and projects and are therefore subject to Appropriate Assessment (AA). The Habitats Directive is transposed in Ireland in the European Communities (Birds and Natural Habitats) Regulations 2011. Appropriate assessments are currently carried out against the conservation objectives (COs), and more specifically on the version of the COs that are available at the time of the Assessment, for designated ecological features, within the site, as defined by the National Parks and Wildlife Service (NPWS). NPWS are the competent authority for the management of Natura 2000 sites in Ireland. Obviously, aquaculture and fishing operations existed in coastal areas prior to the designation of such areas under the Directives. Ireland is thereby assessing both existing and proposed aquaculture and fishing activities in such sites. This is an incremental process, as agreed with the EU Commission in 2009, and will eventually cover all fishing and aquaculture activities in all Natura 2000 sites.

The process of identifying existing and proposed activities and submitting these for assessment is, in the case of fisheries, outlined in SI 346/2009. Here, the industry or the Minister may bring forward fishing proposals or plans which become subject to assessment. These so called Fishery Natura Plans (FNPs) may simply be descriptions of existing activities or may also include modifications to activities that mitigate, prior to the assessment, perceived effects to the ecology of a designated feature in the site. In the case of aquaculture DAMF receives applications to undertake such activity and submits a set of applications, at a defined point in time, for assessment. The FNPs and aquaculture applications are then subject to AA. If the AA finds that significant effects of such activities cannot be discounted the plans or projects will need to be mitigated further if such activities are to continue. The AA is not explicit on how this mitigation should be achieved but rather the degree of mitigation required. In effect, therefore, the AA is a 'point in time' assessment of aquaculture and fishing activities to determine if they are consistent with COs for designated features within a Natura site and thereby compliant with the Directives.

This report is structured such that the summary, conclusions and recommendations from the assessments of fisheries and aquaculture activities in Natura 2000 features for the Lower River Shannon SAC (Site code: 2165) and River Shannon and Fergus Estuaries SPA (Site Code: 4077) are provided in the first part of this report while the full assessments on the SAC and the SPA are provided in Annex 1 and 2, respectively.

Summary SAC Considerations

The SAC

Lower River Shannon is designated as a Special Area of Conservation (SAC) under the Habitats Directive. The marine area is designated for the Annex I habitats Sandbanks which are slightly covered by sea water all the time (1110), Estuaries (1130), Mudflats and sandflats not covered by seawater at low tide (1140), Coastal lagoons (1150), Large shallow inlets and bays (1160) and Reefs (1170). The bay supports a variety of sub-tidal and intertidal sedimentary and reef habitats. The area is also designated for marine mammals (bottlenose dolphin, otter), freshwater fish (Sea, Brook, and River lampreys), the freshwater mussel and the Atlantic salmon (only in freshwater). Conservation Objectives for these habitats and species were identified by NPWS (2012a) 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 SAC. Guidance on the conservation objectives is provided by NPWS (2012b).

Activities in the SAC

Aquaculture is confined to the production of shellfish (Oysters, Mussels). The main aquaculture activity is oyster culture, which involves the culture of the native (Ostrea edulis) and pacific oyster (Crassostrea gigas) on trestles in intertidal areas and subtidally on the seafloor. Mussel culture includes subtidal suspended (longlines) and bottom culture.

The profile of the aquaculture industry in the Lower River Shannon SAC, used in this assessment, was prepared by BIM and is derived from the list of licence applications received by DAFM and provided to the Marine Institute for assessment in August 2013.

The appropriate assessment process

The function of an appropriate assessment and risk assessment 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 (2012b) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in the SAC. This guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with long-term maintenance of certain sensitive habitats while other habitats can tolerate a range of activities. For the practical purpose of management of sedimentary habitats a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance. Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the 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 and risk 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) will be introduced in situations where the risk of significant disturbance is identified. In situations where there is no obvious mitigation to reduce the risk of significant impact, it is advised that caution should be applied in licencing decisions. Overall, the Appropriate Assessment is both

the process and the assessment undertaken by the competent authority to effectively validate this Screening Report and/or NIS. It is important to note that the screening process is considered conservative, in that other activities which may overlap with habitats but which may have very benign effects are retained for full assessment. In the case 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.

Data supports

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

Findings

In the Lower Shannon River SAC aquaculture focuses primarily on shellfish species (mussels, oysters). Oysters are the predominant shellfish species cultured within the SAC, mussels are produced at a lower scale; while Scallops, although licensed, are not currently produced in the area. Based upon this and the information provided in the aquaculture profiling (Section 5), the likely interaction between this aquaculture and conservation features (habitats and species) of the site were considered.

An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur. The habitats and species excluded from further consideration were Freshwater Pearl Mussel Margaritifera margaritifera (1029), Sea Lamprey Petromyzon marinus (1095), Brook Lamprey Lampetra planeri (1096), River Lamprey Lampetra fluviatilis (1099), Atlantic Salmon Salmo salar (only in fresh water)(1106), Sandbanks which are slightly covered by sea water all the time (1110), Coastal lagoons (1150), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), Salicornia and other annuals colonizing mud and sand (1310), Atlantic salt meadows (Glauco-Puccinellietalia maritimae)(1330), Mediterranean salt meadows (Juncetalia maritimi)(1410), Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260), Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (6410) and 91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae).

Summary SPA Considerations

The SPA

This report presents an Appropriate Assessment of aquaculture within the Shannon Estuary. There are a total of 60 aquaculture sites, covering a total area of 631 ha, included in this assessment. Five of the sites are located outside the River Shannon and River Fergus Estuaries Special Protection Area (SPA) in Carrigaholt and Rinnevella Bays. All the sites within the SPA are located in the lower part of the Shannon Estuary downstream of the Fergus Estuary. There are 52 sites (covering 200 ha) of intertidal oyster cultivation, three sites (97 ha) of bottom oyster cultivation, two sites (130 ha) of bouchet pole mussel cultivation, three sites (313 ha) of bottom mussel cultivation and two sites (29 ha) of mussel longline cultivation.

The report assesses the potential impact of the development of these aquaculture sites on the Special Conservation Interests (SCIs) of the River Shannon and River Fergus Estuaries SPA, and on the SCIs of other SPAs where these SCIs may have connectivity with the Shannon Estuary. The potential for cumulative impacts from development of these aquaculture sites in combination with other relevant activities and plans is also assessed. The in-combination activities and plans assessed include: three Fishery Orders, which permit additional aquaculture development in the River Shannon and River Fergus Estuaries SPA; the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary, which provides the framework for the development of various marine-related industries and activities in and around the River Shannon and River Fergus Estuaries SPA; and a range of water-based recreational and commercial activities.

The SCIs of the River Shannon and River Fergus Estuaries SPA covered by this assessment are: Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank and Black-headed Gul. The SCIs of other SPAs covered by this assessment are: the Fulmar SCI of the Kerry Head SPA, the Kittiwake and Guillemot SCIs of the Loop Head SPA, and the Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit SCIs of the Ballyallia Lough SPA.

Methodology

Analysis of the likely impacts of activities covered in this assessment was based on a comparison of spatial overlap between the SCI species distribution and the spatial extent of the activities (as described above) as well as looking at species occurrence, behaviour and general ecology. These analyses focus on distribution patterns of feeding, or potentially feeding birds, as the main potential impacts will be to the availability and/or quality of feeding habitat; as well as an assessment of potential impacts on roosting birds, where relevant. Access points and shore based activities were also considered.

The distribution of waterbird was initially analysed using data from the Irish Wetland Bird Survey (IWeBS) counts and National Parks and Wildlife Service (NPWS) baseline waterbird survey counts (carried out in 2009/10).

Cumulative impacts

This assessment considered the cumulative impacts of the combined effects of the aquaculture and other activities within the SPA, notably fishery order activities, shipping and tourist activities.

SAC Conclusions and Recommendations

An In the Lower Shannon River SAC aquaculture focuses primarily on shellfish species (mussels, oysters) (Figure 5). Oysters are the predominant shellfish species cultured within the SAC, mussels are produced at a lower scale; while Scallops, although licensed, are not currently produced in the area. Based upon this and the information provided in the aquaculture profiling (Section 5), the

likely interaction between this aquaculture and conservation features (habitats and species) of the site were considered.

An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur. The habitats and species excluded from further consideration were Freshwater Pearl Mussel Margaritifera margaritifera (1029), Sea Lamprey Petromyzon marinus (1095), Brook Lamprey Lampetra planeri (1096), River Lamprey Lampetra fluviatilis (1099), Atlantic Salmon Salmo salar (only in fresh water)(1106), Sandbanks which are slightly covered by sea water all the time (1110), Coastal lagoons (1150), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), Salicornia and other annuals colonizing mud and sand (1310), Atlantic salt meadows (Glauco-Puccinellietalia maritimae)(1330), Mediterranean salt meadows (Juncetalia maritimi)(1410), Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260), Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (6410) and 91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae).

Habitats

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the Annex 1 habitats 1110 (Sandbanks which are slightly covered by sea water all the time), 1130 (Estuaries), 1140 (Mudflats and sandflats not covered by seawater at low tide), 1150 (Coastal Lagoon), 1160 (Large Shallow Inlets and Bay) and 1170 (Reefs). The likely effects of the aquaculture activities (species, structures) were considered in light of the sensitivity of the constituent habitats and species of the Annex 1 habitats.

There is no overlap between the Annex I habitats Sandbanks which are slightly covered by sea water all the time (1110) and Coastal Lagoons (1150) and aquaculture activities in the Lower River Shannon SAC, therefore these features were screened out of the assessment.

Furthermore, of the 10 community types listed under the remaining habitat features (1140, 1160 and 1170) two (Estuarine subtidal muddy sand to mixed sediment with gammarids community complex and Mixed subtidal reef community complex) were also excluded from further analysis as they had no overlap with aquaculture activities.

Based upon the scale of spatial overlap the general conclusion relating to the interaction between proposed aquaculture activities with habitats is that consideration can be given to licencing (existing and applications) in the Annex 1 habitats -1140 (Mudflats and sandflats not covered by seawater at low tide), 1160 (Large Shallow Inlets and Bays) and 1170 (Reefs). However, there is one exception where Oyster culture (bottom culture) occurs on the community type Faunal turf-dominated subtidal reef community (28.4%) which is above the threshold (15%) within the qualifying feature 1130 (Estuaries). However, it is questionable whether this activity will be carried out on this community type given the nature of the substrate.

However, based on biological pressures the aquaculture activity of Subtidal Bottom Culture (Mussels, Oysters) poses a potential risk of the introduction and the potential naturalization of non-native species due the placement of mussels and oysters in an uncontained fashion on the seafloor.

Conclusion 1: With one exception (Marine Community type – Anemone-dominated subtidal reef community (28.4%) which is above the threshold (15%) within the qualifying feature Large Shallow inlet and bay), aquaculture activities (intertidal oyster culture) do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC. However, aquaculture activities (bottom mussel, suspended mussel and bottom oyster culture) in-combination with fishery order areas do pose a significant risk of disturbance to a number of qualifying interests in the SAC.

Conclusion 2: Give the long residence time in the Shannon Estuary and the fact that recruitment of the non-native oysters *Magallana (Crassostrea) gigas* is ongoing. The risk posed by the culture of diploid Pacific oyster, *Magallana (Crassostrea) gigas*, cannot be discounted. This risk is further

exacerbated by the culture of these oysters on the seabed. It is recommended that all oyster culture be carried out using triploid oysters and that subtidal culture of M gigas uncontained on the seafloor be reviewed in light of these findings.

Conclusion 3: The source of mussel seed stock inputted into existing licensed mussel areas is collected locally at present. If seed is sourced outside of the site in the future the risk posed by this activity cannot be discounted. It is recommended that acceptable sources of seed (in terms of alien species assessment) are identified for all shellfish culture operations. The movement of stock in and out of the Lower River Shannon SAC should adhere to relevant fish health legislation and follow best practice guidelines (e.g. http://invasivespeciesireland.com/cops/aquaculture/).

Conclusion 4: It is recommended that there be strict adherence to the access routes identified and that density of culture structures within the sites be maintained at current levels.

The activities that are known to occur within the Fishery Order Areas (i.e. bottom culture of oysters and mussel) are deemed disturbing on a number of community types. It should be noted that the information available regarding the extent of usage and type of culture occurring within the Fishery Order Areas is sparse. Therefore the spatial extents listed are the maximum areas the Fishery Order covers, however it is possible that the areas may not be fully utilised by the operators. In the absence of this information and given the fact that the fishery orders are fully licenced, it is clear the decisions regarding the licencing of aquaculture operations should take into account the licence status of the Fishery order areas.

Species

The likely interactions between the proposed aquaculture activities (incl. Fishery Order Areas) and the Annex II species otter (Lutra lutra) were also assessed. The objectives for this species in the SAC focus upon maintaining the good conservation status of the population and consider certain uses of intertidal habitats as important indicators of status. The aspect of the culture activities that could potentially disturb the otter status relates to movement of people and vehicles within the sites as well as accessing the sites over intertidal areas and via water.

It is concluded that the aquaculture activities (incl. Fishery Order Areas) proposed in areas that potentially overlap with otter habitat do not pose a threat to the conservation status of this species within the SAC.

Conclusion 5: The current and proposed levels of aquaculture activities individually and in-combination with activities in fishery order areas are considered non-disturbing to otter conservation features.

The likely interactions between the proposed aquaculture activities and the Annex II species bottlenose dolphin (*Tursiops truncatus*) were also assessed. The objectives for this species in the SAC focus upon maintaining the favourable conservation condition status of the species which is defined by maintaining species range and critical habitat. The aspect of the culture activities that could potentially influence the dolphin status relates to presence of fixed aquaculture structures (Longlines) within the critical habitat areas. However, the small spatial extent and the potential for the structures to act as fish aggregation devices suggest present little risk to the feature in question.

It is concluded that the aquaculture activities proposed in areas that have overlap with dolphin critical habitat do not present a risk to the conservation status of this species within the Lower Shannon River SAC.

Conclusion 6: The current and proposed levels of subtidal suspended and bottom culture aquaculture activities are not considered disturbing to the bottlenose dolphin conservation features.

SPA Conclusions and Recommendations

There is a high potential for development of intertidal aquaculture sites in the Ballylongford/Bunaclugga, Poulnasherry/Kilrush and Aughinish/Foynes areas to cause significant displacement impacts to Grey Plover and Bar-tailed Godwit, while significant displacement impacts to Light-bellied Brent Goose and Ringed Plover are also possible. There is potential for further significant cumulative impacts on some of these species from the development of the above sites in combination with oyster trestle cultivation in the Fishery Order that covers part of Poulnasherry Bay, and development of areas of opportunity identified in the SIFP for tidal energy in Tarbert Bay and for aquaculture in Clonderlaw Bay.

The possibility of significant disturbance impacts to high tide roosts used by Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot and Dunlin from vessel activity associated with the development of sites in the Ballylongford/Bunaclugga and Aughinish/Foynes areas cannot be discounted due to a lack of information about the usage of high tide roost sites in these areas. The potential for cumulative impacts from this vessel activity in combination with other vessel activity in these areas also needs to be considered. Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit are also SCIs of the Ballyallia Lough SPA and there is potential interchange between these populations and the River Shannon and River Fergus Estuaries populations. Therefore, any significant impacts to these species in the River Shannon and River Fergus Estuaries could potentially also affect the conservation condition of these species in the Ballyallia Lough SPA.

The possibility of intertidal or subtidal aquaculture development affecting nocturnal roost sites used by Whooper Swan cannot be discounted as we have no information on the location of these roost sites.

Appropriate Assessment Conclusion Statement by Licensing Authority for aquaculture activities in Kenmare River Special Area of Conservation (SAC) (site code 2158)

This Conclusion Statement outlines how it is proposed to licence and manage aquaculture activities in the above Natura site in compliance with the EU Habitats Directive. Aquaculture in this Natura Site will be licensed in accordance with the standard terms and conditions as set out in the aquaculture licence templates. These are available for inspection on the Department's website at: https://www.agriculture.gov.ie/seafood/aquacultureforeshoremanagement/aquaculturelicensing/aquacultureandforeshorelicencetemplates/
The licences will also incorporate specific conditions so as to accommodate Natura requirements, as appropriate, in accordance with the principles set out in this document.

An Appropriate Assessment report of aquaculture in Kenmare River Special Area of Conservation (SAC) (Site Code: 02158) has been prepared by the Marine Institute on behalf of the Department of Agriculture, Food and the Marine. This report assessed the potential ecological interactions of aquaculture and fisheries activities on the Conservation Objectives of the site. From an aquaculture perspective the information upon which the Appropriate Assessment is based is the definitive list of applications and extant licences for aquaculture available at the time of assessment.

Description of the aquaculture projects

The projects involve the renewal of existing aquaculture activity and the licensing of new aquaculture activity within the SAC. Aquaculture is practiced in a number of locations within the SAC with a focus on shellfish species (mussels, oysters, scallops and clams) and finfish (salmon). Mussels are the predominant shellfish species cultured within the SAC, for example, Killmakilloge and Ardgroom Harbours produce significant amounts of mussel utilising suspended long-lines. There are also a number of sites dedicated to the culture of Atlantic Salmon.

Conservation Features for Kenmare River SAC

Kenmare River is designated as a SAC under the Habitats Directive. This SAC is designated for the habitats Large Shallow Inlet and Bay (1160), Reefs (1170) and Submerged Caves (8330). A number of coastal community types can also be found in the SAC, including those that are sensitive to pressures, which might arise from aquaculture, such as Maerl, seagrass and kelp reefs. The SAC is also

considered an important site for two mammal species, Harbour Seal and the Otter.

Appropriate Assessment

The function of the Appropriate Assessment is to determine if the ongoing and proposed aquaculture activities are consistent with the Conservation Objectives for the site. The National Parks and Wildlife Service (NPWS) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in 'Natura' sites. The assessment of activities was informed by this guidance, which is scaled relative to the anticipated sensitivity of the habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with the 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.

Findings and Recommendations of the Article 6(3) Appropriate Assessment

Aquaculture and Habitats:

The appropriate assessment finds that the majority of activities, at the current and proposed or likely future scale and frequency of activity are consistent with the Conservation Objectives for the Annex 1 Habitats, with the following exceptions:

1. Within the Kenmare River SAC there is an expired licence (no renewal received) for the culture of Scallops on the seabed. This overlapped three keystone communities, '*Zostera* dominated community', '*Maerl* dominated community' and '*Pachycerianthus multiplicatus* community'. Culture of Scallop on the seabed is deemed disturbing to such community types. As key contributors to biodiversity and being sensitive to disturbance these community types must be afforded a high degree of protection and no overlap with a disturbing activity can be tolerated.

2. 'Maerl dominated community' occurs in certain areas (Ardgroom and Killmakilloge Harbours) which are outside of the Qualifying Interests for which the Kenmare River SAC was designated but are still within the SAC

boundary. Maerl, the characterising species of this community, is listed as an Annex V species and as it is within the SAC boundary it must be afforded protection. Suspended mussel culture in Ardgroom Harbour spatially overlaps (1.84%) this community type and is considered disturbing. As a key contributor to biodiversity and being sensitive to disturbance this community type is afforded a high degree of protection and no overlap with a disturbing activity can be tolerated.

3. *'Zostera*-dominated community', as a key contributor to biodiversity and which is sensitive to disturbance should be afforded a high degree of protection i.e. thresholds for impact on these habitats is low and any significant anthropogenic disturbance should be avoided.

Aquaculture and Species:

The appropriate assessment acknowledges that the favourable conservation status of the Harbour Seal has been achieved given the current levels of aquaculture production within the SAC. On this basis the current levels of licensed aquaculture are considered non-disturbing to harbour seal conservation features. The following are the exceptions:

- In Coongar Harbour an oyster farm (licensed) and an application site for mussel culture is in very close proximity to a seal moulting site. The seal site in question has multiple recordings of seals and, therefore, would be considered an important location. The aquaculture site in question has structures confined to the northern portion of the site and cannot expand beyond this immediate area based on the topography of the site. This ensures that the activity will not occur in close proximity to the seal haul-out location. An expansion of intertidal aquaculture activity to areas in the immediate vicinity of the haul out locations would likely increase the risk of disturbance of the seals during the moulting period. The mussel culture site application is an expansion of existing operations and it is likely that seals will be habituated or tolerant of disturbance from this activity;

- In Ardgroom Harbour a mussel farm overlaps a seal site (breeding). A single sighting was recorded at the mussel culture site during 2000 and 2001 – it is assumed, given the lack of natural structures at the site in question, that the seal was hauled out on mussel rafts. The site in question has been licensed (and active) since 1992.

The appropriate assessment found that the aquaculture activities proposed do not pose a threat to the Otter or migrating salmon in the Kenmare River SAC.

Mitigation

Taking account of the recommendations of the Appropriate Assessment, as well as additional technical/scientific observations, the following measures are being taken in relation to licensing in this SAC.

- The overlap of 'scallop culture' with sensitive communities identified in the assessment report is noted. While the scallop culture had been licensed, the licence has expired and no renewal application has been received. The principles that will apply to any further applications for aquaculture in this area are as follows:
  i. No overlap with sensitive habitats will be permitted
  ii. There will be an additional requirement for a sufficient buffer zone to allow for mapping resolution and/or visual enforcement of exclusion

- With one exception, the AA found that the current levels of licensed shellfish and finfish culture and proposed applications are considered non-disturbing to harbour seal conservation features. The exception is the intertidal oyster culture site in Coongar Harbour. If licensing is to be considered for this site, it will be necessary to redraw the site boundaries to exclude the area overlapping the seal haul-out locations to mitigate any disturbance risk to seals.

- A finfish culture site within Kilmakilloge Harbour is in close proximity to designated seal sites. Seal interactions with marine finfish cages have been identified. The risk to seals (as predators) result from their interaction with netting if incorrectly configured. In terms of mitigation and in order to minimise the risk the operator will be instructed to employ a range of management actions including stock management (density control, regular removal of mortalities from cages), use of seal blinds and appropriate net tensioning.

- Aquaculture activity (suspended mussel culture) within Ardgroom Harbour spatially overlaps (1.84%) with the Maerl dominated community and may have negative effects on the distribution and quality of this community type. If licensing is to be considered for this site, it will be

necessary to redraw the site boundaries to exclude the area overlapping the Maerl dominated community, allowing for a suitable buffer zone.

- The location of an intertidal oyster cultivation operation over a *Zostera* bed is considered disturbing. This activity overlaps 18.05% of this community type within the SAC. Given the highly sensitive nature of this community type any activity is likely to have impact either by shading by trestles on seagrass or compaction by transport routes to/through the trestles and increased organic enrichment. It is not proposed to licence this site.

- A licence condition requiring strict adherence to the identified access routes over intertidal habitat in order to minimise species/ habitat disturbance will be required for all relevant sites.

- A licence condition requiring that the licensed and adjoining areas shall be kept clear of all redundant structures (including apparatus, equipment and/or uncontained stock), waste products and operational litter or debris, with provisions for the prompt removal and proper disposal of such material will be required for all relevant sites.

- A licence condition requiring full implementation of the measures set out in the draft Marine Aquaculture Code of Practice prepared by Invasive Species Ireland (e.g. http://invasivespeciesireland.com/cops/aquaculture) will be required for all relevant sites .

- The movement of stock in and out of the Kenmare River SAC should adhere to relevant fish health legislation will be required for all relevant sites.

- The use of updated and enhanced Aquaculture and Foreshore Licences containing terms and conditions which reflect the environmental protection required under EU and National law will be required for all relevant sites;

Conclusion

The Licensing Authority is satisfied that, given the conclusions and recommendations of the Appropriate Assessment process, a decision can be taken in favour of licensing existing and proposed aquaculture operations in Kenmare River SAC, subject to the implementation of the mitigation measures outlined above and other licensing related considerations.

Accordingly, the Licensing Authority is satisfied that by not licensing overlaps with *Zostera* and *Maerl* and other sensitive communities the proposed licensing is not likely to have a significant effect on the integrity of Kenmare River SAC.

September 2019

ANNEX I

Report supporting Appropriate Assessment of Aquaculture in Lower River Shannon SAC

(Site Code: 002165)

August 2019

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1 Preface

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

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

The process of identifying existing and proposed activities and submitting these for assessment is, in the case of fisheries projects and plans, outlined in S.I. 290 of 2013. Fisheries projects or plans are taken to mean those fisheries that are subject to annual secondary licencing or authorization. Here, the industry or the Minister may bring forward fishing proposals or plans which become subject to assessment. These so called Fishery Natura Plans (FNPs) may simply be descriptions of existing activities or may also include modifications to activities that mitigate, prior to the assessment, perceived effects to the ecology of a designated feature in the site. In the case of other fisheries, that are not projects or plans, data on activity are collated and subject to a risk assessment against the COs. Oyster fisheries, managed by DCENR, do not come under the remit of S.I. 290 of 2013 but are defined as projects or plans as they are authorized annually and are therefore also subject to AA.

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

2 Executive Summary

2.1 The SAC

Lower River Shannon is designated as a Special Area of Conservation (SAC) under the Habitats Directive. The marine area is designated for the Annex I habitats Sandbanks which are slightly covered by sea water all the time (1110), Estuaries (1130), Mudflats and sandflats not covered by seawater at low tide (1140), Coastal lagoons (1150), Large shallow inlets and bays (1160) and Reefs (1170). The bay supports a variety of sub-tidal and intertidal sedimentary and reef habitats. The area is also designated for marine mammals (bottlenose dolphin, otter), freshwater fish (Sea, Brook, and River lampreys), the freshwater mussel and the Atlantic salmon (only in freshwater). Conservation Objectives for these habitats and species were identified by NPWS (2012a) 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 SAC. Guidance on the conservation objectives is provided by NPWS (2012b).

2.2 Activities in the SAC

Aquaculture is confined to the production of shellfish (Oysters, Mussels). The main aquaculture activity is oyster culture, which involves the culture of the native (*Ostrea edulis*) and pacific oyster (*Crassostrea gigas*) on trestles in intertidal areas and subtidally on the seafloor. Mussel culture includes subtidal suspended (longlines) and bottom culture.

The profile of the aquaculture industry in the Lower River Shannon SAC, used in this assessment, was prepared by BIM and is derived from the list of licence applications received by DAFM and provided to the Marine Institute for assessment in August 2013.

2.3 The appropriate assessment process

The function of an appropriate assessment and risk assessment 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 (2012b) provide guidance on interpretation of the Conservation Objectives which are, in effect, management targets for habitats and species in the SAC. This guidance is scaled relative to the anticipated sensitivity of habitats and species to disturbance by the proposed activities. Some activities are deemed to be wholly inconsistent with long-term maintenance of certain sensitive habitats while other habitats can tolerate a range of activities. For the practical purpose of management of sedimentary habitats a 15% threshold of overlap between a disturbing activity and a habitat is given in the NPWS guidance. Below this threshold disturbance is deemed to be non-significant. Disturbance is defined as that which leads to a change in the 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 and risk 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) will be introduced in situations where the risk of significant disturbance is identified. In situations where there is no obvious mitigation to reduce the risk of significant impact, it is advised that caution should be applied in licencing decisions. Overall, the Appropriate Assessment is both the process and the assessment undertaken by the competent authority to effectively validate this Screening Report and/or NIS. It is important to note that the screening process is considered conservative, in that other activities which may overlap with habitats but which may have very benign effects are retained for full assessment. In the case 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]. Scientific reports on the potential effects of various activities on habitats and species have been compiled by the MI and provide the evidence base for the findings. The data supporting the assessment of individual activities vary and provides for varying degrees of confidence in the findings.

2.5 Findings

In the Lower Shannon River SAC aquaculture focuses primarily on shellfish species (mussels, oysters) (Figure 5). Oysters are the predominant shellfish species cultured within the SAC, mussels are produced at a lower scale; while Scallops, although licensed, are not currently produced in the area. Based upon this and the information provided in the aquaculture profiling (Section 5), the likely interaction between this aquaculture and conservation features (habitats and species) of the site were considered.

An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur. The habitats and species excluded from further consideration were Freshwater Pearl Mussel *Margaritifera margaritifera* (1029), Sea Lamprey *Petromyzon marinus* (1095), Brook Lamprey *Lampetra planeri* (1096), River Lamprey *Lampetra fluviatilis (*1099), Atlantic Salmon *Salmo salar* (only in fresh water)(1106), Sandbanks which are slightly covered by sea water all the time (1110), Coastal lagoons

[11] NPWS Geodatabase Ver: July 2015 - http://www.NPWS.ie/mapsanddata/habitatspeciesdata/

(1150), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), *Salicornia* and other annuals colonizing mud and sand (1310), Atlantic salt meadows (Glauco-Puccinellietalia maritimae)(1330), Mediterranean salt meadows (*Juncetalia maritimi*)(1410), Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260), *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410) and 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*).

2.6 Habitats

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the Annex 1 habitats 1110 (Sandbanks which are slightly covered by sea water all the time), 1130 (Estuaries), 1140 (Mudflats and sandflats not covered by seawater at low tide), 1150 (Coastal Lagoon), 1160 (Large Shallow Inlets and Bay) and 1170 (Reefs). The likely effects of the aquaculture activities (species, structures) were considered in light of the sensitivity of the constituent habitats and species of the Annex 1 habitats.

There is no overlap between the Annex I habitats Sandbanks which are slightly covered by sea water all the time (1110) and Coastal Lagoons (1150) and aquaculture activities in the Lower River Shannon SAC, therefore these features were screened out of the assessment.

Furthermore, of the 10 community types listed under the remaining habitat features (1140, 1160 and 1170) two (Estuarine subtidal muddy sand to mixed sediment with gammarids community complex and Mixed subtidal reef community complex) were also excluded from further analysis as they had no overlap with aquaculture activities.

Based upon the scale of spatial overlap the general conclusion relating to the interaction between proposed aquaculture activities with habitats is that consideration can be given to licencing (existing and applications) in the Annex 1 habitats -1140 (Mudflats and sandflats not covered by seawater at low tide), 1160 (Large Shallow Inlets and Bays) and 1170 (Reefs). However, there is one exception where Oyster culture (bottom culture) occurs on the community type Faunal turf-dominated subtidal reef community (28.4%) which is above the threshold (15%) within the qualifying feature 1130 (Estuaries). However, it is questionable whether this activity will be carried out on this community type given the nature of the substrate.

However, based on biological pressures the aquaculture activity of Subtidal Bottom Culture (Mussels, Oysters) poses a potential risk of the introduction and the potential naturalization of non-native species due the placement of mussels and oysters in an uncontained fashion on the seafloor.

Conclusion 1: With one exception (Marine Community type – Anemone-dominated subtidal reef community (28.4%)) which is above the threshold (15%) within the qualifying feature Large Shallow inlet and bay), aquaculture activities (intertidal oyster culture) do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC. However, aquaculture activities (bottom mussel, suspended mussel and bottom oyster culture) in-combination with fishery order areas do pose a significant risk of disturbance to a number of qualifying interests in the SAC.

Conclusion 2: Give the long residence time in the Shannon Estuary and the fact that recruitment of the non-native oysters *Crassostrea gigas* is ongoing. The risk posed by the culture of diploid Pacific oyster, *Crassostrea gigas*, cannot be discounted. This risk is further exacerbated by the culture of these oysters on the seabed. It is recommended that all oyster culture be carried out using triploid oysters and that subtidal culture of *C gigas* uncontained on the seafloor be reviewed in light of these findings.

Conclusion 3: The source of mussel seed stock inputted into existing licensed mussel areas is collected locally at present. If seed is sourced outside of the site in the future the risk posed by this activity cannot be discounted. It is recommended that acceptable sources of seed (in terms of alien species assessment) are identified for all shellfish culture operations. The movement of stock in and out of the Lower River Shannon SAC should adhere to relevant fish health legislation and follow best practice guidelines (e.g. http://invasivespeciesireland.com/cops/aquaculture/).

Conclusion 4: It is recommended that there be strict adherence to the access routes identified and that density of culture structures within the sites be maintained at current levels.

The activities that are known to occur within the Fishery Order Areas (i.e. bottom culture of oysters and mussel) are deemed disturbing on a number of community types. It should be noted that the information available regarding the extent of usage and type of culture occurring within the Fishery Order Areas is sparse. Therefore the spatial extents listed are the maximum areas the Fishery Order covers, however it is possible that the areas may not be fully utilised by the operators. In the absence of this information and given the fact that the fishery orders are fully licenced, it is clear the decisions regarding the licencing of aquaculture operations should take into account the licence status of the Fishery order areas.

2.7 Species

The likely interactions between the proposed aquaculture activities (incl. Fishery Order Areas) and the Annex II species otter (*Lutra lutra*) were also assessed. The objectives for this species in the SAC focus upon maintaining the good conservation status of the population and consider certain uses of intertidal habitats as important indicators of status. The aspect of the culture activities that could potentially disturb the otter status relates to movement of people and vehicles within the sites as well as accessing the sites over intertidal areas and via water.

It is concluded that the aquaculture activities (incl. Fishery Order Areas) proposed in areas that potentially overlap with otter habitat do not pose a threat to the conservation status of this species within the SAC.

Conclusion 5: The current and proposed levels of aquaculture activities individually and in-combination with activities in fishery order areas are considered non-disturbing to otter conservation features.

The likely interactions between the proposed aquaculture activities and the Annex II species bottlenose dolphin (*Tursiops truncatus*) were also assessed. The objectives for this species in the SAC focus upon maintaining the favourable conservation condition status of the species which is defined by maintaining

species range and critical habitat. The aspect of the culture activities that could potentially influence the dolphin status relates to presence of fixed aquaculture structures (Longlines) within the critical habitat areas. However, the small spatial extent and the potential for the structures to act as fish aggregation devices suggest present little risk to the feature in question.

It is concluded that the aquaculture activities proposed in areas that have overlap with dolphin critical habitat do not present a risk to the conservation status of this species within the Lower Shannon River SAC.

Conclusion 6: The current and proposed levels of subtidal suspended and bottom culture aquaculture activities are not considered disturbing to the bottlenose dolphin conservation features.

3 Introduction

This document assesses the potential ecological interactions of aquaculture and fisheries activities within the Lower River Shannon SAC (site code 2165) on the Conservation Objectives (COs) of the site (NPWS 21012a, 7/08/2012 Version 1).

The information upon which this assessment is based is a list of applications and extant licences for aquaculture activities administered by the Department of Agriculture Food and Marine (DAFM) and forwarded to the Marine Institute as of August 2013; as well as aquaculture and fishery profiling information provided on behalf of the operators by Bord Iascaigh Mara. The spatial extent of aquaculture licences is derived from a database managed by the DAFM[2] and shared with the Marine Institute.

4 Conservation Objectives for Lower River Shannon SAC (002165)

The appropriate assessment of aquaculture in relation to the Conservation Objectives for Lower River Shannon SAC is based on Version 1.0 of the objectives (NPWS 2012a - Version 1 August 2012) and supporting documentation (NPWS 2012b - Version 1 March 2012). The spatial data for conservation features was provided by NPWS[3].

4.1 The SAC extent

Lower River Shannon SAC is a very large estuary on the west coast of Ireland where the River Shannon enters the Atlantic Ocean. This very large site (120km) stretches along the Shannon valley from Limerick City in the upper reaches out to the Mouth of the Shannon, an area between Loop Head (Co. Clare) in the north and Kerry Head (Co. Kerry) in the south. The mouth of the estuary is over 15 km wide, narrowing to just over 3 km between Kilcredaun and Kilconly Headlands. The site thus encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head (NPWS, 2013a).

The Lower River Shannon SAC is designated for the marine Annex I qualifying interests of Sandbanks which are slightly covered by sea water all the time (1110), Estuaries (1130), Mudflats and sandflats not covered by seawater at low tide (1140), Coastal lagoons (1150), Large shallow inlets and bays (1160) and Reefs (1170) (Figure 1). The Annex I habitats 1130 and 1160 are large physiographic features that may wholly or partly incorporate other Annex I habitats including Reefs, Sandbanks and Mudflats and sandflats within their areas.

[2] DAFM Aquaculture Database version Aquaculture: 30th Aug 2013
[3] NPWS Geodatabase Ver: July 2015 - http://www.NPWS.ie/mapsanddata/habitatspeciesdata/

A number of coastal habitats can also be found in the SAC, including Mediterranean salt meadows (*Juncetalia maritimi*)(1410), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), Salicornia and other annuals colonizing mud and sand (1310), Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)(1330), Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260), *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)(6410), *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)(91E0)

The SAC is also considered an important site for a number of Annex II species including the common bottlenose dolphin (*Tursiops truncatus,* 1349), the otter (*Lutra lutra,* 1355), Freshwater Pearl Mussel (*Margaritifera margaritifera*, 1029), Sea Lamprey (*Petromyzon marinus*, 1095), Brook Lamprey (*Lampetra planeri,* 1096), River Lamprey (*Lampetra fluviatilis*, 1099) and the Atlantic Salmon (*Salmo salar*, 1106 only in fresh water).

The extent of the SAC is shown in Figure 1 below.

4.2 Qualifying interests (SAC)

The SAC is designated for the following habitats and species (NPWS 2012a), as listed in Annexes I, II of the E.U. Habitats Directive:

1029 Freshwater Pearl Mussel *Margaritifera margaritifera*

1095 Sea Lamprey *Petromyzon marinus*

1096 Brook Lamprey *Lampetra planeri*

1099 River Lamprey *Lampetra fluviatilis*

1106 Atlantic Salmon *Salmo salar* (only in fresh water)

1110 Sandbanks which are slightly covered by sea water all the time

1130 Estuaries

1140 Mudflats and sandflats not covered by seawater at low tide

1150 *Coastal lagoons

1160 Large shallow inlets and bays

1170 Reefs

1220 Perennial vegetation of stony banks

1230 Vegetated sea cliffs of the Atlantic and Baltic coasts

1310 *Salicornia* and other annuals colonizing mud and sand

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

1349 Bottlenose Dolphin *Tursiops truncatus*

1355 Otter *Lutra lutra*

1410 Mediterranean salt meadows (*Juncetalia maritimi*)

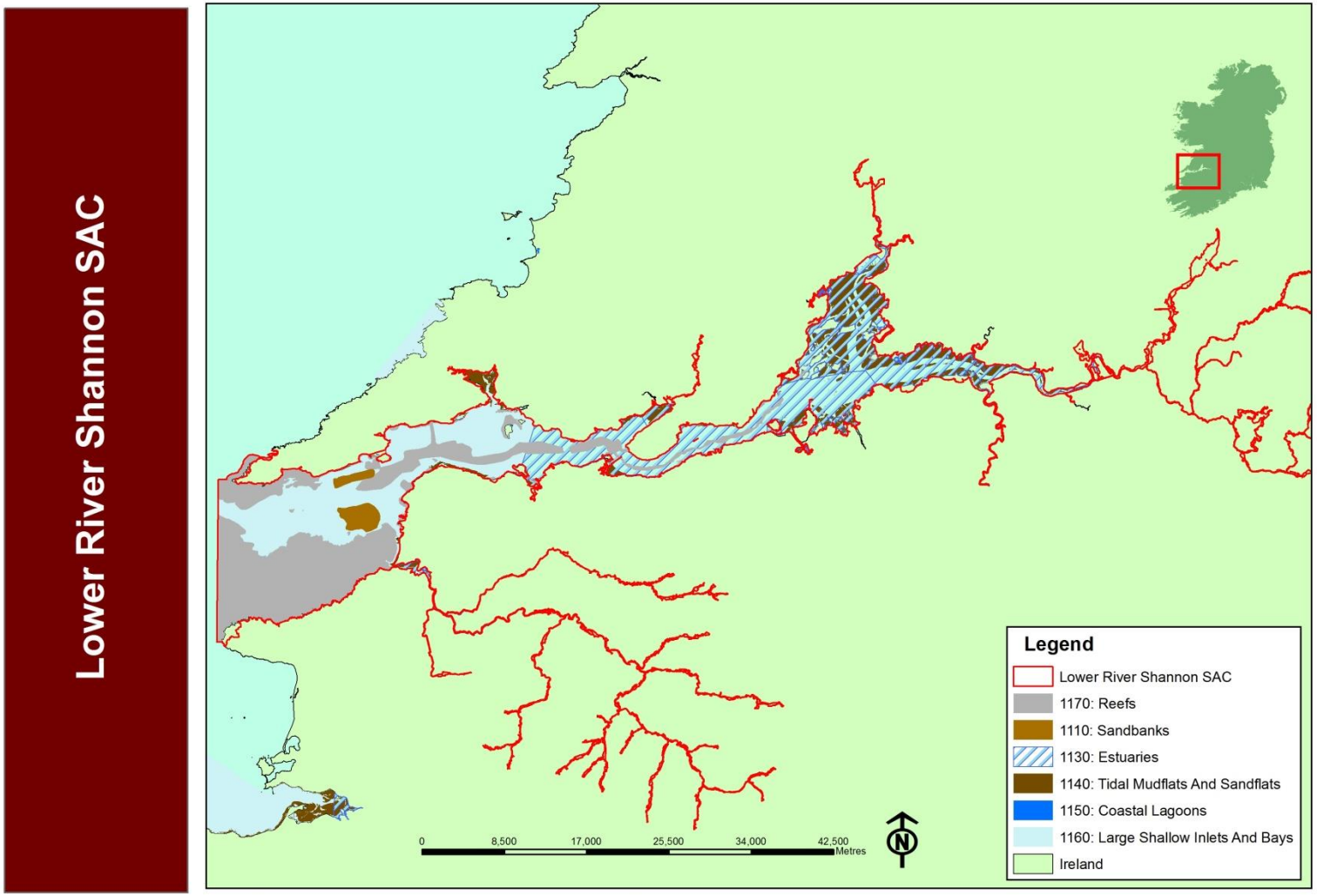
3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

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

*indicates a priority habitat under the habitats directive

Figure 1: The extent of the Lower River Shannon SAC (Site Code 002165) and qualifying interests (habitats).



Ten constituent communities and community complexes recorded within the qualifying interest Annex 1 habitats (i.e. Sandbanks which are slightly covered by sea water all the time (1110), Estuaries (1130), Mudflats and sandflats not covered by seawater at low tide (1140), Large Shallow inlets and Bays (1160) and Reefs (1170)) are listed in NPWS (2012b) and illustrated in Figure 2 and consist of:

- Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community
- Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex
- Estuarine subtidal muddy sand to mixed sediment with gammarids community complex
- Subtidal sand to mixed sediment with *Nucula nucleus* community complex
- Subtidal sand to mixed sediment with *Nephtys* spp. community complex
- Fucoid-dominated intertidal reef community complex
- Mixed subtidal reef community complex
- Faunal turf-dominated subtidal reef community
- Anemone-dominated subtidal reef community
- *Laminaria*-dominated community complex

The Lower River Shannon SAC is one of two designated SAC's in Ireland for the bottlenose dolphin *Tursiops truncatus*, the other being West Connacht Coast SAC (002998). The species is listed on Annex II and Annex IV of the E.U. Habitats Directive. According to Berrow *et al.* (2010) the Shannon Estuary is an important habitat for bottlenose dolphins as it is the largest resident population of the species known to occur in Ireland, they occur throughout the year and it is also an important calving area. Smaller apparently resident groups of bottlenose dolphins have been seen regularly at both outer Cork Harbour and the area around north Connemara, Co Galway. Mirimin *et al.* (2011) suggests that the bottlenose dolphins in the Shannon Estuary are genetically discrete and thus of very high conservation value. Several population assessments of bottlenose dolphins have been carried out in the Shannon Estuary since 1997 with the most recent in 2010 (Ingram 2000; Ingram and Rogan 2003; Englund *et al.* 2007; 2008, cited in Berrow *et al.* 2010). Previous abundance estimates for bottlenose dolphins in the Lower River Shannon SAC ranged from 114 in 2008 to 140 in 2006. According to Berrow *et al.* 2010 the most recent estimate (107) is deemed within this range suggesting that, within the power of the survey technique, the population of bottlenose dolphins in the Lower River Shannon SAC is relatively stable. Two distinct areas have been have been identified within the SAC as been important (NPWS 2012a) and are considered critical habitat for the overall welfare and health of the populations at the site. These are located at the mouth of the SAC near Ballybunion Bank and an area between Tarbert, Co Clare and Kilimer, Co. Clare, (Figure 3).

Figure 2: Principal benthic communities recorded within the qualifying interests of the Lower River Shannon SAC (Site Code 002165) (NPWS 2012a).

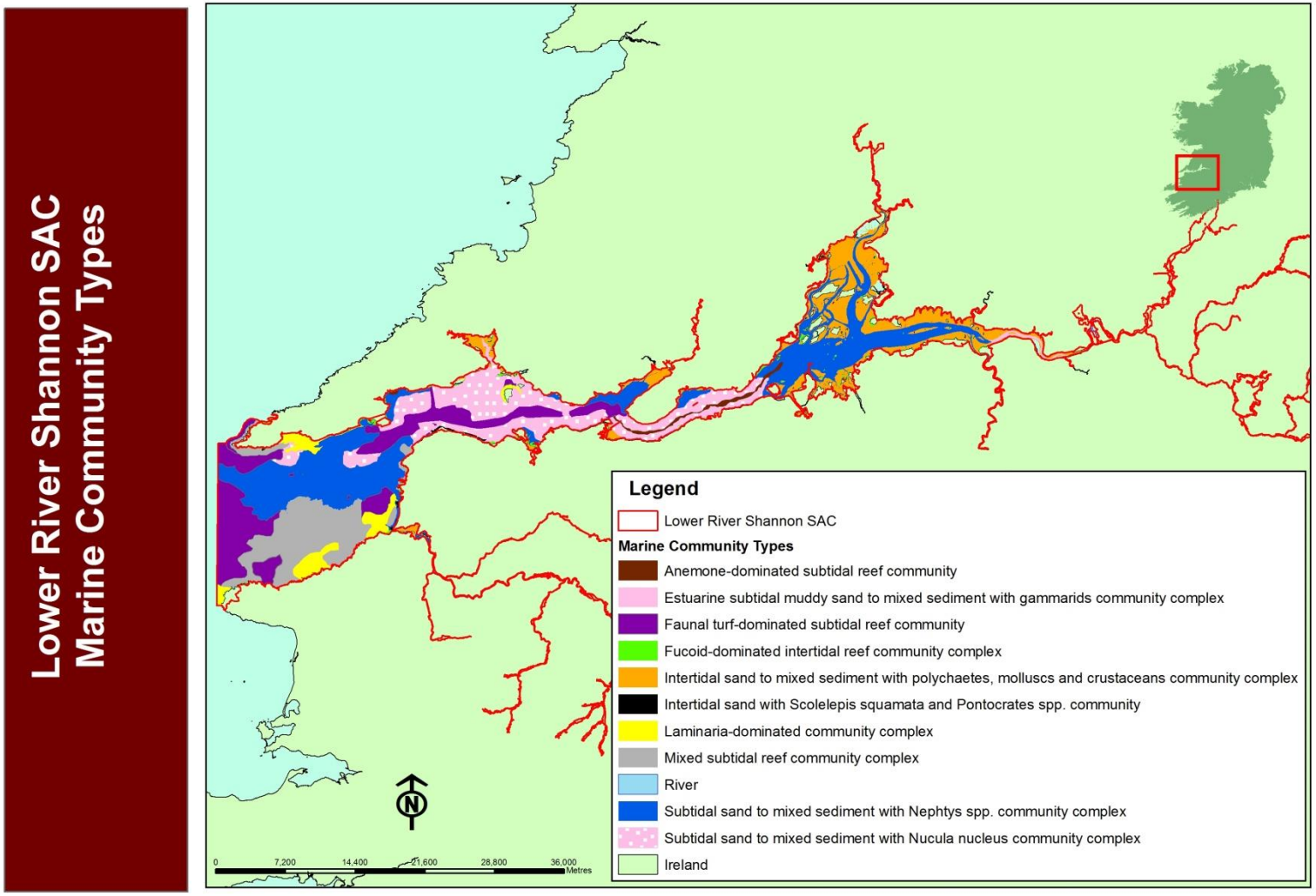
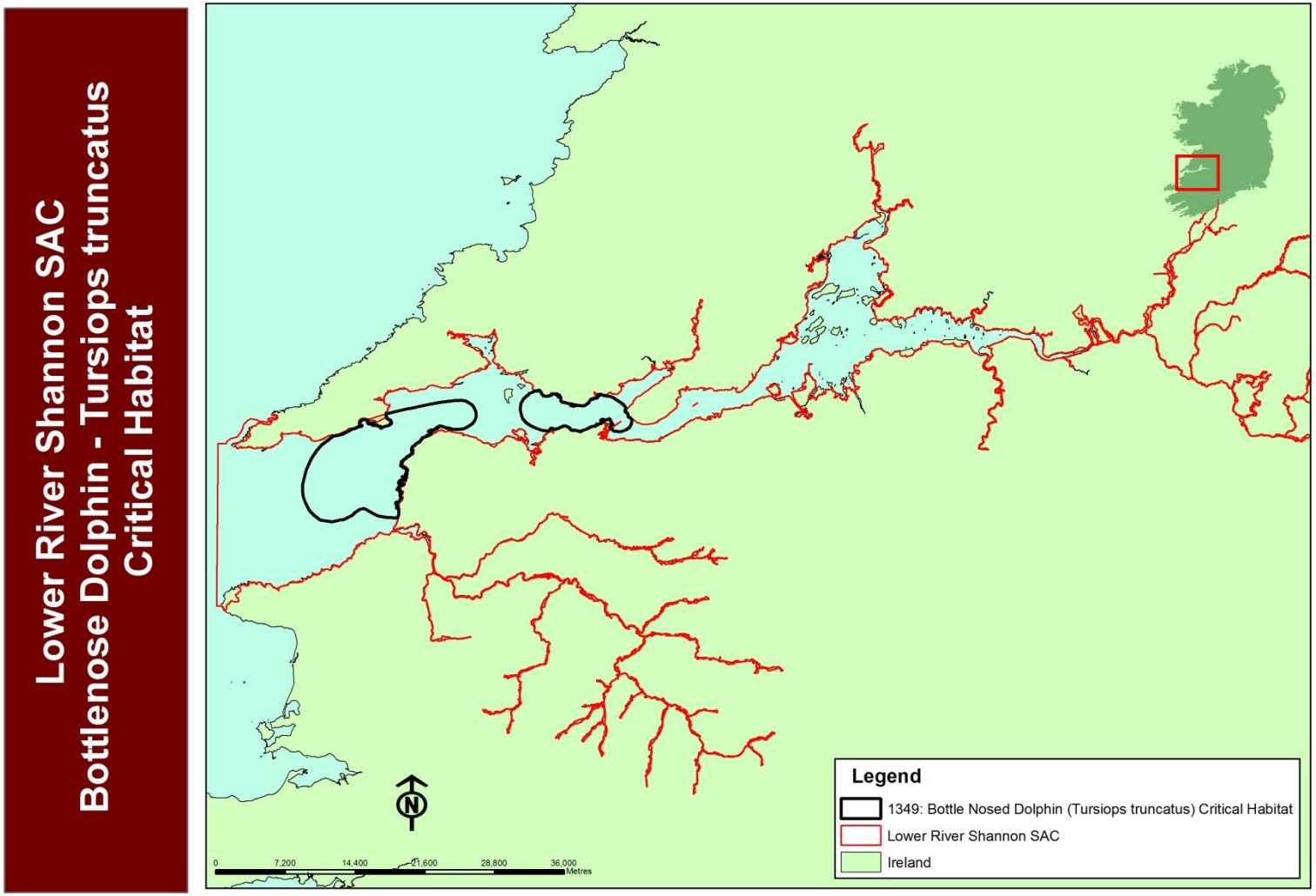


Figure 3: Critical habitat of the bottlenose dolphin (*Tursiops truncatus*) within the Lower River Shannon SAC (Site Code 002165) (NPWS 2012a).



The Shannon River SAC is designated for the otter *Lutra lutra*. The species, which is commonly found on the site (NPWS, 2013a), is listed in Annex II and Annex IV of the E.U. Habitats Directive and is afforded strict protection. According to the NPWS (2009) although otter numbers have declined from 88% in 1980/81 to 70% in 2004/05, otters remain widespread in Ireland.

Other species listed on Annex II, of the E.U. Habitats Directive, found within the site include the Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), and Salmon (*Salmo salar* in fresh water only). The latter two species are also listed on Annex V of the E.U. Habitats Directive There are few other river systems in Ireland which contain all three species of lamprey (NPWS, 2013b). According to the most recent Red Data List (King *et al*. 2011) the Sea lamprey is deemed 'Near Threatened', while both the River and Brook lamprey are evaluated at 'Least Concern'.

The Freshwater Pearl Mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs in parts of the Cloon River, Co. Clare (NPWS 2012a). According to the most recent Red Data List (Byrne *et al.* 2009) this species is deemed 'Critically Endangered' within Ireland.

Fishing is a main tourist attraction on the Shannon and there are a large number of angler associations. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming and boating (including dolphin-watching trips). In order to allow the public to appreciate these animals whilst ensuring that the population continues to live relatively undisturbed in the area strict guidelines exist, which all licensed tour-boat operators within the region must adhere to, and cover the methods and time allowed with dolphin groups within the Lower River Shannon SAC.

4.3 Conservation objectives for Lower River Shannon SAC

The conservation objectives for the qualifying interests (SAC) were identified in NPWS (2012a). The natural condition of the designated features should be preserved with respect to their area, distribution, extent and community distribution. Habitat availability should be maintained for designated species and human disturbance should not adversely affect such species. The features, objectives and targets of each of the qualifying interests within the SAC are listed in Table 1 below.

4.4 Screening of Adjacent SACs for *ex situ* effects

In addition to the Lower River Shannon 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 2 where a preliminary screening is carried out on the likely interaction with aquaculture activities based primarily upon the likelihood of spatial overlap. As it was deemed that there are no *ex situ* effects and no effects on features in adjacent SACs all qualifying features of adjacent Natura 2000 sites were screened out.

Table 1: Conservation objectives and targets for marine habitats and species in the Lower River Shannon SAC (Site Code 002165) (NPWS 2012a, 2012b). Annex I and II features listed in bold.

Feature (Community Type)	Objective	Target
1110 Sandbanks which are slightly covered by water all the time	Maintain favourable conservation condition	1,353ha; The distribution and permanent habitat area is stable subject to natural processes. Constituent community types are conserved in a natural condition.
(Subtidal sand to mixed sediment with *Nephtys* spp. community complex)	Maintain favourable conservation condition	1,353ha; Conserve in a natural condition
1130 Estuaries	Maintain favourable conservation condition	24,273ha; The permanent habitat area is stable or increasing, subject to natural processes. Constituent community types are conserved in a natural condition.
(Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex)	Maintain favourable conservation condition	8130ha; Conserve in a natural condition
(Estuarine subtidal muddy sand to mixed sediment with gammarids community complex)	Maintain favourable conservation condition	268ha; Conserve in a natural condition
(Subtidal sand to mixed sediment with *Nucula nucleus* community complex)	Maintain favourable conservation condition	4196ha; Conserve in a natural condition
(Subtidal sand to mixed sediment with *Nephtys* spp. community complex)	Maintain favourable conservation condition	8404ha; Conserve in a natural condition
(Fucoid-dominated intertidal reef community complex)	Maintain favourable conservation condition	678ha; Conserve in a natural condition
(Anemone-dominated subtidal reef community)	Maintain favourable conservation condition	713ha; Conserve in a natural condition
1140 Mudflats and sandflats not covered by seawater at low tide	Maintain favourable conservation condition	8,808 ha; The permanent habitat area is stable or increasing, subject to natural processes. Constituent community types are conserved in a natural condition.

Feature (Community Type)	Objective	Target
(Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community)	Maintain favourable conservation condition	213ha; Conserve in a natural condition
(Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex)	Maintain favourable conservation condition	8596ha; Conserve in a natural condition
1150 Coastal Lagoons	**Restore favorable conservation condition**	The permanent habitat area is stable or increasing, subject to natural processes. No decline in habitat distribution, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
1160 Large shallow inlets and bays	Maintain favourable conservation condition	35,282 ha; The permanent habitat area is stable or increasing, subject to natural processes. Constituent community types are conserved in a natural condition.
(Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community)	Maintain favourable conservation condition	211ha; Conserve in a natural condition
(Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex)	Maintain favourable conservation condition	466ha; Conserve in a natural condition
(Subtidal sand to mixed sediment with *Nucula nucleus* community complex)	Maintain favourable conservation condition	6095ha; Conserve in a natural condition
(Subtidal sand to mixed sediment with *Nephtys* spp. community complex)	Maintain favourable conservation condition	9431ha; Conserve in a natural condition
(Fucoid-dominated intertidal reef community complex)	Maintain favourable conservation condition	616ha; Conserve in a natural condition
(Mixed subtidal reef community complex)	Maintain favourable conservation condition	74644ha; Conserve in a natural condition

Feature (Community Type)	Objective	Target
(Faunal turf-dominated subtidal reef community)	Maintain favourable conservation condition	8710ha; Conserve in a natural condition
(Anemone-dominated subtidal reef community)	Maintain favourable conservation condition	34ha; Conserve in a natural condition
(*Laminaria*-dominated community complex)	Maintain favourable conservation condition	2221ha; Conserve in a natural condition
1170 Reefs	Maintain favourable conservation condition	21,421ha; The distribution and permanent habitat area is stable subject to natural processes. Constituent community types are conserved in a natural condition.
(Fucoid-dominated intertidal reef community complex)	Maintain favourable conservation condition	1294ha; Conserve in a natural condition
(Mixed subtidal reef community complex)	Maintain favourable conservation condition	74644ha; Conserve in a natural condition
(Faunal turf-dominated subtidal reef community)	Maintain favourable conservation condition	9692ha; Conserve in a natural condition
(Anemone-dominated subtidal reef community)	Maintain favourable conservation condition	747ha; Conserve in a natural condition
(*Laminaria*-dominated community complex)	Maintain favourable conservation condition	2224ha; Conserve in a natural condition
1220 Perennial vegetation of stony banks	Maintain favourable conservation condition	Area unknown; The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	Maintain favourable conservation condition	>67.3km; The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.

Feature (Community Type)	Objective	Target
1310 *Salicornia* and other annuals colonizing mud and sand	Maintain favourable conservation condition	0.223ha; Further unsurveyed areas may be present within the site. The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Maintain favourable conservation condition	495.43ha; Further unsurveyed areas may be present within the site. The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
1410 Mediterranean salt meadows (*Juncetalia maritimi*)	Maintain favourable conservation condition	Area unknown: The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Maintain favourable conservation condition	Area unknown: The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species. Note: The freshwater pearl mussel (1029) conservation objective takes precedence over this objective for habitat 3260 in the Cloon River within this SAC, because the mussel requires environmental conditions closer to natural background levels
6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	Maintain favourable conservation condition	Area unknown: The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.

Feature (Community Type)	Objective	Target
91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)*	Maintain favourable conservation condition	>8.5ha: The habitat area is stable or increasing, subject to natural processes. Targets are identified that focus on a wide range of attributes with the ultimate goal of maintaining function and diversity of favourable species and managing levels of negative species.
1029 Freshwater Pearl Mussel *Margaritifera margaritifera*	**Restore to favorable conservation condition**	Maintain species distribution (7km) within the Cloon River; Population size: Restore adult population >10000; Population structure(Recruitment): Restore 'young mussels' (<65mm) to >20%; Restore 'juvenile mussels' (<30mm) to >5% of population; Population structure (Adult mortality): ≤5% decline in live adults counted; ≤1% dead shells of the adult population and scattered in distribution. Habitat extent: Restore suitable habitat in more than 3.3km, and any additional stretches necessary for salmonid spawning. Restore water quality, substratum quality and appropriate hydrological regimes; Maintain sufficient juvenile salmonids to host glochidial larvae.
1095 Sea Lamprey *Petromyzon marinus*	**Restore to favorable conservation condition**	Increase extent (>75%) of river accessible from estuary to allow upstream migration; remove restrictions (artificial barriers) to allow access to spawning areas. Population structure of juveniles to have at least 3 age/size groups present. Juvenile density in fine sediment at least 1/m². No decline in extent and distribution of spawning beds. More than 50% of sample juvenile habitat sites positive.
1096 Brook Lamprey *Lampetra planeri*	**Maintain favourable conservation condition**	Access to all water courses down to first order streams; remove restrictions (artificial barriers) to allow access to allow up- and downstream migration. Population structure of juveniles to have at least 3 age/size groups present. Juvenile density in fine sediment at least 2/m². No decline in extent and distribution of spawning beds. More than 50% of sample juvenile habitat sites positive.
1099 River Lamprey *Lampetra fluviatilis*	Maintain favourable conservation condition	Access to all water courses down to first order streams; remove restrictions (artificial barriers) to allow access to allow up- and downstream migration. Population structure of juveniles to have at least 3 age/size groups present.

Feature (Community Type)	Objective	Target
		Juvenile density in fine sediment at least 2/m². No decline in extent and distribution of spawning beds. More than 50% of sample juvenile habitat sites positive.
1106 Atlantic *Salmon Salmo salar* (only in fresh water)	**Restore favourable conservation condition**	Increase extent (100%) of river channels down to second order accessible from estuary. Conservation Limit (CL) of number of adult fish spawning for each system consistently exceeded. Maintain or exceed current mean catchment-wide Salmon 0+ fry abundance threshold value (Currently set at 17 salmon fry/5 min sampling). No significant decline in out-migrating smolt abundance. No decline in number and distribution of spawning redds due to anthropogenic causes Water quality at least Q4 at all sites sampled by EPA.
1349 Bottlenose Dolphin *Tursiops truncatus*	Maintain favourable conservation condition	Species range within the site should not be restricted by artificial barriers to site use; Critical areas, representing habitat used preferentially by bottlenose dolphins, should be conserved in a natural condition; Human activities should occur at levels that do not adversely affect the bottlenose dolphin populations
1355 **Otter *Lutra lutra***	**Restore favourable conservation condition**	No significant decline in distribution. No significant decline in extent of terrestrial habitat (596.8ha), marine habitat (4461.6ha), river habitat (500.1km), lake/lagoon habitat (125.6ha) 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.

Figure 4: Natura 2000 sites adjacent to Lower River Shannon SAC (Site Code 002165) (NPWS 2012a).

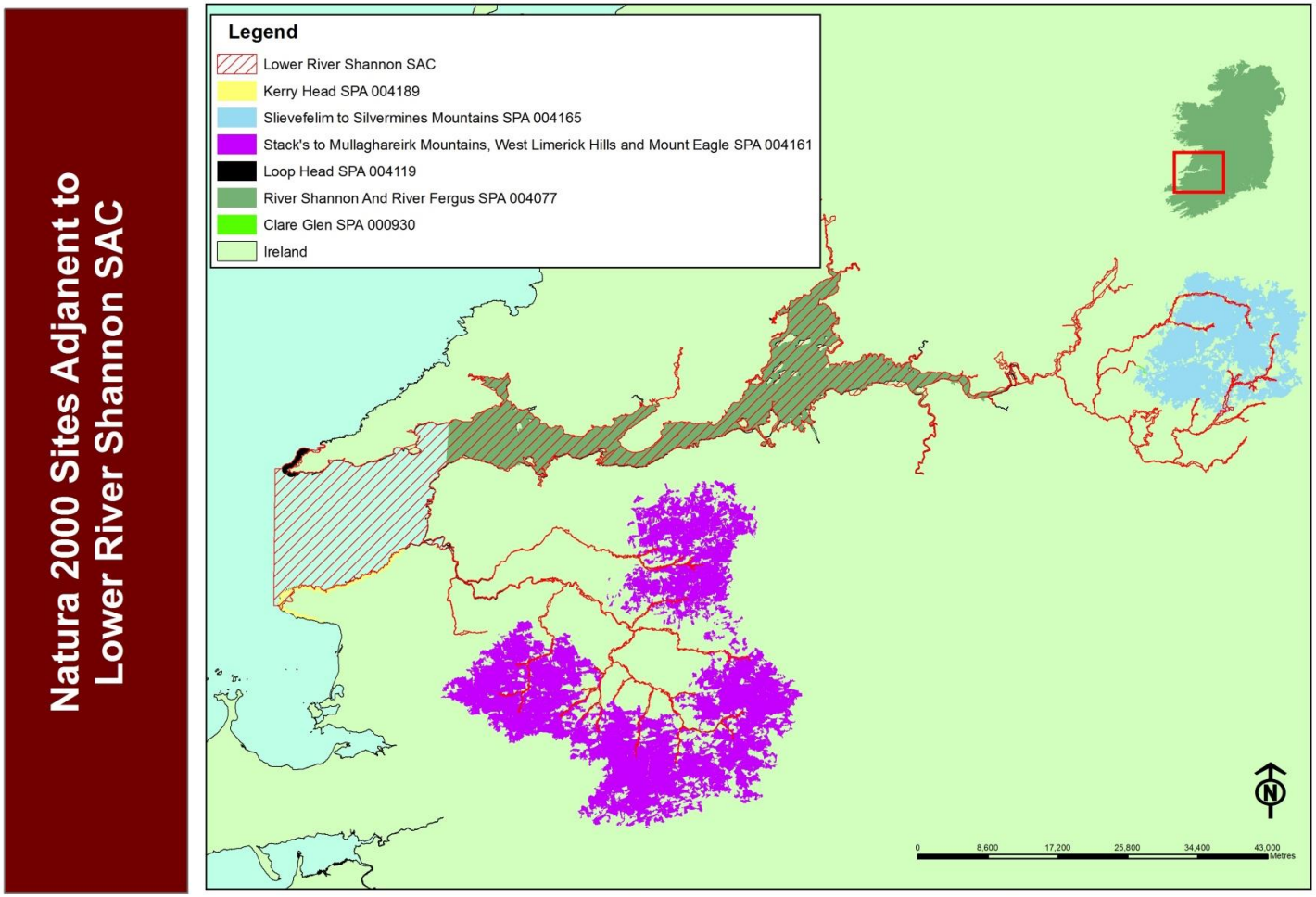


Table 2: Natura Sites adjacent to Lower River Shannon SAC and qualifying features with initial screening assessment on likely interactions with aquaculture activities.

NATURA SITE	QUALIFYING FEATURES [HABITAT CODE]	AQUACULTURE INITIAL SCREENING
River Shannon and River Fergus Estuaries SPA (004077)	Cormorant (*Phalacrocorax carbo*) [A017]	Subject to separate Assessment report
	Whooper Swan (*Cygnus cygnus*) [A038]	
	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	
	Shelduck (*Tadorna tadorna*) [A048]	
	Wigeon (*Anas penelope*) [A050]	
	Teal (*Anas crecca*) [A052]	
	Pintail (*Anas acuta*) [A054]	
	Shoveler (*Anas clypeata*) [A056]	
	Scaup (*Aythya marila*) [A062]	
	Ringed Plover (*Charadrius hiaticula*) [A137]	
	Grey Plover (*Pluvialis squatarola*) [A141]	
	Lapwing (*Vanellus vanellus*) [A142]	
	Knot (*Calidris canutus*) [A143]	
	Dunlin (*Calidris alpina*) [A149]	
	Black-tailed Godwit (*Limosa limosa*) [A156]	
	Bar-tailed Godwit (*Limosa lapponica*) [A157]	
	Curlew (*Numenius arquata*) [A160]	
	Redshank (Tringa totanus) [A162]	
	Greenshank (Tringa nebularia) [A164]	
	Black-headed Gull (Chroicocephalus ridibundus) [A179]	
	Wetland and Waterbirds [A999]	

Table 2 cont'd**: Natura Sites adjacent to Lower River Shannon SAC and qualifying features with initial screening assessment on likely interactions with aquaculture activities.**

NATURA SITE	QUALIFYING FEATURES [HABITAT CODE]	AQUACULTURE INITIAL SCREENING
Loop Head SPA (004119)	Kittiwake (*Rissa tridactyla*) [A188] Guillemot (*Uria aalge*) [A199]	No spatial overlap or likely interaction with activities within Lower Shannon SAC– excluded from further analysis
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)	Hen Harrier (*Circus cyaneus*) [A082]	No spatial overlap or likely interaction with activities within Lower Shannon SAC– excluded from further analysis
Slievefelim to Silvermines Mountains SPA (004165)	Hen Harrier (*Circus cyaneus*) [A082]	No spatial overlap or likely interaction with activities within Lower Shannon SAC– excluded from further analysis
Kerry Head SPA (004189)	Fulmar (*Fulmarus glacialis*) [A009] Chough (*Pyrrhocorax pyrrhocorax*) [A346]	No spatial overlap or likely interaction with activities within Lower Shannon SAC– excluded from further analysis
Clare Glen SAC (00930)	Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] *Trichomanes speciosum* (Killarney Fern) [1421]	No spatial overlap or likely interaction with activities within Lower Shannon SAC– excluded from further analysis

5 Details of the proposed plans and projects

5.1 Aquaculture

Aquaculture in the Lower River Shannon SAC focuses primarily on shellfish species (mussels, oysters) (Figure 5). Oysters are the predominant shellfish species cultured within the SAC, mussels are produced at a lower scale; while Scallops, although licensed, are not currently produced in the area. Descriptions of spatial extents of existing and proposed activities within the qualifying interests of the Lower River Shannon SAC were calculated using coordinates of activity areas in a GIS. The spatial extent of the various aquaculture activities (current and proposed) overlapping the habitat features is presented in Table 3 (data provided by DAFM).

5.1.1 Oyster Culture

There are five locations currently in operation for oyster culture within the SAC, located in Rinneville, Carrigaholt, Ballylongford, Askeaton/Foynes, Poulnasherry Bays.

There is currently one licensed oyster producer in Rinneville Bay, the cultivation method employed is bag and trestle. A small number of native (*Ostrea edulis*) and pacific (*Crassostrea gigas*) (diploid) oysters (Approx 10,000 oysters) are onsite. Native and pacific oyster spat is collected on site using plates and shell during spring and autumn. The producer is planning to invest in Seasalter seed with projected tonnage of up to 20 tonnes annual production within 4 years.

There are three licensed sites, and one application, within Carrigaholt Bay for the cultivation of oysters. These involve intertidal bag & trestle cultivation and subtidal bottom culture. Three stages of oyster growth are planned in the Bay. Land based nursery will take in oysters seed (size 3-6m) from Tralee Bay Hatchery. Upon reaching G5 size the oyster will be transferred out to the bag and trestles oyster site and on-grown to 10gr. The stock will then be transferred subtidally to oyster sites for bottom culture. All seed sourced from Tralee Bay Hatchery is currently 100% diploid. The grow out time frame for oysters in the bay from input onto sites to market size is 24+ months.

In Ballylongford Bay two methods of intertidal oyster cultivation are employed bag & trestles and oyster longlines. Triploid oyster seed is sourced from French hatcheries and arrives on site in September. Bag & trestle method involves initial stocking densities of 2000 seed/bag (4ml mesh). The following June density will be reduced to 500/bag (6ml mesh). The seed will be approx 30ml depending on growth conditions. Six months later (approx. Nov/Dec) stocking density reduced again to 140/bag in either 9 or 14ml bags. In general, first top grade will be 2 years from input onto the site with the bottom grade taking up to 3 years to reach market size. Oyster Long lines involves a line made from steel rope placed intertidally on the shore. The rope is kept upright with two strainer posts at each end, with upright posts in between along the line length (approx. 120m). 4/5 baskets are located between each upright, basket size is approximately 2ft x 3ft depth and will hang approx. 1.5ft off the seabed. Long lines can be used for seed and ongrowing.

In Askeaton/Foynes area *C gigas* oysters are cultivated intertidally using bag and trestle method. Seed is sourced from Seasalter. Seed (G6/G7) is placed at a stocking density of 2500/bag, and after 6 months this is split down to 1000/bag. The oysters are then finished by bottom culture in Atlantic shellfish's Order area. Stock on site is 80% diploid, 20% triploid. Future plans also include growing oysters (*C. gigas*) on the seabed.

Oysters are the only species produced in Poulnasherry Bay. Cultivation is by bag and trestle method, stock is sourced (G6/G7) from Seasalter or Guernsey hatcheries. Stock is predominantly diploid with on average 80% diploid and 20% triploid. Initial stocking density is 2000/bag (4ml). Many producers then split down to approx. 900/bag after 6/8 weeks. During the autumn seed numbers are reduced to 500/bag. The final number of oyster in bags for finishing tends to be in the range 140-160/bag. Producers use 4ml, 6ml, 9ml and 14 ml bags in the production cycle. The production cycle is approx. 30 months to have 70% of all seed inputed is sent to market.

5.1.2 Fishery Order Areas

T8/004A: Currently one producer working the order area and approx. 34ha utilised for the relaying of seed and half grown oysters which are then harvested once they reach commercial size.
T8/004B: One producer has leased the entire western order area. The planned usage is for different methods of oyster cultivation in various places dependant on the suitability of the areas within the order areas. Planned usage in the area will be a combination of different methods as appropriate and as methods are developed, i.e. Rafts, Longlines, Floating Flupsys, Bottom Culture, Bags & Trestles and Tidal and Sub-tidal Frames.
T8/08OFO: 25% of the Order area is under cultivation of oysters by bag & trestle.

5.1.3 Mussels

In the Lower River Shannon SAC mussels are produced using bottom cultivation and suspended long-line mussel farming. Cromane Seafoods has a bottom mussel licence in Ballylongford. The site has not been extensively utilised over the years but the company has plans to further utilise the site in coming years. The site is used for bottom culture of mussels. The seed is transplanted by pumping it, mixed with seawater, from the hold of the boat onto the site. The vessels are fitted with a pumping system. This pattern of relaying is achieved by the vessels moving across the site during pumping in an effort to achieve an even distribution of mussel on the site in order to maximise survival and growth. The dredge uses 2--4 single dredges while harvesting. The type of dredge used are 2m mussel dredges with a flat bar that is designed to skim the surface of the substrate and separate mussel seed from the underlying sediment of the substrate and remove the mussel seed.

Within this bay there is an application for two sites for mussel longlines. These sites will be used as collector sites for mussel seed). These longlines will be in Ballylongford/Tarbert area of the Shannon. Production cycle is predicted at 2-3 years.

5.1.4 Access Routes

There is a combination of shore and marine access for the sites within the Lower River Shannon SAC (Figure 5).

The intertidal area is typically accessed during spring tides (at low tide) using tractors or loaders. Preparatory work is always conducted in the intervening periods, including grading and packing, preparation of bags and trestles and general maintenance work which includes shaking and turning of bags, rotating baskets and cages, and hand removal of fouling and seaweed to ensure maintenance of water flow through the bags when submerged. The access routes are identified in Figure 5.

Calculation of area of the access routes in the SAC is linear length (in metres) by a putative route width of 10m, which is considered a sufficiently precautionary estimate, gives a total spatial overlap of 12.7ha within the SAC.

The spatial overlap of access routes on Qualifying Interests is presented in Table 3 (while Tables 6-9 presents spatial overlap on constituent communities of Qualifying Interests of 1130, 1140, 1160 and 1170).

Figure 5: Aquaculture sites (Licenced and Applications) in Lower River Shannon SAC (Site Code 002165).

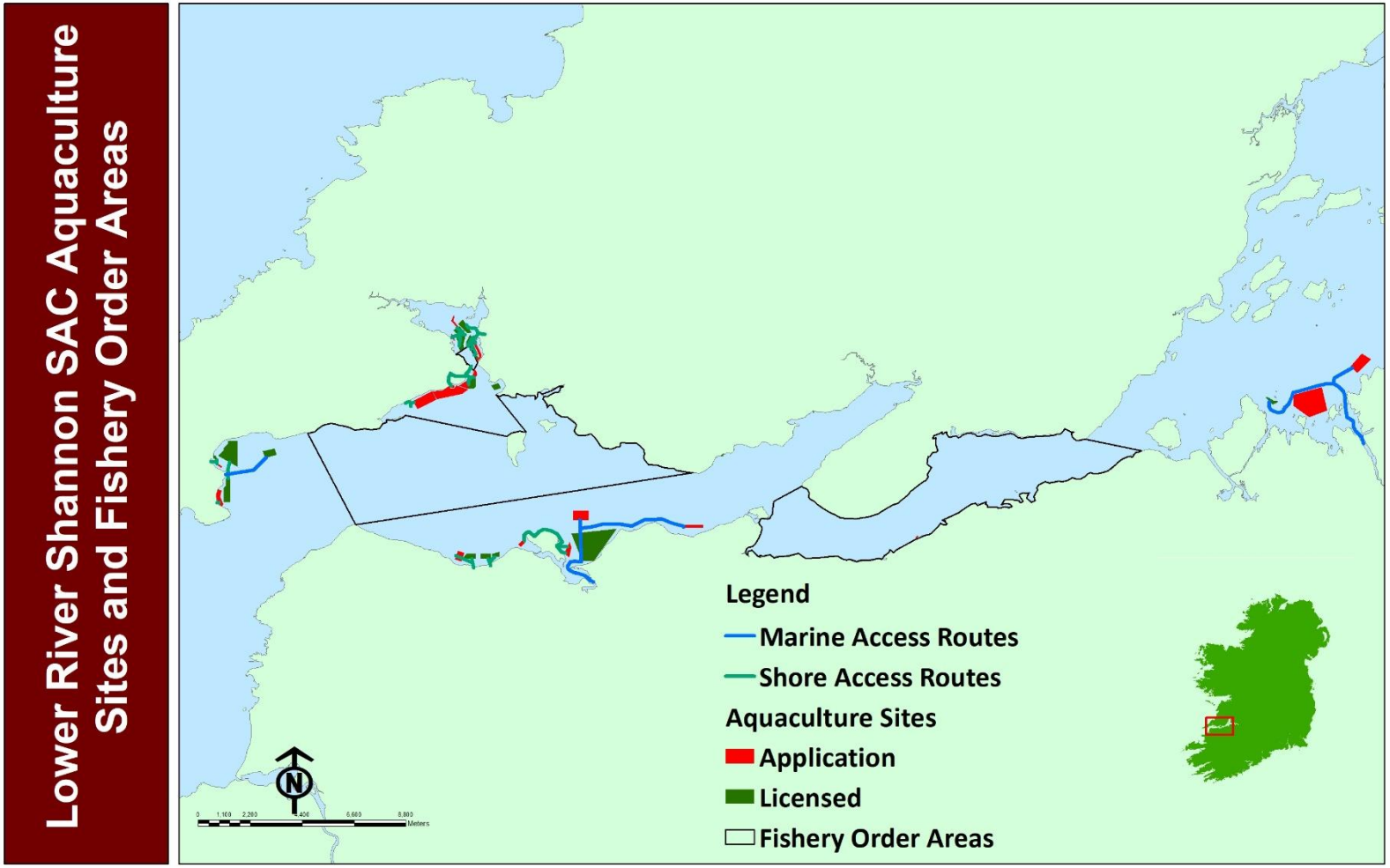


Table 3: Spatial extent (ha) of aquaculture activities and Fishery Order overlapping with qualifying interests and Critical Dolphin Habitat in Lower River Shannon SAC (Site Code 002165). **L = Licensed; A = Application; FO = Fishery Order.**

Species	Status	Location	1130 Estuaries (24,273ha)		1140 Mudflats and sandflats not covered by seawater at low tide (8,808ha)		1160 Large shallow inlets & bays (35,282ha)		1170 Reefs (21,421ha)		1349 Critical Dolphin Habitat	
			Area (ha)	% Feature	Area (ha)	% Feature	Area (ha)	% Feature	Area (ha)	% Feature	Area (ha)	% Feature
Oysters	L	Intertidal	6.23	0.03	41.91	0.48	102.4	0.29	3.00	0.01	5.58	0.04
Oysters	A	Intertidal	0	0	71.29	0.81	138.41	0.39	10.93	0.05	0	0
Oysters	L	Subtidal	0	0	0	0	98.86	0.28	9.60	0.05	14.32	0.10
Oysters	A	Subtidal	134.76	0.55	0	0	79.78	0.23	0	0	0	0
Mussels	L	Subtidal	151.47	0.62	0	0	0	0	3.03	0.014	14.36	0.10
Mussels	A	Subtidal	37.46	0.15	0	0	0	0	0	0	37.46	0.26
Access Routes			1.93	0.01	4.83	0.05	9.83	0.02	3.6	0.01	0	0
Total			331.85	1.31	118.02	1.34	347.51	0.97	30.16	0.13	71.72	0.5
Oysters	FO	Subtidal	4151.70	17.11	199.38	2.27	3823.63	10.8	2020.83	9.44	2050.88	14.23
Total			4483.55	18.42	317.4	3.61	4171.14	11.77	2050.99	9.57	2122.6	14.73

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 fishing gears or aquaculture structures and human activities on designated species, intertidal and sub-tidal habitats, invertebrate communities and biotopes within those broad habitat types. The overall effect on the conservation status will depend on the spatial and temporal extent of fishing and aquaculture activities during the lifetime of the proposed plans and projects and the nature of each of these activities in conjunction with the sensitivity of the receiving environment.

6.1 Aquaculture

Within the qualifying interest of the Lower River Shannon SAC, the species cultured are:

- Mussels (*Mytilus edulis*) in suspended culture (subtidal longlines) and subtidally on the seafloor.
- Oysters (*Ostrea edulis*, *Crassostrea gigas*) in suspended culture (bags & trestles) and subtidally on the seafloor.

Details of the potential biological and physical effects of these aquaculture activities on the habitat features, their sources and the mechanism by which the impact may occur are summarised in Table 4, below**.** The impact summaries identified in the table are derived from published primary literature and review documents that have specifically focused upon the environmental interactions of mariculture (e.g. McKindsey *et al*. 2007; NRC 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 (Table 3). The degree of deposition and accumulation of biologically derived material on the seafloor is a function of a number of factors discussed below.

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

Furthermore, the culture of a non-native species (e.g. the Pacific Oyster - *Crassostrea gigas*) may also 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 (including the Shannon Estuary) and appears to have become naturalised (i.e. establishment of a breeding population) in two locations (Kochmann *et al* 2012; 2013; Zwerschke et al 2016; 2017). This phenomenon has been demonstrated to be exacerbated by the culture of oyster uncontained on the seabed (MagAoidh 2011).

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

Hydrography – will govern how quickly the wastes disperse from the culture location and the density at which they will accumulate on the seafloor.

Turbidity in the water - the higher the turbidity the greater the production of pseudo-faeces and faeces by the filter feeding animal and the greater the risk of accumulation on the seafloor.

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

- depth of the site (shallow sites have shorter droppers and hence fewer culture organisms
- the husbandry practices proper maintenance will result in optimum densities on the lines in order to give high growth rates as well as reducing the risk of drop-off of culture animals to the seafloor and sufficient distance among the longlines to reduce the risk of cumulative impacts in depositional areas.

In addition placement of structures associated with mussel culture can influence the degree of light penetration to the seabed. This is likely important for organisms and habitats e.g. Maërl and seagrasses which need sun light for production. Rafts or lines will to a degree limit light penetration to the sea bed and may therefore reduce production of photosynthesising species. However, such effects have not been demonstrated for seagrass.

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 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 may reduce water flow and allowing suspended material (silt, clay as well as faeces and pseudo-faeces) to fall out of suspension to the seafloor. The build-up of material will typically occur directly beneath the trestle structures and can result in accumulation of fine, organically rich sediments. These sediments may result in the development of infaunal communities distinct from the surrounding areas. Whether material accumulates is dictated by a number of factors, including:

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

Turbidity of water – 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.

Density of culture – the density of oysters in a bag and consequently the density of bags on a trestle will increase the likelihood of accumulation on the seafloor. In addition, if the trestles are located in close proximity a greater dampening effect can be realised with resultant accumulations. Close proximity may also result in impact on shellfish performance due to competitive interactions for food.

Exposure of sites - the degree to which the aquaculture sites are exposed to prevailing weather conditions will also dictate the level of accumulated organic material in the area. As fronts move through culture areas increased wave action will resuspend and disperse material away from the trestles.

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

Sub-tidal shellfish culture i.e. bottom culture of oysters/mussels: This activity involves relaying shellfish 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 result as a result of dredging during maintenance and harvesting. Uncontained sub-tidal shellfish culture will lead to change in community structure and function through the addition, at high % cover, of an epi-benthic species (living on the seabed) to an infaunal sedimentary community.

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

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.

Other considerations: The high density of the culture organisms in the bottom cultivation method can lead to exclusion of native biota and the ground preparation and harvest methods (by mechanical means or by hand) can lead to considerable disturbance of biota characterising the habitat.

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 to other species is unknown.

Ireland enjoys a high health status (Category 1) in relation to the fish/shellfish on farms, in rivers and lakes and remains free of many diseases that occur in other countries (www.fishhealth.ie). In Ireland, there are programmes in place that govern the movement of (fish and shellfish) stock for on-growing among sites. These movement controls are supported by a risk-based fish health surveillance programme which is operated on a nationwide basis by the Marine Institute, in co-operation with private veterinary practitioners. Council Directive 2006/88/EC on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals form the legislative basis that governs the monitoring and management of disease outbreaks in mariculture operations in Ireland. For diseases not listed in this Directive, a Code of Practice and Fish Health Handbook has been developed jointly by the State and industry with the primary objectives of disease prevention and control.

Table 4: Potential indicative environmental pressures of aquaculture activities within the qualifying interests (Annex I Habitats) of the Lower River Shannon SAC.

Activity	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
Aquaculture							
Suspended Culture **Subtidal** (Longlines)	**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
		Fouling	Increased secondary production on structures and culture species. Increased nekton production		365	All year	Culture/structure density
		Introduction of non-native species	Potential for non-native culture and 'hitchhiker' species become naturalized				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.				Culture density
	Physical	Current alteration	Baffling effect resulting in a slowing of currents and increasing deposition onto seabed changing sedimentary composition	Floats, longlines, continuous ropes (New Zealand system), and droppers	365	All year	Location (sheltered location for year round activity)
		Shading	Prevention of light penetration to seabed potentially impacting light sensitive species		365	All year	Culture/structure density
	Biological	Deposition	Faecal and pseudofaecal deposition on seabed		365	All year	Hydrography, Turbidity, Culture/structure density

Activity	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
Suspended Culture **Intertidal** (Bags & trestles)			potentially altering sediment and community composition				
		Seston filtration	Alteration of phyto/zooplankton communities and potential impact on carrying capacity		365	All year	Culture density, Turbidity
		Fouling	Increased secondary production on structures and culture species. Increased nekton production		365	All year	Culture/structure density
		Introduction of non-native species	Potential for non-native culture and 'hitchhiker' species become naturalized				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.				Culture density
	Physical	Current alteration	Structures may alter the current regime and resulting increased deposition of fines or scouring.	Trestles and bags, frames and service equipment	365	All year	At low tide only
		Surface disturbance	Ancillary activities at sites, e.g. servicing, transport increase the risk of sediment compaction resulting in sediment changes and associated community changes.	Site services, human & vehicular traffic	365	All year	At low tide only
		Shading	Structures prevent light penetration to the seabed and therefore potentially impact on light sensitive species.	Long lines, Bags, Trestles, Floats, bouchot poles etc	365	All year	Culture/structure density

Metier/ Activity	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
Subtidal culture Bottom Culture	**Biological**	Seston filtration	Alteration of phyto/zooplankton communities and potential impact on carrying capacity		365	All year	Culture density, Turbidity
		Monoculture	Habitat dominated by single species and transformation of infaunal dominated community to epifaunal dominated community.		365	All year	Culture density
		By-catch mortality	Mortality of organisms captured or disturbed during the harvest or process, damage to structural fauna of reefs				
		Introduction of non-native species	Potential for non-native culture and 'hitchhiker' species become naturalized				Screening/ Culture method/ Introduce biosecurity plan/seed from low-risk sources
		Disease risk	In event of epizootic the ability to manage disease in uncontained subtidal shellfish populations would likely be compromised. The risk introduction of disease causing organisms by introducing seed originating from the 'wild' in other jurisdictions				Screening/ Introduce biosecurity plan
		Nutrient exchange	Increased primary production. N_2 removal at harvest or denitrification at sediment surface				Culture density
	Physical	Surface disturbance	Abrasion at the sediment surface and redistribution of sediment	Dredge		Seasonal	Weather for site access. Size of shellfish and market constraints
		Shallow disturbance	Sub-surface disturbance to 25mm				

Aquaculture and marine mammal interactions

Potential interactions between shellfish culture and marine mammals are broadly summarized in Table 5. Potential impacts on marine mammals as a result of aquaculture interaction include death or injury through entanglement in gear, displacement, altered food chain, disruption of migration pathways (for large cetaceans), and human intervention (marine mammals killed or relocated) (Watson-Capps and Mann, 2005). 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). 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).

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 a recent report by NPWS (2009) the overall conservation assessment is "unfavourable - inadequate", reflecting the current unfavourable status of the otter population in the country and, in particular the decline in otter population seen during the 1980s. Notwithstanding the above, the risk posed to otter by proposed shellfish culture activity is considered low. Given the crepuscular nature of the otter, likely interactions (and disturbance) with operators are considered low. Furthermore shellfish culture (intertidal and suspended) are not considered a threat to otters. In the threat response plan NPWS (2009) "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.

Bottlenose Dolphin (*Tursiops truncatus*)

There is very little literature describing the likely interactions between aquaculture practices and dolphin behaviour and distribution. Some studies relating to interactions with finfish aquaculture have demonstrated modified behaviour of small cetaceans (i.e. dolphins) in the vicinity of fishfarms during harvesting operations (Diaz-Lopez 2012). Displacement of bottlenose dolphin has been observed at suspended shellfish culture sites (pearl oyster) (Watson-Capps and Mann 2005); however, it is unclear if the displacement was a function of the structures or disturbance resulting from activities at the sites? It is likely that interactions will occur at suspended culture sites (e.g., longlines) and less so at intertidal sites which are, even when inundated, found in quite shallow waters.

Table 5: Potential interactions between aquaculture activities and the qualifying interests (Annex II species) within the Lower River Shannon SAC.

Culture Method	Pressure category	Pressure	Potential effects	Equipment	Duration (days)	Time of year	Factors constraining the activity
All Aquaculture Methods	**Physical**	Habitat Exclusion	Structures may result in a barrier to movement and displacement .	Bags & trestles, longlines	365	All year	Spatial extent and location of structures used for culture.
		Disturbance	Ancillary activities at sites increase the risk of disturbance to marine mammals and other Annex Species	Site services, human, boat and vehicular traffic	365	All year	Seasonal levels of activity relating to seeding, grading, and harvesting. Peak activities do not coincide with more sensitive periods for marine mammals and other Annex Species
		Entanglement	Entanglement by ropes or material used on structures or during operation of farms	Ropes and/or nets used in day to day	365	All year	Farm management practices
		Ingestion	Injury or even mortality due to Ingestion of waste material used on farms	Ties used to secure bags and secure bags to trestle, floats, ropes etc.	365	All year	Farm management practices
		Deterrent Methods	Mammals interfering with cages will result in deterrent actions, e.g. use of Acoustic deterrent or harassment Devices. If all non lethal avenues fail then lethal methods may be employed (under licence).	ADDs and lethal devices (shooting)	365	All year	Fallow periods no fish on-site

7 Screening of Aquaculture Activities

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

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

7.1 Aquaculture Activity Screening

Where the spatial overlap between an aquaculture activity and a habitat feature is zero it is screened out and not considered further unless some other likely interaction is proposed. The Annex I habitats of Sandbanks which are slightly covered by sea water all the time (1110) and Coastal Lagoons (1150) have no spatial overlap with (existing and proposed) aquaculture activities are excluded from further consideration in this assessment.

Table 3 highlights the spatial overlap between (existing and proposed) aquaculture activities and the qualifying interests for habitats (i.e. Estuaries (1130), Mudflats and sandflats not covered by seawater at low tide (1140), Large shallow inlets and bays (1160) and Reefs (1170)) and the Critical Dolphin Habitat.

Tables 6, 7, 8, 9 provide an overview of overlap (ha, %) of aquaculture activities and specific community types within the broad habitat features 1130, 1140 1160 and 1170 (identified from Conservation Objectives, NPWS, 2012a).

Where the overlap between an aquaculture activity and a qualifying feature is zero it is screened out and not considered further in the assessment unless some other likely interaction is proposed. None of the aquaculture activities (existing or proposed) overlaps or likely interacts with the following qualifying features (habitats and species), and therefore these ten habitats and four taxa are excluded from further consideration in this assessment:

- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera*
- 1096 Brook Lamprey *Lampetra planeri*

- 1099 River Lamprey *Lampetra fluviatilis*
- 1110 Sandbanks which are slightly covered by sea water all the time
- 1150 Coastal lagoons
- 1220 Perennial vegetation of stony banks
- 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
- 1310 *Salicornia* and other annuals colonizing mud and sand
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
- 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

The Atlantic Salmon (*Salmo salar*) migrates through the Lower River Shannon SAC Given the nature of the activities proposed for aquaculture in the Lower River Shannon, it is unlikely that existing aquaculture activities or those proposed 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 by the proposed activity)
- Water quality (freshwater)

On this basis Atlantic Salmon *Salmo salar* (1106) is excluded from further analysis.

The Sea lamprey (*Petromyzon marinus*) migrates through the Lower River Shannon SAC into the Fergus, Feale and Mulkear Rivers. The aquaculture activities do not present a barrier to migration of this species, given that any structures used (trestles/longlines etc) will allow the lamprey to swim among and through such structures. It is unlikely that they will impact upon other attributes and their targets for the Sea lamprey, which are primarily freshwater in nature. The attributes are:

- Extent of anadromy
- Population structure (of juveniles for Sea lamprey only)
- Juvenile density in fine sediments (Sea lamprey only)
- Extent and distribution of spawning habitat
- Availability of juvenile habitat (Sea lamprey only)

On this basis, the Sea Lamprey *Petromyzon marinus* (1095) has been excluded from further analysis.

As the aquaculture production activities within the SAC spatially overlap with otter (*Lutra lutra*, 1355) territory, the otter has not been excluded from further analysis.

There is spatial overlap between intensive (Longlines) and extensive (bottom culture) mussel farming and the critical habitat of the Annex II species bottlenose dolphin (*Tursiops truncatus,* 1349). These critical areas (Figure 3) represent high value habitats used preferentially by the species within its overall range at the site and they coincide with areas of steep benthic slope, greater depth and greater currents. It is probable that intensive (Longlines) mussel farming and extensive (bottom culture) may impact upon the following conservation objective and targets for the species:

Objective 1 - To maintain the favourable conservation condition of bottlenose dolphin in Lower River Shannon SAC which is defined by the following targets

- Target 1 - Species range within the site should not be restricted by artificial barriers to site use
- Target 2 - Critical Areas, representing habitat used preferentially by bottlenose dolphin, should be maintained in a natural condition.

On this basis, the Bottlenose Dolphin *Tursiops truncatus* (1349) has not been excluded from further analysis.

Furthermore, of the 10 community types (see Table 1) listed under the qualifying habitat interests of the SAC, six have spatial overlap with aquaculture activities:

- Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community
- Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex
- Subtidal sand to mixed sediment with *Nucula nucleus* community complex
- Subtidal sand to mixed sediment with *Nephtys* spp. community complex
- Fucoid-dominated intertidal reef community complex
- Anemone-dominated subtidal reef community

On this basis, the following community types have no spatial overlap between them and any aquaculture activities and are excluded from further analysis of aquaculture interactions:

- Estuarine subtidal muddy sand to mixed sediment with gammarids community complex
- Mixed subtidal reef community complex

When overlap was observed it was estimated in a GIS application and calculated on the basis of coverage of specific activity (representing different pressure types), licence status (licenced or application) intersecting with designated conservation features and/or sub-features (community types) and presented in Tables 6,7,8 and 9.

Table 6: Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activity and Fishery Order over community types within the qualifying interest 1130 - Estuaries

(Spatial data based on licence database provided by DAFM. Habitat & community data provided in NPWS 2012a, 2012b).

				1130 Estuaries						
Culture Type	Location	Method	Status	Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex (8130ha)	Estuarine subtidal muddy sand to mixed sediment with gammarids community complex (268 ha)	Subtidal sand to mixed sediment with *Nucula nucleus* community complex (4196 ha)	Subtidal sand to mixed sediment with *Nephtys* spp. community complex (8404 ha)	Fucoid-dominated intertidal reef community complex (678 ha)	Faunal turf-dominated subtidal reef community (981 ha)	Anemone-dominated subtidal reef community (713 ha)
Oysters	Intertidal	I	L	4.67 (0.06)	0	0	0.91 (0.01)		0	0
Oysters	Intertidal	I	A	0	0	0	0.08 (9.16E-04)	0.57 (0.08)	0	0
Mussels	Subtidal	I	A	0	0	37.46 (0.89)	0	0	0	0
Oysters	Subtidal	E	L	0	0	0	0	0	0	0
Oysters	Subtidal	E	A	49.69 (0.61)	0	0.39 (0.01)	82.30 (0.98)	2.38 (0.35)	0	0
Mussels	Subtidal	E	L	0	0	119.43 (2.85)	28.99 (0.35)	3.04 (0.45)	0	0
Access Routes				0.3 (0.004)	0	0	0.76 (0.01)	0.87 (0.13)	0	0
Fishery Order	Subtidal			178.53 (2.20)	0	2691 (64.16)	362.82 (4.32)	193.70 (28.57)	169.11 (17.24)	553.74 (77.65)

Table 7: Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activity and Fishery Order over community types within the qualifying interest 1140 - Mudflats and sandflats not covered by seawater at low tide.

(Spatial data based on licence database provided by DAFM. Habitat & community data provided in NPWS 2012a, 2012b).

				1140 Mudflats and sandflats not covered by seawater at low tide	
Culture Type	Location	Method	Status	Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. Community (213 ha)	Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex (8596 ha)
Oysters	Intertidal	I	L	0	13.80 (0.16)
Oysters	Intertidal	I	A	6.44 (3.03)	36.26 (0.42)
Mussels	Subtidal	I	A	0	0
Oysters	Subtidal	E	L	0	0
Oysters	Subtidal	E	A	0.21 (0.10)	59.48 (0.69)
Mussels	Subtidal	E	L	0	0
Access Routes				0.03 (0.01)	4.54 (0.053)
Fishery Order	Subtidal			0.41 (0.19)	198.97 (2.32)

Table 8: Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activity and Fishery Order over community types within the qualifying interest 1160 - Large shallow inlets and bays. (Spatial data based on licence database provided by DAFM. Habitat & community data provided in NPWS 2012a, 2012b).

				1160 Large shallow inlets and bays								
Culture Type	Location	Method	Status	Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. Community (211 ha)	Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex (466 ha)	Subtidal sand to mixed sediment with *Nucula nucleus* community complex (6095 ha)	Subtidal sand to mixed sediment with *Nephtys* spp. community complex (9431 ha)	Fucoid-dominated intertidal reef community complex (616 ha)	Mixed subtidal reef community complex (7464 ha)	Faunal turf-dominated subtidal reef community (8710 ha)	Anemone dominated subtidal reef community (34 ha)	*Laminaria*-dominated community complex (2221 ha)
Oysters	Intertidal	I	L	0	9.12 (1.96)	4.95 (0.08)	7.62 (0.08)	2.27 (0.37)	0	0	0	0
Oysters	Intertidal	I	A	6.44 (3.05)	34.61 (7.44)	109.97 (1.8)	9.71 (0.1)	8.98 (1.46)	0	0	0	0
Mussels	Subtidal	I	A	0	0	0	0	0	0	0	0	0
Oysters	Subtidal	E	L	0	0	0	72.86 (0.77)	0	0	0	9.60 (28.40)	0
Oysters	Subtidal	E	A	0.21 (0.10)	9.80 (2.10)	49.96 (0.82)	0.01 (1.33E-04)	0.16 (0.03)	0	0	0	0
Mussels	Subtidal	E	L	0	0	0	0	0	0	0	0	0
Access Routes				0.03 (0.001)	4.24 (0.91)	1.78 (0.03)	0.76 (0.0001)	2.76 (0.45)	0	0	0	0
Fishery Order	Subtidal/ Intertidal			0.41 (<0.001)	20.45 (0.04)	2701.07 (44.3)	0	95.65 (15.5)	0	916.27 (10.5)	8.50 (25)	81.13 (3.70)

Table 9: Habitat utilisation i.e. spatial overlap in hectares and percentage (given in parentheses) of aquaculture activity and Fishery Order over community types within the qualifying interest 1170 - Reefs.

(Spatial data based on licence database provided by DAFM. Habitat & community data provided in NPWS 2012a, 2012b).

				1170 Reefs				
Culture Type	Location	Method	Status	Fucoid-dominated intertidal reef community complex (1294 ha)	Mixed subtidal reef community complex (7464 ha)	Faunal turf-dominated subtidal reef community (9692 ha)	Anemone dominated subtidal reef community (747 ha)	*Laminaria*-dominated community complex (2224 ha)
Oysters	Intertidal	I	L	2.27 (0.18)	0	0	0	0
Oysters	Intertidal	I	A	9.55 (0.73)	0	0	0	0
Mussels	Subtidal	I	A	0	0	0	0	0
Oysters	Subtidal	E	L	0	0	0	9.60 (1.29)	0
Oysters	Subtidal	E	A	2.54 (0.20)	0	0	0	0
Mussels	Subtidal	E	L	3.04 (0.24)	0	0	0	0
Access Routes				3.6 (0.20)	0	0	0	0
Fishery Order	Subtidal			289.34 (22.36)	0	1085.42 (11.20)	562.24 (75.27)	83.83 (3.77)

8 Assessment of Aquaculture Activities

8.1 Determining significance

The significance of the possible effects of the proposed activities on habitats, as outlined in the Natura Impact Statement (Section 6) and subsequent screening exercise (Section 7), is determined here in the assessment. The significance of effects is determined on the basis of Conservation Objective guidance for constituent habitats and species (Figures 1, 2 and NPWS 2012a, 2012b).

Habitats and species that are key contributors to biodiversity and which are sensitive to disturbance should be afforded a high degree of protection i.e. thresholds for impact on these habitats is low and any significant anthropogenic disturbance should be avoided. Within the Lower River Shannon SAC the qualifying habitats/species considered subject to potential disturbance and therefore, carried further in this assessment are:

- 1130 Estuaries
- 1140 Mudflats and sandflats not covered by sea water all the time
- 1160 Large shallow inlets and bays
- 1170 Reefs
- 1349 Bottlenose Dolphin *Tursiops truncatus*
- 1355 Otter *Lutra lutra*

For broad habitats and sedimentary communities (Figures 1 and 2) significance of impact is determined in relation to, first and foremost, spatial overlap (see Section 7; Figure 6). 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 2012b) for constituent communities. The likelihood of change depends on the sensitivity of the characterising species to the activities in question. Sensitivity results from a combination of intolerance to the activity and/or recoverability from the effects of the activity (see Section 8.2 below).

2. The persistence of the disturbance in relation to the intolerance of the community. If the activities are persistent (high frequency, high intensity) and the receiving community has a high intolerance to the activity (i.e. the characterising species of the communities are sensitive and consequently impacted) then such communities could be said to be persistently disturbed.

3. The area of communities or proportion of populations disturbed. In the case of community disturbance (continuous or ongoing) of more than 15% of the community area it is deemed to be significant. This threshold does not apply to sensitive habitats (e.g. *Zostera*, Maerl) where any physical disturbance should generally be avoided.

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

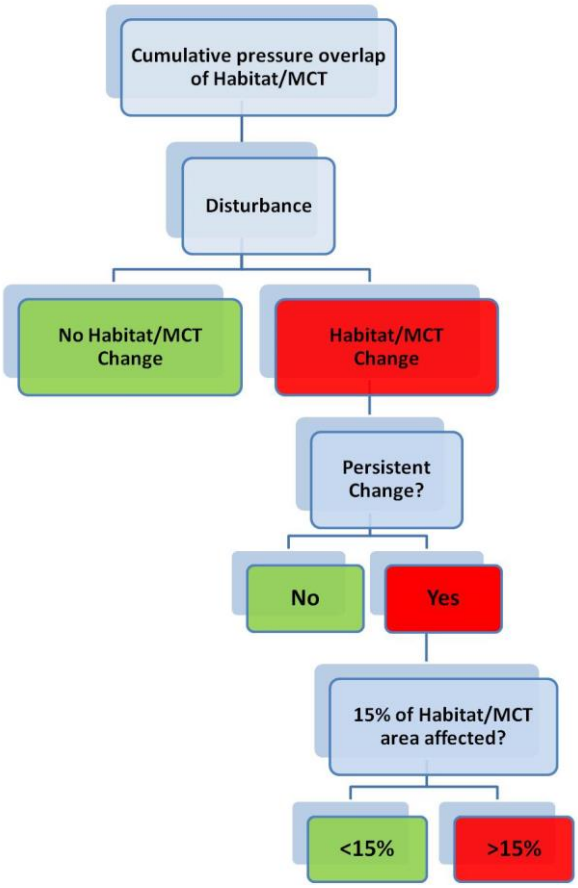


Figure 6: Schematic outlining the determination of significant effects on habitats and marine community types (MCT) (following NPWS 2012b).

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

8.2 Sensitivity and Assessment Rationale

This assessment used a number of sources of information in assessing the sensitivity of the characterising species of each community recorded within the benthic habitats of the Lower River Shannon 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 fishery activities (ABPMer 2013a-h). These reviews draw from the broader literature, including the MarLIN Sensitivity Assessment (Marlin.ac.uk) and the AMBI Sensitivity Scale (Borja *et al*., 2000) and other primary literature. Sensitivity of a species to a given pressure is the product of the intolerance (the susceptibility of the species to damage, or death, from an external factor) of the species

to the particular pressure and the time taken for its subsequent recovery (recoverability is the ability to return to a state close to that which existed before the activity or event caused change). Life history and biological traits are important determinants of sensitivity of species to pressures from aquaculture.

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

- For persistent pressures i.e. activities that occur frequently and throughout the year recovery capacity may be of little relevance except for species/habitats that may have extremely rapid (days/weeks) recovery capacity or whose populations can reproduce and recruit in balance with population damage caused by aquaculture. In all but these cases and if sensitivity is moderate or high then the species/habitats may be negatively affected and will exist in a modified state. Such interactions between aquaculture and species/habitat/community represent persistent disturbance. They become significantly disturbing if more than 15% of the community is thus exposed (NPWS 2012a).
- 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 Lower River Shannon SAC to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are listed, where available, in Table 10. The sensitivities of species which are characteristic (as listed in the Conservation Objective supporting document) of benthic communities to pressures similar to those caused by aquaculture (e.g. smothering, organic enrichment and physical disturbance) are listed, where available, in Table 11. The following guidelines broadly underpin the analysis and conclusions of the species and habitat sensitivity assessment:

- Sensitivity of certain taxonomic groups such as emergent sessile epifauna to physical pressures is expected to be generally high or moderate because of their form and structure (Roberts *et al.* 2010). Also high for those with large bodies and with fragile shells/structures, but low for those with smaller body size. Body size (Bergman and van Santbrink 2000) and fragility are regarded as indicative of a high intolerance to physical abrasion caused by fishing gears (i.e. dredges). However, even species with a high intolerance may not be sensitive to the disturbance if their recovery is rapid once the pressure has ceased.
- Sensitivity of certain taxonomic groups to increased sedimentation is expected to be low for species which live within the sediment, deposit and suspension feeders; and high for those sensitive to clogging of respiratory or feeding apparatus by silt or fine material.

Table 10: Matrix showing the characterising community types sensitivity scores x pressure categories for habitats in Lower River Shannon SAC (ABPMer 2013a-h).

Pressure Type	Physical Damage								Change in Habitat Quality									Biological Pressures				Chemical Pollution				Physical
Community Type (EUNIS code)	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/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	Ecosystem Services-Loss of biomass	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching [illegible]
Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community (A2.22)* Scores A2.23)	NS (*)	L (*)	L (*)	NS (*)	L-NS (*)	L-M (*)	L-M (*)	L-M (*)	L-M (*)	M (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	L-NS (*)	L-NS (*)	NS (***)	NS (*)	NS (*)	NA	NS (*)	NS (*)	L (*)	NS (*)
Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex (A2.41)* Scores A2.42	NS (*)	L (*)	L (*)	NS (*)	L (*)	L-M (*)	L-M (*)	L-M (*)	NS (*)	NS (*)	L-M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	L (*)	L (*)	H (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	L (*)	NS (*)
Subtidal sand to mixed sediment with *Nucula nucleus* community complex (A5.4)	H (*)	M (*)	M (*)	NE	NE	N-L (*)	L-M (*)	L-M (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	M (*)	M (*)	L (*)	H (*)	H (*)	NA	H (*)	H (*)	M (*)	H (*)

Pressure Type	Physical Damage								Change in Habitat Quality									Biological Pressures				Chemical Pollution				Physical
Community Type (EUNIS code)	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/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	Ecosystem Services-Loss of biomass	Introduction of antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching
Subtidal sand to mixed sediment with *Nephtys* spp. community complex (A5.4)	H (*)	M (*)	M (*)	NE	NE	N-L (*)	L-M (*)	L-M (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	H (*)	M (*)	M (*)	L (*)	H (*)	H (*)	NA	H (*)	H (*)	M (*)	H (*)
Fucoid-dominated intertidal reef community complex (A1.21)	NS (*)	NA	NA	NS (*)	NE	NA	L (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	NS (*)	NS (*)
Faunal turf-dominated subtidal reef community (A4.1/4.2)	NS (*)	NA	NA	NE	NE	NA	NS (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	NS (*)	NS (*)
Anemone-dominated subtidal reef community (A3.24/A3.3)*Scores A3.22	NS (*)	NA	NA	NE	NE	NA	NS (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	NS (*)	NS (*)
Laminaria-dominated community complex (A3.21)* Scores A3.22	NS (*)	NA	NA	NE	NE	NA	NS (*)	M-VH (*)	NA	NA	NS (*)	NS (*)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NA	NS (*)	NS (*)	NS (*)	NS (*)

Note: *No sensitivity listed for this community type using scores for similar habitat as listed.

Table 11: Matrix showing the characterising species sensitivity scores x pressure categories for species in Lower River Shannon SAC (ABPMer 2013a-h).

Pressure Type	Physical Damage								Change in Habitat Quality									Biological Pressures				Chemical Pollution			Physical Pressure
Species	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-	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	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 antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
A. digitatum/	L-M (***)	NE	NE	NE	NE	NE	L (**)	M (*)	NA	NA	L (*)	NS (*)	NS (*)	NEv	NE	NS (*)	NE	M(*)	NEv	NS (*)	NS (*)	NEv	NEv	NS (*)	NS (*)
Bathyporeia spp.	NS (*)	L (***)	L (***)	NS (*)	L (*)	L-M (*)	L (** *)	L-M (*)	L-M (*)	L-M (*)	NS (*)	NS (*)	NS (*)	L-M (*)	L-M (*)	NS (*)	L-M (***)	L-M (***)	L-M (*)	NS (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
C. celata	M (***)	NA	NA	NE	NE	NE	L (**)	M (*)	NA	NA	NEv	NS (***)	NS (*)	NS (***)	NE	NS (*)	NE	NEv	NS (*)	NS (*)	NS (*)	NEv	NEv	NEv	NS (*)
C. volutator	L (***)	L (***)	L (***)	L (*)	L (*)	L (*)	L (** *)	L (***)	M (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (***)	NS (*)	L (***)	L (***)	Nev	NS (*)	NS (*)	NA	NEv	L (***)	NS (*)
E. esculentus	L-M (***)	NA	NA	NE	NE	NA	L (** *)	H(*)	NA	NA	NS (*)	NS	NS (*)	NS	NE	NS (*)	NE	H (***)	NS (*)	L-M	NS	NEv	NEv	M-H	NS (*)
H. diversicolor	NS (*)	L-M (**)	L-H (**)	NS (*)	L (*)	L-H (*)	NS (** *)	L-M (**)	M-H (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (**)	NS (**)	NS (*)	NS (**)	NS (**)	L-M (*)	L-M (**)	NS (*)	NS (*)	M-H (**)	M-H (**)	NS (*)
H. ulvae	L-NS (*)	L (***)	L (*)	L-NS (*)	L-NS (*)	M (*)	NS (** *)	L(*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (*)	L (*)	L (*)	L (*)	NS (*)	NS (*)	NEv	NEv	M (*)	NS (*)
P. triqueter	L (***)	L (***)	L (*)	L (*)	L (*)	L (*)	L (*)	L (*)	NS (*)	L (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (*)	NEv	NEv	NS (*)	L (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
M. balthica	L (*)	L (*)	M (**)	L (**)	M (*)	M-H (**)	NS (**)	M-H (*)	M (*)	NS (*)	NS (*)	NS (**)	NS (*)	NS (**)	NS (**)	NS (*)	NS (**)	NS (**)	M (**)	NS (*)	NS (*)	NS (*)	NEv	M (**)	NS (**)
N. hombergii	NS (*)	L (*)	L (***)	NS (*)	L (*)	L (*)	NS (**)	NS (*)	L (*)	NS (*)	NS (**)	NS (*)	NS (*)	NS (*)	NS (**)	NS (*)	NS (***)	NS (***)	NS (*)	M (*)	NS (*)	NS (**)	NEv	M (***)	NS (*)
N. cirrosa	NS (*)	L (***)	L (***)	NS (*)	L (*)	L (*)	NS (** *)	NS (*)	L (*)	NS (*)	L (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	M (*)	M (*)	NS (*)	NS (*)	NEv	NEv	NS (*)
S. armiger	NS (*)	L (*)	L-M (*)	NS (*)	L (*)	H (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NS (***)	NS (***)	NS (*)	M (***)	M (***)	M (*)	M (**)	NS (*)	NS (*)	NEv	NEv	NS (*)

Pressure Type	Physical Damage								Change in Habitat Quality									Biological Pressures				Chemical Pollution			Physical Pressure
Species	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-	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	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 antifoulants	Introduction of medicines	Introduction of hydrocarbons	Prevention of light reaching seabed/features
S. plana	NS (*)	NS (**)	M-H (*)	NS (**)	L (**)	M-H (*)	NS -L (*)	M-H (*)	M-H (*)	NS (*)	NS (*)	L (*)	NS (*)	M (*)	M (*)	NS (*)	NS (*)	NS (*)	M (*)	NS (*)	NS (*)	NS (*)	NA	L (*)	NS (*)
A. nodosum	L (*)	NA	NA	L (***)	NE	NA	NS (***)	VH (*)	NA	NA	NS (***)	L-NS (***)	NS (*)	NS (*)	NE	NS (*)	NE	NS (*)	M (***)	H (***)	NS (*)	NS (***)	NEv	NS (***)	H (***)
Fucus sp.	L (*)	NA	NA	L (***)	NE	NA	M (***)	H (*)	NA	NA	NS (*)	L-NS (***)	NS (**)	NS (***)	NE	NS (*)	NE	NS (*)	NS (*)	NS (*)	NS (*)	NS (*)	NEv	NS (*)	M (*)
L. digitata	NS (*)	NA	NA	NE	NE	NA	NS (***)	H (*)	NA	NA	NS (***)	M (***)	NS (*)	NS (*)	NE	NS (*)	NE	NEv	M (***)	H (***)	NS (*)	NS (*)	NEv	NS (***)	M (*)
L. hyperborea	L (*)	NA	NA	NE	NE	NA	NS (***)	H (*)	NA	NA	NS (***)	M (***)	NS (*)	NS (***)	NE	NS (*)	NE	NEv	M (*)	M (***)	NS (*)	NS (*)	NEv	NS (***)	M (*)
Halidrys siliquosa	L (*)	NA	NA	L(*)	NE	NA	NS (*)	H (*)	NA	NA	NS (***)	L-NS (***)	NS (***)	NS (***)	NE	NS (*)	NE	NEv	M (***)	NS (*)	NS (*)	NS (*)	NEv	NS (*)	M (***)
S. polyschides	L (*)	NA	NA	NE	NE	NA	NS (*)	M (*)	NA	NA	NS (***)	M (*)	L (*)	NS (*)	NE	NS (*)	NE	NS (*)	M (*)	M (*)	NS (***)	NEv	NEv	NS (*)	M (*)
Ulva sp.	L (*)	NA	NA	L(*)	NE	NA	NS (***)	L (*)	NA	NA	NS (*)	NS (**)	NS (**)	NS (***)	NE	NS (*)	NE	NEv	NEv	NS (*)	NS (*)	NS (***)	NEv	L (***)	M (***)

Table 12: Codes of sensitivity and confidence applying to species and pressure interactions presented in Tables 10 and 11.

Species x Pressure Interaction Codes	
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

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

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

Aquaculture pressures on a given habitat are related to vulnerability (spatial overlap or exposure of the habitat to the equipment/culture organism combined with the sensitivity of the habitat) to the pressures induced by culture activities. To this end, the location and orientation of structures associated with the culture organism, the density of culture organisms, the duration of the culture activity and the type of activity are all important considerations when considering risk of disturbance to habitats and species. Different species and habitats will have different tolerance to the pressures associated with aquaculture activities (pressures as discussed in Section 5).

The aquaculture activity overlap six different community types found within the qualifying interest of the SAC. Tables 13 - 17 below identify the likely interactions between the relevant aquaculture activities and the constituent marine community types of the habitat features (1130, 1140, 1160 and 1170, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistent disturbance on the habitat. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the overall proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS 2012b).

NPWS (2012b) provides lists of species characteristic of benthic communities that are defined in the Conservation Objectives. The sedimentary community types brought further in the analysis are intertidal (tolerant of desiccation and physical stress) and subtidal sand and sand to mixed sediment. The intertidal sands support a community of polychaetes (*Scolelepis squamata*) and crustaceans; while the sand to mixed sediment habitat is dominated by polychaetes (*Hediste diversicolor*), crustaceans and molluscs (*Scrobicularia plana*, *Macoma balthica*, *Hydrobia ulvae*). Subtidal sands/mixed sediments support a community complexes characterised by polychaetes (*Nephtys* spp.). The rocky habitat communities brought further in the analysis, include a Fucoid-dominated intertidal reef community

complex that is dominated by brown algal species with red algae and a faunal aspect typical of the rocky intertidal (i.e. gastropods, and barnacles) and an Anemone-dominated subtidal reef community.

For the qualifying feature - **Estuaries (1130)** - there are a number of attributes (with associated targets) relating to the following broad Annex I 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 with the feature Estuaries. The habitat area is likely to remain stable.
2. Community Distribution - (conserve a range of community types in a natural condition).
   This attribute considered interactions between aquaculture activities and 4 communities identified in the broad Annex I feature (i.e. Estuaries, 1130) and brought forward from the previous screening exercise (Section 7):
   - Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex
   - Subtidal sand to mixed sediment with *Nucula nucleus* community complex
   - Subtidal sand to mixed sediment with *Nephtys* spp. community complex
   - Fucoid-dominated intertidal reef community complex

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities, some of these may result in more chronic and long-term changes in community composition, which were considered during the assessment process. Such activities as dredging for oyster and mussels which will result in physical disturbance to infaunal communites and long line mussel culture which results in organic loading on the seabed resulting in biogeochemical changes to sediment and a likely change in faunal composition - whether this results in permanent change to the community type is unclear. Table 10 lists the community types and Table 11 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores are derived from a range of sources identified above. Table 12 provides the code for the various categorisation of sensitivity and confidence. The pressures are listed as those likely to result from the primary aquaculture activities (shellfish production) proposed in the Lower Shannon River SAC. Considered in the assessment are Mussels (*Mytilus edulis*) in suspended culture (subtidal longlines) and subtidally on the seafloor; and Oysters (*Ostrea edulis*, *Crassostrea gigas*) in suspended culture (bags & trestles) and subtidally on the seafloor.

Table 13 below identifies the likely interactions between the relevant aquaculture activities and the habitat features (1160) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistent disturbance on the habitat/community type. If persistent disturbance is likely then the spatial extent of the overlap is considered further. No aquaculture activity extends beyond 15% of the community type (Tables 6 and 13). In addition, combined aquaculture activities listed overlap with 1.31% of the habitat feature Estuaries (1130) (Table 3).

For the qualifying feature - **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 Annex I 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 with 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). This attribute considered interactions with two communities identified in the broad Annex I feature (i.e. Mudflats and sandflats not covered by seawater at low tide,(1140) and brought forward from the previous screening exercise (Section 7):
    - Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community
    - Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities, some of these may result in more chronic and long-term changes in community composition, which were considered during the assessment process. Such activities as dredging for oyster and mussels which will result in physical disturbance to infaunal communites and long line mussel culture which results in organic loading on the seabed resulting in biogeochemical changes to sediment and a likely change in faunal composition - whether this results in permanent change to the community type is unclear. Table 10 lists the community types and Table 11 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores are derived from a range of sources identified above. Table 12 provides the code for the various categorisation of sensitivity and confidence. The pressures are listed as those likely to result from the primary aquaculture activities (shellfish production) proposed in the Lower Shannon River SAC. Considered in the assessment are Mussels (*Mytilus edulis*) in suspended culture (subtidal longlines) and subtidally on the seafloor; and Oysters (*Ostrea edulis*, *Crassostrea gigas*) in suspended culture (bags & trestles) and subtidally on the seafloor.

Table 14 below identifies the likely interactions between the relevant aquaculture activities and the habitat features (1140) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistent disturbance on the habitat/community type. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS 2013). No activity (Aquaculture) extends beyond 15% of the community type (Tables 7 and 14). In addition, combined activities of aquaculture overlap with 1.34% of the habitat feature Mudflats and sandflats not covered by seawater at low tide (1140) (Table 3).

For the qualifying feature - **Large Shallow Inlets and Bays (1160)** - there are a number of attributes (with associated targets) relating to the following broad Annex I 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 with the feature Large Shallow Inlets and Bays. The habitat area is likely to remain stable.
2. Community Distribution - (conserve a range of community types in a natural condition). This attribute considered aquaculture interactions with thecommunities identified in the broad Annex I feature (i.e. Large Shallow inlets and bays, 1160) and brought forward from the previous screening exercise (Section 7) and are:
    - Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community
    - Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex
    - Subtidal sand to mixed sediment with *Nephtys* spp. community complex
    - Fucoid-dominated intertidal reef community complex
    - Mixed subtidal reef community complex
    - Anemone-dominated subtidal reef community

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities, some of these may result in more chronic and long-term changes in community composition, which were considered during the assessment process. Such activities as dredging for oyster and mussels which will result in physical disturbance to infaunal communites and long line mussel culture which results in organic loading on the seabed resulting in biogeochemical changes to sediment and a likely change in faunal composition - whether this results in permanent change to the community type is unclear. Table 10 lists the community types and Table 11 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores are derived from a range of sources identified above. Table 12 provides the code for the various categorisation of sensitivity and confidence. The pressures are listed as those likely to result from the primary aquaculture activities (shellfish production) proposed in the Lower Shannon River SAC. Considered in the assessment are Mussels (*Mytilus edulis*) in suspended culture (subtidal longlines) and subtidally on the seafloor; and Oysters (*Ostrea edulis*, *Crassostrea gigas*) in suspended culture (bags & trestles) and subtidally on the seafloor.

Table 15 below identifies the likely interactions between the relevant aquaculture activities and the habitat features (1160) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistent disturbance on the habitat/community type. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS 2013). No activity extends beyond 15% of the community type (Tables 8 and 15). In addition,

combined activities listed overlap with 0.97% of the habitat feature (1160) Large Shallow Inlet and Bay (Table 3).

For the qualifying feature - **Reefs (1170)** - there are a number of attributes (with associated targets) relating to the following broad Annex I habitat features as well as constituent community types

1. Distribution of Reef - the distribution of reef habitat within the SAC are unlikely to be affected by the aquaculture activities and are considered stable.
2. Habitat Area - the habitat area of reef is unlikely to be changed by as a consequence of aquaculture activities and is considered stable.
3. Community Distribution (conserve a range of community types in a natural condition)
   This attribute considered interactions with twocommunities identified in the broad Annex I feature (i.e. Reefs, 1170) and brought forward from the previous screening exercise (Section 7):
   - Fucoid-dominated intertidal reef community complex
   - Anemone-dominated subtidal reef community

The community types listed above will be exposed to differing ranges of pressures from aquaculture activities, some of these may result in more chronic and long-term changes in community composition, which were considered during the assessment process. Table 10 lists the community types and Table 11 lists the constituent taxa and both provide a commentary of sensitivity to a range of pressures. The risk scores are derived from a range of sources identified above. Table 12 provides the code for the various categorisation of sensitivity and confidence. The pressures are listed as those likely to result from the primary aquaculture activities (shellfish production) proposed in the Lower Shannon River SAC. Considered in the assessment are Mussels (*Mytilus edulis*) in suspended culture (subtidal longlines) and subtidally on the seafloor; and Oysters (*Ostrea edulis*, *Crassostrea gigas*) in suspended culture (bags & trestles) and subtidally on the seafloor.

Table 16 below identifies the likely interactions between the relevant aquaculture activities and the habitat features (1170) and their constituent community types, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question. It must be noted that the sequence of distinguishing disturbance is as highlighted above, whereby activities with spatial overlap on habitat features are assessed further for their ability to cause persistent disturbance on the habitat/community type. If persistent disturbance is likely then the spatial extent of the overlap is considered further. If the proportion of the overlap exceeds a threshold of 15% disturbance of the habitat then any further licencing should be informed by interdepartmental review and consultation (NPWS 2013). No activity extends beyond 15% of the community type (Tables 9 and 16). In addition, combined aquaculture activities listed overlap with 0.13% of the habitat feature (1170) Reefs (Table 3).

Biological Pressures

It must be noted that a number of activities (i.e. culture of diploid oysters) have been identified whereby, the risk of proliferation on non-native species in the site cannot be discounted without specific management actions. Successful reproduction of the Pacific oyster *(Crassostrea gigas*) has been documented in areas where this species is cultured in Ireland, including the Lower Shannon River SAC

(Kochmann *et al*., 2013). Kochmann et al (2013) identified a series of hydrological and morphological characteristics that facilitate Pacific oyster settlement, including residence time, which in the case of the Shannon Estuary, was calculated as approximately 53 days (T. Dabrowski, Marine Institute - personal communication). Any residence time greater than 21 days would be considered likely to result in an increased risk of settlement. An additional factor potentially contributing to successful recruitment is availability of suitable substrate (i.e. hard substrate or biogenic features, e.g., mussel shell). However, a negative association with macroalgae was speculated. Therefore, intertidal areas with high levels of macroalgal cover would appear to mitigate against successful recruitment of Pacific oysters (Kochmann et al 2013; Kochmann and Crowe, 2014). Zwerschke et al. (2017) identified greater number so oysters at the same sites in the SAC indicating ongoing recruitment. Furthermore, in addition to the use of diploid oysters throughout the SAC, the risk of successful reproduction is potentially amplified by the uncontained culture of *M. gigas* subtidally on the seabed, where gonad development has been shown to be greater than in oysters held intertidally (MagAoidh, 2011). The collection of 'wild' gigas spat as described in the profile (Section 5) also speaks to the fact that recruitment of this non-native species is ongoing in the SAC. Also the culture of *M. gigas* on the seabed will make it very difficult to manage the risk exacerbation of an introduction or establishment of 'wild' populations of this species or disease outbreaks. In bags or under netting nearly 100% of the culture species can be removed from an area in the event of unforeseen negative impact. It is highly unlikely that 100% of stock broadcast in an uncontained fashion on the seabed (subtidally) can be recaptured. Furthermore, the use of triploid oyster (3n) for seabed culture also cannot be considered a fail-safe given that chemically induced triploids are never 100% successful (i.e., a proportion are diploid) and genetically induced triploids risk reversion to mosaics or diploids. This, allied with the inability to fully retrieve the oysters, presents a risk of successful reproduction (Hallerman et al, 2001; Zhang et al 2010; Sousa et al 2016).

The importation of mussel seed (or half-grown oysters) from areas outside of site also presents a risk of introducing non-native species into the Shannon. The introduction of the non-native gastropod *Crepidula fornicata* into Belfast Lough was thought to be associated with seed mussel introduced from the UK (McNeill et al., 2010).

Table 13: **Interactions between the relevant aquaculture activities and the habitat feature Estuaries (1130) constituent communities with a broad conclusion on the nature of the interactions.**

Culture Type	1130 Estuaries			
	Fucoid-dominated intertidal reef community complex	**Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex**	**Subtidal sand to mixed sediment with *Nucula nucleus* community complex**	**Subtidal sand to mixed sediment with *Nephtys* spp. community complex**
Oysters **Bags & trestles** **Suspended Culture**	**Disturbing: Yes** **Justification:** The species have high recoverability and are tolerant of the impacts of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The species have high recoverability and are tolerant of the impacts of this aquaculture type. The stock is confined in bags; seed is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**N/A**	**Disturbing: Yes** **Justification:** The community type is deemed tolerant to the majority of pressures from this activity. The stock is confined in bags; seed is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*
Oysters **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are possible. This activity overlaps 0.35% of this community type	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also due to the uncontained placement on the seafloor, wide scale impacts are possible. This activity overlaps 0.61% of this community type.	**Disturbing: Yes** **Justification** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The habitat and fauna are sensitive to the following impacts: Change in habitat quality & Physical damage. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.01% of this community type.	**Disturbing: Yes** **Justification** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The habitat and fauna are sensitive to the following impacts: Change in habitat quality & Physical damage. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.98% of this community type.
Mussel **Suspended Culture**	**N/A**	**N/A**	**Disturbing: Yes** **Justification** The community type is deemed sensitive to the pressures from this activity as a consequence of organic enrichment. This activity overlaps 0.89% of this community type.	**N/A**
Mussel **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. However, if mussel seed is imported from outside of the site there may be a risk of introducing non-native species. It is unlikely this activity will be carried out on this community type given the nature of the substrate. This activity overlaps 0.45% of this community type.	**N/A**	**Disturbing: Yes** **Justification** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The habitat and fauna are sensitive to the following impacts: Change in habitat quality & Physical damage. If mussel seed is imported from outside of the site there may be a risk of introducing non-native species. This activity overlaps 2.85% of this community type.	**Disturbing: Yes** **Justification** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The habitat and fauna are sensitive to the following impacts: Change in habitat quality & Physical damage. If mussel seed is imported from outside of the site there may be a risk of introducing non-native species. This activity overlaps 0.35% of this community type.

Table 13 cont'd: **Interactions between the relevant aquaculture activities and the habitat feature Estuaries (1130) constituent communities with a broad conclusion on the nature of the interactions.**

Culture Type	1130 Estuaries			
	Fucoid-dominated intertidal reef community complex	**Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex**	**Subtidal sand to mixed sediment with *Nucula nucleus* community complex**	**Subtidal sand to mixed sediment with *Nephtys* spp. community complex**
Access Routes	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.13%.	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.004%.	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.01%.	**N/A**
Cumulative Impact	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.93% on this community type. On foot of the use of diploid oysters and the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.60% on this community type. On foot of the use of diploid oysters and the uncontained culture on the seabed,, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 3.76% on this community type. On foot of the use of diploid oysters and the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 1.33% on this community type. On foot of the use of diploid oysters and the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*

Table 14: **Interactions between the relevant aquaculture activities and the habitat feature Mudflats and sandflats not covered by seawater at low tide (1140) constituent communities with a broad conclusion on the nature of the interactions.**

Culture Type	1140 Mudflats and sandflats not covered by seawater at low tide	
	Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community	**Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex**
Oysters **Bags & trestles** **Suspended culture**	**Disturbing: Yes** **Justification:** The species have high recoverability and are tolerant of the impacts of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The species have high recoverability and are tolerant of the impacts of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*
Oysters **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.10% of this community type (<15% threshold).	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.69% of this community type (<15% threshold).
Access Routes	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.053%.	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.01%.
Cumulative Impact	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.15% on this community type. On foot of the use of diploid oysters and the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.7% on this community type. On foot of the use of diploid oysters and the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*

Table 15: **Interactions between the relevant aquaculture activities and the habitat feature Large shallow inlets and bays (1160) constituent communities with a broad conclusion on the nature of the interactions.**

Culture Type	1160 – Large shallow inlets and bays			
	Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community	**Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex**	**Subtidal sand to mixed sediment with *Nucula nucleus* community complex**	**Subtidal sand to mixed sediment with *Nephtys* spp. community complex**
Oysters **Bags & trestles** **Suspended culture**	**Disturbing: Yes** **Justification:** The species have high recoverability and are tolerant of the impacts of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The species have high recoverability and are tolerant of the impacts of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification** The community type is deemed tolerant to the majority of pressures from this activity. The stock is confined in bags; seed is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification** The community type is deemed tolerant to the majority of pressures from this activity. The stock is confined in bags; seed is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.*
Oysters **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.10% of this community type.	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 2.10% of this community type.	**Disturbing: Yes** **Justification** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.82% of this community type.	**Disturbing: Yes** **Justification** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.77% of this community type.
Access Routes	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.001%.	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.91%.	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.03%.	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.0001%.
Cumulative Impact Aquaculture	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.10% on this community type . On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 3.01% on this community type . On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.85% on this community type . On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.77% on this community type . On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*

Table 15 cont'd**: Interactions between the relevant aquaculture activities and the habitat feature Large shallow inlets and bays (1160) constituent communities with a broad conclusion on the nature of the interactions.**

Culture Type	1160 – Large shallow inlets and bays			
	Fucoid-dominated intertidal reef community complex	**Faunal turf-dominated subtidal reef community**	**Anemone-dominated subtidal reef community**	***Laminaria*-dominated community complex**
Oysters **Bags & trestles** **Suspended culture**	**Disturbing: Yes** **Justification:** The species are sensitive to the the impacts (i.e., shading) of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* This activity overlaps 0.54% of this habitat type.	**N/A**	**N/A**	**N/A**
Oysters **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The habitat and fauna are sensitive to the following impacts: Change in habitat quality & Physical damage The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* However, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.03% of this community type.	**N/A**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas* and the uncontained placement on the seafloor may result in wide scale impacts. This activity overlaps 28.4% of this community type.	**N/A**
Access Routes	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.45%.	**N/A**	**N/A**	**N/A**
Cumulative Impact Aquaculture	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 1.02% on this community type. On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**N/A**	**Disturbing: Yes** **Justification:** The pressure of likely impacting activities is 28.4% on this community type (>15% threshold). Also, on foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas*.	**N/A**

Table 16: Interactions between the relevant aquaculture activities and the habitat feature Reefs (1170) constituent communities with a broad conclusion on the nature of the interactions.

Culture Type	1170 - Reefs	
	Fucoid-dominated intertidal reef community complex	**Anemone-dominated subtidal reef community**
Oysters **Bags & trestles** **Suspended culture**	**Disturbing: Yes** **Justification:** The species are sensitive to the impacts (i.e., shading) of this aquaculture type. The stock is confined in bags, is collected locally and/or sourced from hatcheries and is diploid/triploid. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* This activity overlaps 0.30% of this community type.	**N/A**
Oysters **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas.* Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. This activity overlaps 0.20% of this community type.	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The habitat and fauna are sensitive to the following impacts: Change in habitat quality & Physical damage The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas* and the uncontained placement on the seafloor may result in wide scale impacts. This activity overlaps 1.3% of this community type.
Mussel **Bottom culture**	**Disturbing: Yes** **Justification:** The activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. However, if mussel seed is imported from outside of the site there may be a risk of introducing non-native species. It is unlikely this activity will be carried out on this community type given the nature of the substrate. This activity overlaps 0.24% of this habitat type.	**N/A**
Access Routes	**Disturbing: Yes** **Justification:** This community type is sensitive to physical disturbance. The spatial overlap with the community type is 0.2%.	**N/A**
Cumulative Impact Aquaculture	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 0.76% on this community type. On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*	**Disturbing: Yes** **Justification:** The cumulative pressure of likely impacting activities is 1.3% on this community type. On foot of the uncontained culture on the seabed, the Lower Shannon SAC has increased likelihood of successful recruitment of the alien species *Crassostrea gigas.*

8.4 Assessment of the effects of Fishery Order Areas on the Conservation Objectives for habitat features in the Lower River Shannon SAC.

This assessment follows the same criteria as outlined above (Section 8.3). The Fishery Orders overlap four habitat features (1130, 1140, 1160 and 1170) and two additional community types (Faunal turf-dominated subtidal reef community, *Laminaria*-dominated community complex) found within the qualifying interest of the SAC (Tables 6-9). On the basis of the activities at the order sites (i.e., primarily bottom culture of oysters), the activity is considered disturbing because of the culture of a high density of single species and the physical disturbance associated with harvest. The long residence time in Lower Shannon SAC will increase the likelihood of successful recruitment of the alien species *Crassostrea gigas*. Also, due to the uncontained placement on the seafloor, wide scale impacts are likely. Listed below are the community types specifically interacting with the Fishery Order activities that are considered disturbing (i.e., greater than 15% spatial overlap) within each habitat feature (1130, 1140 and 1170). In summary, the Fishery Orders are considered disturbing to a number of habitat features and their constituent community types.

Estuaries (1130):

The Fishery Order significantly (17.11%) overlaps this feature (Table 3).

The Fishery Order also significantly overlaps a number of community types recorded within this feature (Table 6, Table 17).

- Subtidal sand to mixed sediment with *Nucula nucleus* community complex (64.16%),
- Fucoid-dominated intertidal reef community complex (28.57%),
- Faunal turf-dominated subtidal reef community (17.24%),
- Anemone-dominated subtidal reef community (77.65%)
- *Laminaria*-dominated community complex (98.01%)

Mudflats and sandflats not covered by seawater at low tide (1140)

The Fishery Order overlaps 2.27% of this feature (Table 3).

Large Shallow Inlets and Bays (1160)

The Fishery Orders overlaps 10.8% of this feature (Table 3).

The Fishery Orders also significantly overlaps a number of community types recorded within this feature (Table 8):

- Subtidal sand to mixed sediment with *Nucula nucleus* community complex (44.3%),
- Fucoid-dominated intertidal reef community complex (15.5%),
- Faunal turf-dominated subtidal reef community (10.5%),
- Anemone-dominated subtidal reef community (25%)

Reefs (1170)

The Fishery Orders overlaps 9.44% of this feature (Table 3).

The Fishery Orders also significantly overlaps a number of community types recorded within this feature (Table 9, Table 19):

- Fucoid-dominated intertidal reef community complex (22.36%)
- Anemone-dominated subtidal reef community (75.27%)

It should be noted that the information available regarding the extent of usage and type of culture occurring within the Fishery Order Areas is sparse. Therefore, the spatial extents listed are the maximum areas the Fishery Order covers, however the area may not be fully utilised by the operators.

8.5 Assessment of the effects of aquaculture on the Conservation Objectives for the otter in Lower River Shannon River SAC.

The Lower River Shannon SAC is designated for Annex II species the otter (*Lutra lutra*); the conservation objectives for such are listed in Table 1.

For the qualifying feature - **Otter (*Lutra lutra*)** - there are a number of attributes (with associated targets) which maintain favourable conservation condition (NPWS, 2012a):

1. Distribution - No significant decline
2. Extent of terrestrial habitat - No significant decline
3. Extent of marine habitat - No significant decline
4. Extent of freshwater habitat - No significant decline
5. Couching sites and holts - No significant decline
6. Fish biomass available - No significant decline
7. Barriers to connectivity - No significant increase

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

Suspended Intertidal Oyster Culture

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

Suspended Subtidal Mussel Culture

Otter will likely forage in and around mussel lines. The lines are typically large in diameter and the risk of entanglement is minimal. Given that otter foraging is primarily crepuscular the interaction with mussel culture operators is likely to be minimal. It is unlikely that mussel culture poses a risk to otter populations within the site. Impacts can be discounted.

Subtidal Shellfish (Mussels, Oyster) Culture

Given that this culture type does not entail any structures and all operations are likely to be carried out in daylight hours, while otter foraging is primarily crepuscular, the interaction between otter and operator/operations is likely to be minimal. It is unlikely that these culture types pose a risk to otter populations in the Lower Shannon River. Impacts can be discounted.

Fishery Order Areas:

Given that all operations are likely to be carried out in daylight hours, and that otter foraging is primarily crepuscular the interaction with culture operators is likely to be minimal. Structures may be used within these areas but it is unlikely they would pose a risk to otter populations within the site.
Impacts can be discounted.

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

- Decline in extent of terrestrial habitat nor marine habitat nor 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 and fisheries 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 state.

8.6 Assessment of the effects of aquaculture on the Conservation Objectives for the bottlenose dolphin in the Lower Shannon River SAC.

The Lower River Shannon SAC is designated for the Annex II species the bottlenose dolphin (*Tursiops truncatus*); the conservation objectives for such are listed in Table 1.

For the qualifying feature - **Bottlenose dolphin (*Tursiops truncatus*)** - there are a number of attributes (with associated targets) which maintain favourable conservation condition (NPWS, 2012a):

1. Access to suitable Habitat - species range within the site should not be restricted by artificial barriers.
2. Habitat use - Critical habitat area should be maintained in a natural condition.
3. Human Disturbance - Human activity should occur at levels that do not adversley affect species population at the site

As the aquaculture production activities within the SAC spatially overlap with dolphin critical habitat area, these activities may have negative effects on the range and distribution of populations of the species. Table 20 below identifies the likely interactions between the relevant aquaculture activities and the bottlenose dolphin, with a broad conclusion and justification on whether the activity is considered disturbing to the feature in question.

The risk of negative interactions between aquaculture operations and dolphins 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?

3. Is the species range within the site restricted by artificial barriers to site use?

4. Is the Critical Areas, representing habitat used preferentially by bottlenose dolphin, maintained in a natural condition?

Suspended Intertidal Oyster Culture

Given the intertidal location of the structures and activities associated this form of oyster culture it is unlikely that the marine mammals will have any negative interaction with this culture method. Ancillary activities at sites, i.e. site services human, boat and vehicular traffic, may increase the risk of minor disturbance to marine mammals. Impacts can be discounted.

Subtidal Bottom Shellfish (Mussels, Oyster) Culture

Given that this culture type does not entail any structures, it would not act as a barrier to movement of the species throughout its habitat range, including the critical habitat area. While biological effects of such as aquaculture may alter the natural condition of the critical habitat, it is likely that structure provided by shellfish on the seafloor may increase attraction for dolphin prey items (fish). The schedule of operations may also cause disturbance, however disturbance would be limited to seasonal activities i.e. seeding, grading, and harvesting and would be confined to a small number of vessels. The cumulative impacts of these activities are unlikely to appreciably disturb the marine mammals and result in permanent exclusion. Furthermore, the timing of such activities are such that they are unlikely to coincide with more sensitive periods for marine mammals (May to September calving period). Impacts can be discounted.

Suspended Subtidal Mussel Culture

Given the presence of subtidal fixed structures associated with the suspended subtidal culture of shellfish operations i.e. longlines, there is a possibility that their presence may act as a barrier restricting the range and movement of the species within the critical habitat area however, it is unlikely that it may cause harm due to the ability of the dolphin to avoid structures. We note the recent publication on interactions between dolphin and floating structures used in the culture of shellfish (rafts) (Díaz López and Methion, 2017). The study concluded that shellfish farms appeared to have a positive impact on dolphin occurrence, with increased bottlenose dolphin occurrence at mussel farm locations and in waters close to the aquaculture zones. The structure may act as fish aggregation devices which might benefit the dolphin. Biological effects of such aquaculture may alter the natural condition of the seabed habitat. The schedule of operations may also cause disturbance, however disturbance would be limited to seasonal activities i.e. seeding, grading, and harvesting. Which should not coincide with the more sensitive periods for marine mammals (see above). Ancillary activities at sites, i.e. site services human and boat traffic, may increase the risk of disturbance to marine mammals. However, given the low level of overlap (0.26%) and the limited levels of activity at the risk of permanent exclusion from the site is likely to be very low. Impacts from suspended subtidal mussel culture can be discounted.

Table 17: Interactions between the relevant aquaculture activities and the Critical Habitat of the bottlenose dolphin (*Tursiops truncatus*) with a broad conclusion on the nature of the interactions.

Culture Type	1349 - Bottlenose Dolphin (*Tursiops truncatus*)
Oysters Bags & trestle Suspended culture Intertidal	**Disturbing: No** **Justification:** The activity is carried out in the intertidal which would not affect the subtidal marine mammal. However, there may be limited disturbance due to ancillary activities at sites i.e. site services, human, boat and vehicular traffic.
Oysters Bottom culture Subtidal	**Disturbing: No** **Justification:** There are no physical structures associated with this culture type to act as a barrier to movement or cause displacement. Disturbance would be limited to seasonal activities i.e. seeding, grading, and harvesting. The biological effects of the aquaculture may affect the natural condition of the critical habitat. Yet the presence of oysters may attract prey items for dolphin (fishes).
Mussel Suspended Culture Subtidal	**Disturbing: No** **Justification:** The physical structures associated with this culture type may persistently reduce the range of the species within it's critical habitat, and may be a barrier to free movement. However, dolphin can easily avoid such structures and may be attracted to them on the basis that they might act as fish attraction/aggregation devices. Disturbance would otherwise be limited to seasonal activities i.e. seeding, grading, and harvesting. The biological effects of the aquaculture may affect the natural condition of the critical habitat. However, given the small scale of the activities and the potential positive interactions the activity is considered non-disturbing.
Mussel Bottom culture Subtidal	**Disturbing: No** **Justification:** There are no physical structures associated with this culture type to act as a barrier to movement or cause displacement. Disturbance would be limited to seasonal activities i.e. seeding, grading, and harvesting. Which should not coincide with more sensitive periods for marine mammals. The biological effects of the aquaculture may affect the natural condition of the critical habitat. Yet the presence of oysters may attract prey items for dolphin (i.e., fishes).
Cumulative Impact Aquaculture	**Disturbing: No** **Justification:** While activities associated with these activities are considered potentially disturbing, it is unlikely that they will occur at the same time or in a persistent manner. Potential positive aspects of these activities whereby, they may act as attraction for potential food source for dolphin, is also considered.

9 Other Activities

Fisheries

There are some fishery activities towards the mouth of the River Shannon. These activities comprise shrimp potting (south shore of river near Ballylongford) and tangle net (Crayfish), trammel net (baitfish), creel (lobster and crab) all at the mouth of the estuary (Marine Institute, 2015). All wild fisheries are confined to static gear and present no risk to habitat features. The nature of the tangle netting can present an entanglement risk to mobile species (Otter and Bottlenose Dolphin). However, the location of tangle netting is outside of the range of otter but well within that of dolphin and does present a risk.

Other activities

Commercial ports are located at Foynes and Limerick Docks, with private port terminals at Aughinish, Moneypoint, Shannon Airport and Tarbet. The navigation channel runs the length of the Upper and Lower Shannon sections of the SPA and may require maintenance dredging on occasion (on the approaches to limerick Dock and at the berths at Foynes). A car ferry runs between Tarbert and Killimer. These activities will unlikely have an impact on the current status of habitat features in the SAC, with the exception of dredging of already disturbed channels. The disturbance to species may present a risk if considered in combination with shellfish culture activities identified above.

10 SAC Aquaculture Appropriate Assessment Concluding Statement and Recommendations

In the Lower Shannon River SAC aquaculture focuses primarily on shellfish species (mussels, oysters) (Figure 5). Oysters are the predominant shellfish species cultured within the SAC, mussels are produced at a lower scale; while Scallops, although licensed, are not currently produced in the area. Based upon this and the information provided in the aquaculture profiling (Section 5), the likely interaction between this aquaculture and conservation features (habitats and species) of the site were considered.

An initial screening exercise resulted in a number of habitat features and species being excluded from further consideration by virtue of the fact that no spatial overlap of the culture activities was expected to occur. The habitats and species excluded from further consideration were Freshwater Pearl Mussel *Margaritifera margaritifera* (1029), Sea Lamprey *Petromyzon marinus* (1095), Brook Lamprey *Lampetra planeri* (1096), River Lamprey *Lampetra fluviatilis (*1099), Atlantic Salmon *Salmo salar* (only in fresh water)(1106), Sandbanks which are slightly covered by sea water all the time (1110), Coastal lagoons (1150), Perennial vegetation of stony banks (1220), Vegetated sea cliffs of the Atlantic and Baltic coasts (1230), *Salicornia* and other annuals colonizing mud and sand (1310), Atlantic salt meadows (Glauco-Puccinellietalia maritimae)(1330), Mediterranean salt meadows (*Juncetalia maritimi*)(1410), Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260), *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410) and 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*).

10.1 Habitats

A full assessment was carried out on the likely interactions between aquaculture operations (as proposed) and the Annex 1 habitats 1110 (Sandbanks which are slightly covered by sea water all the time), 1130 (Estuaries), 1140 (Mudflats and sandflats not covered by seawater at low tide), 1150 (Coastal Lagoon), 1160 (Large Shallow Inlets and Bay) and 1170 (Reefs). The likely effects of the aquaculture activities (species, structures) were considered in light of the sensitivity of the constituent habitats and species of the Annex 1 habitats.

There is no overlap between the Annex I habitats Sandbanks which are slightly covered by sea water all the time (1110) and Coastal Lagoons (1150) and aquaculture activities in the Lower River Shannon SAC, therefore these features were screened out of the assessment.

Furthermore, of the 10 community types listed under the remaining habitat features (1140, 1160 and 1170) two (Estuarine subtidal muddy sand to mixed sediment with gammarids community complex and Mixed subtidal reef community complex) were also excluded from further analysis as they had no overlap with aquaculture activities.

Based upon the scale of spatial overlap the general conclusion relating to the interaction between proposed aquaculture activities with habitats is that consideration can be given to licencing (existing

and applications) in the Annex 1 habitats -1140 (Mudflats and sandflats not covered by seawater at low tide), 1160 (Large Shallow Inlets and Bays) and 1170 (Reefs). However, there is one exception where Oyster culture (bottom culture) occurs on the community type Faunal turf-dominated subtidal reef community (28.4%) which is above the threshold (15%) within the qualifying feature 1130 (Estuaries). However, it is questionable whether this activity will be carried out on this community type given the nature of the substrate.

However, based on biological pressures the aquaculture activity of Subtidal Bottom Culture (Mussels, Oysters) poses a potential risk of the introduction and the potential naturalization of non-native species due the placement of mussels and oysters in an uncontained fashion on the seafloor.

Conclusion 1: With one exception (Marine Community type – Anemone-dominated subtidal reef community (28.4%) which is above the threshold (15%) within the qualifying feature Large Shallow inlet and bay), aquaculture activities (intertidal oyster culture) do not pose a risk of significant disturbance to the qualifying interests (Habitats) of the Lower River Shannon SAC. However, some aquaculture activities (bottom mussel, suspended mussel and bottom oyster culture), when considered in-combination with fishery order areas, do pose a significant risk of disturbance to a number of qualifying interests in the SAC.

Conclusion 2: Give the long residence time in the Shannon Estuary and the fact that recruitment of the non-native oysters *Crassostrea gigas* is ongoing. The risk posed by the culture of diploid Pacific oyster, *Crassostrea gigas*, cannot be discounted. This risk is further exacerbated by the culture of these oysters on the seabed. It is recommended that all oyster culture be carried out using triploid oysters and that subtidal culture of *C gigas* uncontained on the seafloor be reviewed in light of these findings.

Conclusion 3: The source of mussel seed stock inputted into existing licensed mussel areas is collected locally at present. If seed is sourced outside of the site in the future the risk posed by this activity cannot be discounted. It is recommended that acceptable sources of seed (in terms of alien species assessment) are identified for all shellfish culture operations. The movement of stock in and out of the Lower River Shannon SAC should adhere to relevant fish health legislation and follow best practice guidelines (e.g. http://invasivespeciesireland.com/cops/aquaculture/).

Conclusion 4: It is recommended that there be strict adherence to the access routes identified and that density of culture structures within the sites be maintained at current levels.

The activities that are known to occur within the Fishery Order Areas (i.e. bottom culture of oysters and mussel) are deemed disturbing on a number of community types. It should be noted that the information available regarding the extent of usage and type of culture occurring within the Fishery Order Areas is sparse. Therefore the spatial extents listed are the maximum areas the Fishery Order covers, however it is possible that the areas may not be fully utilised by the operators. In the absence of this information and given the fact that the fishery orders are fully licenced, it is clear the decisions regarding the licencing of aquaculture operations should take into account the licence status of the Fishery order areas.

10.2 Species

The likely interactions between the proposed aquaculture activities (incl. Fishery Order Areas) and the Annex II species otter (*Lutra lutra*) were also assessed. The objectives for this species in the SAC focus upon maintaining the good conservation status of the population and consider certain uses of intertidal habitats as important indicators of status. The aspect of the culture activities that could potentially disturb the otter status relates to movement of people and vehicles within the sites as well as accessing the sites over intertidal areas and via water.

It is concluded that the aquaculture activities (incl. Fishery Order Areas) proposed in areas that potentially overlap with otter habitat do not pose a threat to the conservation status of this species within the SAC.

Conclusion 5: The current and proposed levels of aquaculture activities individually and in-combination with activities in fishery order areas are considered non-disturbing to otter conservation features.

The likely interactions between the proposed aquaculture activities and the Annex II species bottlenose dolphin (*Tursiops truncatus*) were also assessed. The objectives for this species in the SAC focus upon maintaining the favourable conservation condition status of the species which is defined by maintaining species range and critical habitat. The aspect of the culture activities that could potentially influence the dolphin status relates to presence of fixed aquaculture structures (Longlines) within the critical habitat areas. However, the small spatial extent and the potential for the structure to act as fish aggregation devices suggest present little risk to the feature in question.

It is concluded that the aquaculture activities proposed in areas that have overlap with dolphin critical habitat do not present a risk to the conservation status of this species within the Lower Shannon River SAC.

Conclusion 6: The current and proposed levels of subtidal suspended and bottom culture aquaculture activities are not considered disturbing to the bottlenose dolphin conservation features.

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Annex II

Marine Institute Bird Studies

River Shannon and Fergus Estuaries SPA: Appropriate Assessment of Aquaculture

May 2019

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Executive Summary

This report presents an Appropriate Assessment of aquaculture within the Shannon Estuary. There are a total of 60 aquaculture sites, covering a total area of 631 ha, included in this assessment. Five of the sites are located outside the River Shannon and River Fergus Estuaries Special Protection Area (SPA) in Carrigaholt and Rinnevella Bays. All the sites within the SPA are located in the lower part of the Shannon Estuary downstream of the Fergus Estuary. There are 52 sites (covering 200 ha) of intertidal oyster cultivation, three sites (97 ha) of bottom oyster cultivation, two sites (130 ha) of bouchet pole mussel cultivation, three sites (313 ha) of bottom mussel cultivation and two sites (29 ha) of mussel longline cultivation[1].

The report assesses the potential impact of the development of these aquaculture sites on the Special Conservation Interests (SCIs) of the River Shannon and River Fergus Estuaries SPA, and on the SCIs of other SPAs where these SCIs may have connectivity with the Shannon Estuary. The potential for cumulative impacts from development of these aquaculture sites in combination with other relevant activities and plans is also assessed. The in-combination activities and plans assessed include: three Fishery Orders, which permit additional aquaculture development in the River Shannon and River Fergus Estuaries SPA; the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary, which provides the framework for the development of various marine-related industries and activities in and around the River Shannon and River Fergus Estuaries SPA; and a range of water-based recreational and commercial activities.

The SCIs of the River Shannon and River Fergus Estuaries SPA covered by this assessment are: Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank and Black-headed Gul. The SCIs of other SPAs covered by this assessment are: the Fulmar SCI of the Kerry Head SPA, the Kittiwake and Guillemot SCIs of the Loop Head SPA, and the Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit SCIs of the Ballyallia Lough SPA.

There is a high potential for development of intertidal aquaculture sites in the Ballylongford/Bunaclugga, Poulnasherry/Kilrush and Aughinish/Foynes areas to cause significant displacement impacts to Grey Plover and Bar-tailed Godwit, while significant displacement impacts to Light-bellied Brent Goose and Ringed Plover are also possible. There is potential for further significant cumulative impacts on some of these species from the development of the above sites in combination with oyster trestle cultivation in the Fishery Order that covers part of Poulnasherry Bay, and development of areas of opportunity identified in the SIFP for tidal energy in Tarbert Bay and for aquaculture in Clonderlaw Bay.

There are also a number of potential impacts that cannot be discounted at this stage due to lack of relevant information.

The possibility of significant disturbance impacts to high tide roosts used by Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot and Dunlin from vessel activity associated with the development of sites in the Ballylongford/Bunaclugga and Aughinish/Foynes areas cannot be discounted due to a lack of information about the usage of high tide roost sites in these areas. The potential for cumulative impacts from this vessel activity in combination with other vessel activity in these areas also needs to be considered. Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit are also SCIs of the Ballyallia Lough SPA and there is potential interchange between these populations and the River Shannon and River Fergus Estuaries populations. Therefore, any significant impacts to these species in the River Shannon and River Fergus Estuaries could potentially also affect the conservation condition of these species in the Ballyallia Lough SPA.

The possibility of intertidal or subtidal aquaculture development affecting nocturnal roost sites used by Whooper Swan cannot be discounted as we have no information on the location of these roost sites.

The potential for intertidal oyster cultivation in Poulnasherry Bay to cause significant impacts to the availability of suitable foraging habitat for Scaup cannot be excluded due to lack of knowledge about the effects of oyster

[1] Note that some of the sites have multiple potential uses, so the summed total numbers and areas of the listed activities is greater than the total number and overall area of the aquaculture sites.

trestles on Scaup foraging behaviour. The potential for cumulative impacts from this activity in combination with oyster trestle cultivation in Fishery Order that covers part of Poulnasherry Bay and/or bottom oyster cultivation in the other Fishery Orders also needs to be considered.

The potential impact of intertidal aquaculture on Black-headed Gull cannot be assessed at this stage, due to lack of data on Black-headed Gull distribution within the River Shannon and River Fergus Estuaries SPA at the time of its likely peak usage of the area.

The potential cumulative impacts of disturbance from wildfowling activity in-combination with aquaculture activity in the River Shannon and River Fergus Estuaries SPA due to the lack of detailed information on the distribution and intensity of wildfowling activity within the SPA.

1. Introduction

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

1.2 This report presents an Appropriate Assessment of aquaculture in the Shannon Estuary. The subject of the assessment are areas that have either already been licensed for aquaculture, or for which there are applications for such licenses; these are collectively referred to as aquaculture sites. The information on the licensing status of aquaculture sites used in this report was provided by the Department of Agriculture, Food and the Marine.

1.3 Most of the aquaculture sites are within the River Shannon and River Fergus Estuaries SPA. Five aquaculture sites in Carrigaholt and Rinnevella Bays, which are outside the River Shannon and River Fergus Estuaries SPA, are also included in this assessment. Therefore, the assessment covers all the aquaculture sites in the Shannon Estuary. The River Shannon and River Fergus Estuaries SPA is the primary focus of this assessment. In addition, following a screening exercise, Special Conservation Interests (SCIs) from three other SPAs are included in this assessment. These SPAs are: Ballyallia Lough SPA, Kerry Head SPA and Loop Head SPA. The SPAs covered by this assessment are shown in Figure 1.1.

1.4 This assessment is based on a desktop review of existing information. Where relevant, it identifies information gaps that may affect the reliability of the conclusions of this assessment.

1.5 The data analysis and report writing was done by Tom Gittings. Paul O'Donoghue assisted with project design, document preparation and undertook document review. Data entry was carried out by Owen Twomey.

1.6 This report relies heavily on the research carried out for a previous Marine Institute project: *The effects of intertidal oyster culture on the spatial distribution of waterbirds*. The results of this project have been published as technical report (Gittings and O'Donoghue, 2012) and a scientific paper (Gittings and O'Donoghue, 2016b). The report and paper, and additional unpublished data from this project, are referred to hereafter as the *trestle study*.

1.7 Scientific names and British Trust for Ornithology (BTO) species codes of bird species mentioned in the text are listed in Appendix A.

Structure of this report

1.8 The structure of the report is as follows: -

- Chapter 2 of the report describes the methodology used for the assessment.
- Chapter 3 of the report contains a preliminary screening assessment that reviews the Special Conservation Interests (SCIs) of the River Shannon and River Fergus Estuaries SPA, and the SCIs of other SPAs in the wider vicinity, and screens out SCIs that do not show any significant spatial overlap with the activities being assessed.
- Chapter 4 of the report describes the Conservation Objectives, and their attributes and targets, of the SCIs that were screened in for this assessment.

- Chapter 5 of the report contains a brief summary of waterbird habitats and distribution in the River Shannon and River Fergus Estuaries SPA, and of the status and distribution of the SCI species included in the assessment. This chapter only contains a very brief summary of distribution patterns; detailed analyses of distribution patterns of individual, species are carried out, as appropriate, in the impact assessment chapters later in the document.
- Chapter 6 provides a description of the current and proposed future extent of the aquaculture activities covered by this assessment and the nature of their operations.
- Chapter 7 assesses the likely impact of the intertidal aquaculture activities included in this assessment on the SCIs that were screened in for this assessment.
- Chapter 8 assesses the likely impact of the subtidal aquaculture activities included in this assessment on the SCIs that were screened in for this assessment.
- Chapter 9 contains an assessment of cumulative impacts.
- Chapter 10 concludes the report by assessing the impact of aquaculture activities in the Shannon Estuary, and any in-combination impacts (if relevant), on the conservation objectives of the SCIs included in this assessment.

Constraints to this assessment

1.9 This assessment is based on a desktop review of waterbird data and other relevant information combined with a limited number of site visits. The waterbird data available for the River Shannon and River Fergus Estuaries SPA is very limited, and there are also issues with the available intertidal mapping. Therefore, the conclusions derived from the analysis of this data are subject to very significant caveats, which are discussed in the relevant sections of this report.

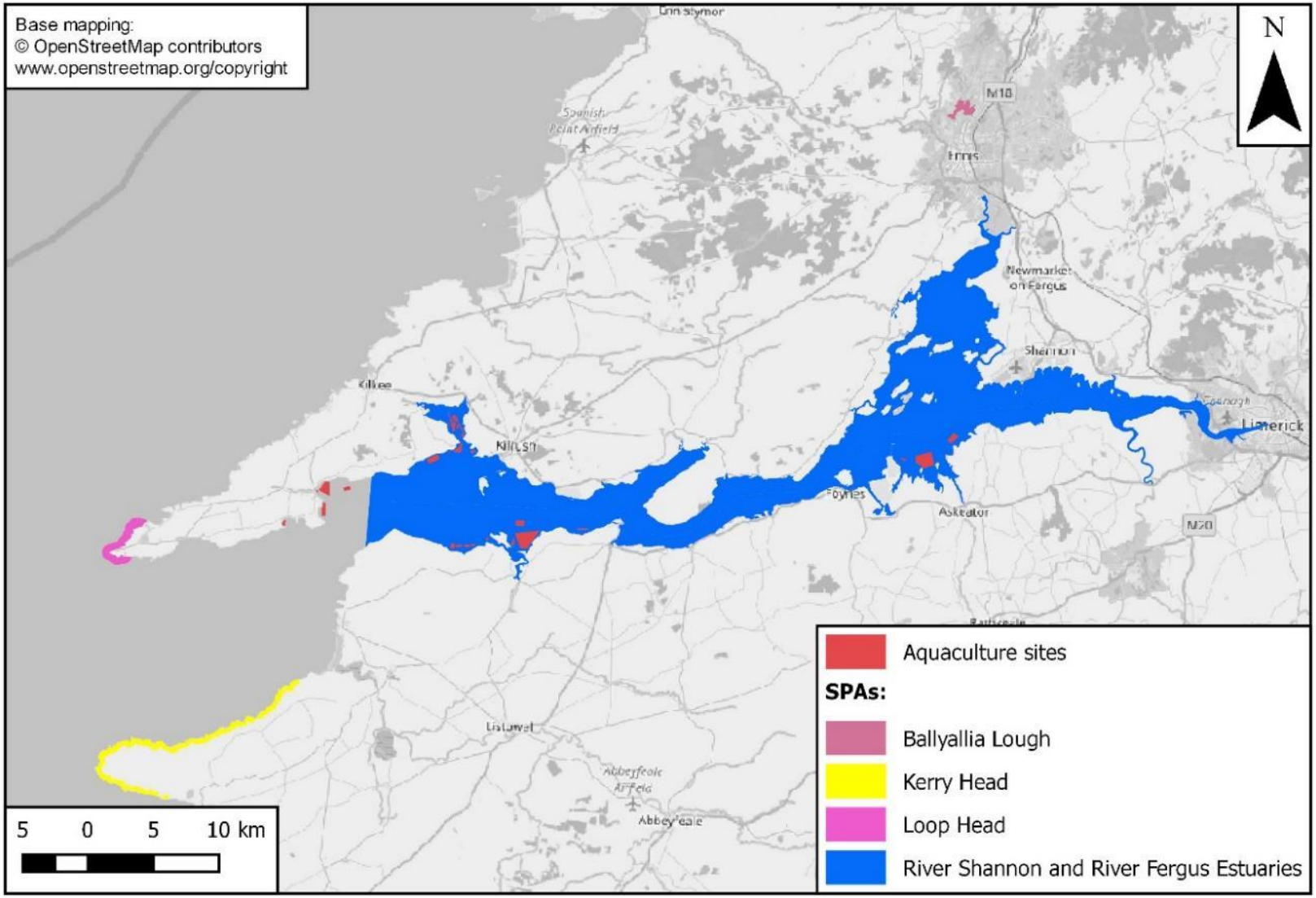

Figure 1.1 SPAs included in this assessment.

2. Methodology

General

2.1 This assessment is based on a desktop review of existing information about waterbird population trends and distribution in the River Shannon and River Fergus Estuaries SPA, supplemented by site visits to assess the habitat characteristics and tidal regimes in the areas around the aquaculture sites.

Data sources

2.2 The SPA boundaries are derived from NPWS shapefiles[2] (which were last updated on 09/11/2015).

2.3 The spatial extents of the aquaculture sites have been derived from shapefiles supplied by the Marine Institute (shapefile dated 14th September 2016).

2.4 Information on the development and current practices of aquaculture activities in the Shannon Estuary was obtained from the aquaculture profile document compiled by Bord Iascaigh Mhara (BIM) in May 2016, supplemented by additional information provided by BIM in response to specific queries, and information from the CLAMS report (CLAMS, 2002).

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

- Bird usage counts carried out in 2000-2002 by NPWS.
- Irish Wetland Bird Survey (I-WeBS) counts, 1994/95-2012/13.
- NPWS Waterbird Survey Programme (WSP) 2010/11 counts.
- The descriptions of waterbird distribution within the River Shannon and River Fergus Estuaries SPA in the SPA Conservation Objectives Supporting Document (NPWS, 2012c), and other reviews of waterbird distribution and waterbird count coverage in the River Shannon and River Fergus Estuaries SPA (Natura, 2012; Lewis *et al*., 2016).
- Data collected during the 2011 trestle study (Gittings and O'Donoghue, 2012, 2016b), including unpublished data not presented in these publications.
- General observations made during site visits by TG in October and November 2010 (for the trestle study) and in February and March 2017.

2.6 Information on the distribution of biotopes in the River Shannon and River Fergus Estuaries SPA is taken from the surveys of intertidal, subtidal and reef habitats by AQUAFACT (2011a, b, c), and the map showing the distribution of benthic communities in NPWS (2012b).

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

[2] http://www.npws.ie/maps-and-data/designated-site-data/download-boundary-data (accessed 19th January 2017).

Mapping

Intertidal habitat definitions and mapping

2.8 Ordnance Survey Ireland (OSI) mapping from the early 20th century forms the basis for the mapping of the mudflats and sandflats not covered by seawater at low tide (1140) Annex I habitat by NPWS (see 2012b). Subsequent changes in extent of this habitat will not be reflected in the OSI base mapping, nor in the subsequent NPWS mapping of intertidal habitat. Therefore, the NPWS mapping does not provide an accurate representation of the current distribution of intertidal habitat in the River Shannon and River Fergus Estuaries SPA.

2.9 An additional source of error in the NPWS mapping is that significant areas of *Spartina* beds are included in the area mapped as the *mudflats and sandflats not covered by seawater at low tide (1140)* Annex I habitat (per sobs), and the associated intertidal marine community types, in NPWS (2012b).

2.10 To have obtained accurate mapping of intertidal habitat for this assessment, it would have been necessary to carry out tideline mapping over tens of kilometres of intertidal habitat under a range of tidal conditions. This was beyond the scope of this assessment. Therefore, for the purposes of this assessment we have used the following procedure to draw up intertidal mapping for the entire River Shannon and River Fergus Estuaries SPA: -

- We used the mapping of the extent of intertidal mapping, which appears to be based on Admiralty mapping, and the division into shore types (sediment, mixed and rock) by AQUAFACT (2011a) as the basis for our mapping.
- This mapping defines all areas up to the 0m chart datum as intertidal habitat, which represents the area exposed on extreme spring low tides. The OSI mapping maps the intertidal habitat to the mean low tide (as recorded at the time of the surveys). Therefore, we used the tideline position from the OSI mapping to subdivide the AQUAFACT mapping into mean and spring low tide zones.
- For the aquaculture areas, we also reviewed the upper edge of the intertidal mapping and edited it to match the current shoreline as shown on recent aerial imagery, excluding areas of *Spartina* beds and miscellaneous other intrusions.
- For the GLIN AQUA, we also reviewed the shore type divisions mapped by AQUAFACT and edited it to match the habitat boundaries shown in recent aerial imagery.
- During out site visits, we made notes about any major discrepancies that we observed between the actual extent of intertidal habitat, and the areas mapped above. We used the observations to qualitatively modify assessments made from quantitative analysis of the above mapping.

2.11 The above procedure, provides a broad assessment of the likely distribution of open intertidal habitat in the River Shannon and River Fergus Estuaries SPA, with particular reference to the areas around the aquaculture sites.

2.12 Note that *Spartina* beds, and other saltmarsh habitats, are in the intertidal zone. However, this assessment focuses on open (unvegetated) intertidal habitats: i.e., intertidal habitats defined as littoral rock or littoral sediment habitats in Fossitt (2007). Therefore, in this report references to intertidal habitat refer to open (unvegetated) intertidal habitats.

Subtidal habitat definitions and mapping

2.13 We divided subtidal habitats into three categories to reflect waterbird usage of the habitat: shallow, moderately deep and deep. We defined shallow subtidal habitat as subtidal habitat less than 0.5m deep. This corresponds to the depth range used by most species of geese and dabbling ducks for foraging (Kirby *et al*., 2000; Cramp and Simmons, 2004). We defined moderately deep subtidal habitat as subtidal habitat less than 5m deep. This corresponds to the depth range used by various species of seaduck and grebes, including Scaup (Kirby *et al*., 2000; Cramp and Simmons, 2004). All subtidal habitat more than 5m deep was defined as deep subtidal habitat. Species associated with offshore and pelagic habitats, including Cormorant, can feed in this depth range.

2.14 We used the Admiralty Chart mapping to assess the distribution of these subtidal habitat categories within the River Shannon and River Fergus Estuaries SPA. We defined the shallow subtidal zone as the zone between the intertidal/subtidal boundary and the 0m contour on the Admiralty Chart, which represents the lowest astronomical tides, and we used -5m contour on the Admiralty Chart to define the boundary between the moderately deep and deep subtidal zones. In reality the spatial extent of the shallow subtidal zone will vary on each low tide, but the overall distribution of the zone between subsites is likely to remain similar. Varying amounts of the shallow subtidal zone will be exposed on spring low tides. Therefore, the shallow subtidal zone was also treated as being available to birds that feed in the intertidal zone on spring tides.

Aquaculture mapping

2.15 No detailed mapping of the existing extent of aquaculture activity (i.e., the areas of the aquaculture sites that are currently in use) in the River Shannon and River Fergus Estuaries SPA was available for this assessment.

2.16 A sketch map of the extent of trestles in the inner part of Poulnasherry Bay in 2000 was included in the NPWS bird usage data. We carried out some limited GPS mapping, supplemented by sketch mapping, of trestle blocks in the Poulnasherry Bay area, and in Ballylongford and Bunaclugga Bays in 2010, and made sketch mapping of the extent of trestle blocks in these areas on our site visits in 2017.

Site divisions

Waterbodies

2.17 The River Shannon and River Fergus Estuaries SPA is a very large site. The total area of the *mudflats and sandflats not covered by seawater at low tide (1140)* Annex I habitat mapped by NPWS in the SPA is over 8500 ha. This compares to areas ranging from around 5000 ha (Wexford Harbour and Slobs SPA) to 2300 ha (Lough Swilly) and 4300 ha (Castlemaine), in other coastal SPAs subject to similar assessments. The mapping of transitional and coastal waterbodies for the Water Framework Directive (WFD) divides the River Shannon and River Fergus Estuaries SPA into four main divisions, and all the aquaculture sites are in the Lower Shannon Estuary transitional waterbody, or the Mouth of the Shannon coastal waterbody. The total area of intertidal habitat within the Lower Shannon Estuary WFD site and the section of the Mouth of the Shannon coastal waterbody within the SPA is around 2500 ha, which is more comparable to the scale of the above previous assessments. Therefore, for analysing broad patterns of waterbird distribution, the River Shannon and River Fergus Estuaries SPA was divided into three waterbodies based on the WFD mapping: the Lower Shannon, the Upper Shannon and the Fergus Estuary (Figure 2.1). Furthermore, the assessment of potential displacement impacts consider the significance of the potential displacement in the context of the distribution of the species within the Lower Shannon waterbody, as well as in the context of the overall River Shannon and River Fergus Estuaries SPA.

Aquaculture sites

2.18 The aquaculture sites within the River Shannon and River Fergus Estuaries SPA can be divided into three distinct clusters: Poulnasherry Bay and surrounding area, Ballylongford and Bunaclugga Bays and the Aughinish area. Each of these clusters occurs in discrete areas of intertidal habitat separated from each other, and from other similar areas, by open water and/or long sections of shoreline with negligible amounts of intertidal habitat. For each of these clusters, the distribution of intertidal habitat, and the boundaries of waterbird count subsites have been used to define an *aquaculture area* (AQUA): the *Ballylongford/Bunaclugga AQUA*, the *Poulnasherry/Kilrush AQUA*, and the *Aughinish/Foynes AQUA*.

2.19 There are two additional outlying aquaculture sites within the River Shannon and River Fergus Estuaries SPA: one near Glin on the southern shore, and one near Killimer on the northern shore. The *Glin AQUA* has been defined using two waterbird count subsites around the site. The area around the Killimer site is referred to as the *Killimer AQUA*, but, as there is no discrete waterbird count data for this area, the extent of this AQUA has not been mapped.

2.20 The aquaculture sites outside the River Shannon and River Fergus Estuaries SPA that are included in this assessment are clustered in Carrigaholt Bay and the nearby Rinnevella Bay. These sites and the surrounding waters are collectively referred to as the *Carrigaholt AQUA*.

2.21 The above AQUAs form the main focus of detailed analysis of habitat and waterbird distribution patterns in this assessment. These AQUAs are shown in Figure 2.2.

2.22 Some of the discussions and analyses of waterbird distribution and impact assessments in the Poulnasherry/Kilrush AQUA make reference to Poulnasherry Bay. The area referred to as Poulnasherry Bay in this report is the estuarine bay that is enclosed by Cammoge Point, and is approximately defined by WSP subsite 0H519 and 520 (see Figure 7.2).

Waterbird count subsites

2.23 The River Shannon and River Fergus Estuaries SPA was divided into 66 subsites for the 2010/11 WSP survey. However, the analyses of waterbird distribution in this assessment focus on the subsites within the AQUAs (Table 2.1).

Table 2.1 - WSP subsites included in aquaculture areas (AQUAs).

AQUA	WSP subsites included
Ballylongford/Bunaclugga AQUA	0K507, 508 and 509
Poulnasherry/Kilrush AQUA	0H 507, 517, 518, 519 and 520
Glin AQUA	0I442 and443
Aughinish/Foynes AQUA	0I432, 436, 437, 438, 439, 449, 458 and 491

2.24 A large number of subsites have been used over the years for I-WeBS counts in the River Shannon and River Fergus Estuaries SPA. There have been different subsites used for aerial and ground-based surveys, and different subsites used between seasons for the same survey method. A detailed review of subsite coverage of the River Shannon and River Fergus Estuaries SPA has been carried out by Lewis *et al*. (2016). In this assessment, we only make limited use of I-WeBS data (for reasons discussed below) and we define the relevant I-WebS subsites as and when they are mentioned in the text.

Wintering waterbird datasets

I-WeBS

2.25 Waterbird populations and distribution in the River Shannon and River Fergus Estuaries SPA has been monitored as part of the Irish Wetland Bird Survey (I-WeBS) each winter since 1994/95.

2.26 The I-WeBS scheme aims to carry out monthly counts each winter between September and March in all sites that are important for non-breeding waterbird populations. However, this level of coverage is not always possible to achieve in a volunteer-based scheme, and the River Shannon and River Fergus Estuaries SPA is a particularly difficult site to cover due to its size and access issues in some of the major areas. Aerial surveys have been carried out most winters and these provide good coverage of certain species. However, many waterbird species are difficult to count accurately in aerial surveys. Also, the subsites used for the aerial surveys are generally very large, so they do not provide a high resolution of data on spatial distribution. Variable levels of counts have also been carried out from ground-based surveys.

2.27 I-WeBS data for the River Shannon and River Fergus Estuaries SPA is difficult to interpret due to variable coverage between winters, difference in the subsites used between winters, and issues with comparing aerial and ground-based survey data. Also, GIS mapping of the I-WeBS subsites was not available, although some of the subsites are shown in Lewis *et al*. (2016). Therefore, for this assessment we have only made limited use of the I-WeBS data.

Waterbird Survey Programme

2.28 Details of the Waterbird Survey Programme (WSP) methodology and results in the River Shannon and River Fergus Estuaries SPA are described in Cummins and Crowe (2011), NPWS (2012c) and Lewis and Tierney (2014).

Counts

2.29 Four low tide and one high tide counts were carried out. The counts were carried out by a coordinated team of eight professional counters. Each count was completed over two days (Cummins and Crowe, 2011). The low tide counts were carried out on 20-21st October 2010, 22nd and 24th November 2010, and 6th-7th January 2011 and 18th-19th February 2011. The high tide count was carried out on 26th-27th January 2011.

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

Flock maps

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

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

High tide roost survey

2.33 As part of the WSP, a high tide roost survey was carried out on 24th and 25th February 2011. This survey counted each high tide roost and mapped its position.

Trestle study

2.34 Poulnasherry Bay was included in a study carried out of the relationship between oyster trestle cultivation and waterbird distribution (Gittings and O'Donoghue, 2012, 2016b). This work included an extensive study across six sites, and one of these sites was Poulnasherry Bay.

2.35 At Poulnasherry Bay, a study area was defined that included the main block of trestles then present (which was located along the lower intertidal to the south of Black Island), and five control areas comprising trestle-free intertidal habitat. The control areas were selected to represent similar intertidal habitat to those occupied by trestles. Because of the extensive area of algal cover in the upper part of the Poulnasherry Bay, and the intermingled presence of areas of mixed sediment shore habitat, there were only limited areas of suitable control habitat.

2.36 Four counts were carried out in January and February 2011. Each count was carried out on low tides of 0.5-0.7 m (Kilrush), during the period when the intertidal habitat within the study area was fully exposed. On each count the numbers of all waterbird species were counted in each sector and their location (within or outside trestle blocks), position (tideline or intertidal) and activity (feeding or roosting/other) were recorded. The position of the tideline was also mapped in each sector.

NPWS bird usage counts

2.37 NPWS carried out a series of 21 low tide waterbird counts of Poulnasherry Bay in March-April 2000, February-April 2001 and November 2001-April 2002. These counts covered the inner bay, approximately corresponding to the area covered by WSP subsite 0H 519.

2.38 On each count, the positions of all, or most, of the birds counted were mapped (see example of a count map in Figure 2.3). The count area was also divided into eleven sectors, although sector count data was not included for all the count dates in the material that we received.

Analyses of waterbird distribution

Quantitative analyses

2.39 The quantitative analyses of waterbird distribution in this assessment focus on distribution patterns of feeding, or potentially feeding birds, as the main potential impacts will be to the availability and/or quality of feeding habitat. However, we have included assessment of potential impacts on roosting birds, where relevant.

2.40 We compared the broad waterbird distribution patterns of waterbirds across the River Shannon and River Fergus Estuaries SPA by calculating the mean percentage of each WSP count (including the high tide count) that occurred in each of the waterbodies. This analysis was restricted to birds that were recorded in intertidal and subtidal habitat on the low tide counts, but included birds recorded

in supratidal and terrestrial habitat on the high tide count (as many of the birds that feed in intertidal habitat at low tide may roost in supratidal or terrestrial habitat at high tide).

2.41 To assess the occurrence of waterbird species in each of the AQUAs we calculated the mean percentages of the total SPA count, and of the total Lower Shannon count, that occurred in the AQUA on each WSP count (including the high tide count). Again, the analysis was restricted to birds that were recorded in intertidal and subtidal habitat on the low tide counts, but included birds recorded in supratidal and terrestrial habitat on the high tide count.

2.42 To assess the distribution of waterbird species within the AQUAs we calculated the mean count that occurred in each of the WSP subsites within the AQUA on each WSP low tide count. We used the mean subsite count rather than mean percentages of the total AQUA count because the overall numbers of many species were so low that mean percentages would be biased by the random effects of small count totals. These calculations were restricted to birds that were recorded in intertidal and subtidal habitat.

2.43 In Poulnasherry Bay, we made an additional analysis using the NPWS bird usage counts. This analysis compared the mean, and range of, total numbers recorded between the bird usage count dataset with the WSP dataset. To do this we restricted the analysis of the bird usage count dataset to counts from the same seasonal period as the WSP counts, so we only used the bird usage counts from February 2011 and November 2011-February 2012. We restricted the analysis of the WSP count dataset to birds recorded in intertidal and subtidal habitat in subsite 0H519.

2.44 In the analyses using percentage distributions, we excluded counts with very low overall totals from the analyses.

Flock mapping data

2.45 We used the WSP flock mapping data to supplement our analyses of waterbird distribution patterns. The flock mapping data can be useful in indicating relationships between species distributions and broad topographical/habitat zones, such as biotopes, edges of tidal channels, upper shore areas, etc. However, there are some limitations to the interpretation of flock map data because of the difficulties of accurately mapping positions of distant flocks from shoreline vantage points and also the different observers may have varied in the extent to which they mapped flocks. Therefore, in reviewing flock mapping data we compared it with the subsite counts and if there were significant discrepancies (e.g., lack of flocks mapped in the subsite that held the largest numbers), we interpreted the data with caution.

2.46 In Poulnasherry Bay we were also able to use the flock mapping data from the NPWS bird usage counts. To do this we mapped the centroid of each flock position mapped on each count. As these counts effectively mapped all of the birds counted, and given the number of counts and the nature of the area counted (which makes mapping of bird positions more reliable than in many of the other areas covered by the WSP), this flock mapping data is likely to provide a fairly reliable picture of low tide waterbird distribution within Poulnasherry Bay during the period covered by the counts.

Trestle study data

2.47 We used the site-specific data for Poulnasherry Bay from the trestle study to analyse patterns of association with oyster trestles. We tested the null hypothesis that bird distribution within our study area at Poulnasherry Bay was not affected by the presence of oyster trestles, so that the observed occurrence of birds within areas of oyster trestles was not significantly different from that predicted by the percentage of the available habitat occupied by the oyster trestles. We calculated the numbers that would be expected to occur within the oyster trestle blocks under the null hypothesis

and then used Jacobs' Index (D; Jacobs 1974) to quantify the degree of positive or negative association with trestle blocks. D can vary from -1 (indicating complete avoidance) to +1 (strong preference). Full details of these analyses are provided in Gittings and O'Donoghue (2016b).

Assessment methodology

Screening

2.48 The SCIs of the River Shannon and River Fergus Estuaries SPA, and other nearby SPAs, were reviewed and screened in for detailed assessment if: -

- The SCI was considered likely to have significant spatial overlap with the aquaculture activities in the Shannon Estuary, or the potential for such overlap could not be discounted; and
- The SCI was considered likely to be adversely impacted by the aquaculture activities, or the potential for adverse impacts could not be discounted.

2.49 For SCIs of other SPAs it is difficult to determine the likelihood of spatial overlap as there is generally little information about movements of wintering birds between sites, or about the foraging ranges from breeding colonies.

2.50 For waterbird SCIs of other SPAs designated for their wintering populations, we considered the general ecology of the species and, in particular, their known usage of non-tidal habitats[3] and/or the degree of site faithfulness.

2.51 For SCIs designated for their breeding populations, we used information from the literature to define typical foraging ranges for various species.

2.52 The main source for our information on foraging ranges was the BirdLife Seabird Foraging Database (Thaxter *et al.*, 2012). This provides a range of values for foraging ranges (the mean, the mean maximum and the maximum). The explanatory document for the BirdLife Seabird Foraging Database (Lascelles, 2008) says "*it may be useful to think of areas within the average foraging range as a core zone of activity being exploited by the majority of the birds the majority of the time, and those between the average and the maximum foraging range as a buffer zone, exploited by fewer birds for less of the time*" (although it also acknowledges that this is not always the case). Therefore, we have generally focused on the mean foraging range (rather than the mean maximum or maximum) to give an indication of the core foraging zones.

2.53 It should be noted that the above approach is analogous to the approach recommended by Scottish Natural Heritage for considering connectivity between SPAs and wind farm developments for the purposes of screening (Scottish Natural Heritage, 2013). The Scottish Natural Heritage guidance states that: -

> "*In most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests. Maximum ranges are also provided to indicate that birds will, at times, travel further. In exceptional cases distances up to the maximum foraging range may be considered; for example, whilst osprey core foraging range is 10 km an osprey foraging at a loch well beyond this distance from its SPA may still be connected if there is a lack of other closer foraging sites.*"

[3] Waterbird SCIs that make significant use of non-tidal habitats are more likely to move away from the SPA that they are a SCI of, and, therefore, may be more likely to have some interchange with the River Shannon and River Fergus Estuaries SPA.

2.54 We are not aware of any other explicit guidance relating to this issue. Therefore, we consider that our approach for screening the SCIs designated for their breeding populations is in accordance with recognised best practise for assessing potential connectivity between breeding bird populations and development proposals.

Identification of potential impacts

2.55 The potential impacts of the activities covered in this assessment were assessed under three broad categories: ecosystem effects, habitat impacts and disturbance impacts.

Ecosystem effects

2.56 Large-scale bivalve aquaculture could, theoretically, have impacts on ecosystem functioning and reduce the abundance of food resources for waterbird species. This could occur as a result of reduced recruitment (due to direct consumption of eggs and larvae by the cultured bivalves), and/or through indirect food web effects (e.g., consumption of organic matter by the cultured bivalves that would have otherwise been available to support other species). We describe these potential impacts as ecosystem effects as they are not spatially restricted to the areas in the vicinity of the aquaculture sites, but could affect the whole ecosystem.

2.57 Detailed consideration of ecosystem effects and / or ecosystem modelling in order to provide a robust assessment of potential impacts is beyond the scope of this assessment. However, the scale of the aquaculture activities covered by this assessment, relative to the overall size of the River Shannon and River Fergus Estuaries SPA ecosystem indicates that ecosystem effects from these activities are unlikely to be an issue at the SPA scale in the River Shannon and River Fergus Estuaries SPA. Therefore, we have not analysed potential ecosystem impacts in this assessment.

Habitat and disturbance impacts

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

2.59 For each of the aquaculture activities included in this assessment, we reviewed the scientific literature to assess the potential impact of the activity of intertidal and subtidal habitat structure and function and how this might affect the availability of food resources for the SCI species covered by this assessment.

2.60 For two of the aquaculture activities included in this assessment we were able to use the results of detailed research to directly assess the potential impacts on waterbirds: the trestle study (Gittings and O'Donoghue, 2012, 2016b) for the assessment of oyster trestle cultivation; and work by Roycroft *et al*. (2004, 2007) in Bantry Bay (the Bantry Bay study) for the assessment of suspended mussel cultivation. The trestle study was carried out during periods with typical levels of husbandry activity, and the Bantry Bay study was also carried out using operational farms where it can be assumed that typical levels of husbandry activity were taking place. Therefore, the effects of disturbance due to husbandry activity associated with these assessments are included in the categorisation of species responses by these studies.

2.61 The trestle study focused on species associated with the intertidal and/or shallow subtidal habitats and did not assess potential impacts to fish-eating species that may use the trestle areas at high tide, while detailed scientific information on the potential impacts to waterbirds of the other aquaculture activities included in this assessment (bottom mussel culture and bouchet mussel

culture) is not available. For these potential impacts/activities, we used the literature review of the potential impact on food resources, as well as information from studies of analogous types of physical impacts, to assess the potential impacts of habitat alteration, and we used information on the timing and frequency of husbandry activity, and the sensitivity of the species concerned, to assess the potential impact of disturbance.

2.62 We also assessed the potential impact of disturbance from travel to/from the aquaculture sites by reviewing the access routes in relation to potentially sensitive areas, and taking into account the timing and frequency of the usage of these routes.

Assessment of impact magnitude

Displacement impacts

2.63 Where potential impacts from an aquaculture activity on a SCI species have been identified, or cannot be ruled out, the spatial overlap between the distribution of the species and the spatial extent of the activity was assessed. This overlap is considered to represent the potential magnitude of the impact, as it represents the maximum potential displacement if the species has a negative response to aquaculture activity.

2.64 In previous assessments (e.g., Gittings and O'Donoghue, 2014) we have used detailed quantitative analyses to assess potential displacement impacts. However, in the present assessment we considered that the quality of the available data was not sufficient to support quantitative analysis. This was due to the poor quality of the marine community types mapping supplied by NPWS, the very limited amount of data on waterbird distribution within the River Shannon and River Fergus Estuaries SPA, and the limitations of the scope of the work for this assessment which precluded detailed site surveys. Therefore, for this assessment, we have qualitatively assessed the potential displacement impacts using the scale defined in Table 2.2.

2.65 We assessed potential displacement impacts separately in each AQUA.

Table 2.2 - Impact magnitude scale used to assess displacement impacts.

Magnitude level	Criteria
Negligible	Subsite(s) containing the aquaculture site(s) appears to hold very low numbers and/or appears to be irregularly used Subsite(s) containing the aquaculture site(s) appears to hold low or moderate number numbers, but habitat characteristics or other factors suggest that the birds do not make significant use of the sections of the subsite(s) around the aquaculture site(s)
Minor	Subsite(s) containing the aquaculture site(s) appears to hold low numbers Subsite(s) containing the aquaculture site appears to hold moderate number numbers, but habitat characteristics or other factors suggest that the birds show preferences for sections of the subsite(s) away from the aquaculture site(s)
Moderate	Subsite(s) containing the aquaculture site(s) appears to hold moderate numbers Subsite(s) containing the aquaculture site(s) appears to hold large numbers, but habitat characteristics or other factors suggest that the birds show preferences for sections of the subsite(s) away from the aquaculture site(s)
Substantial	Subsite(s) containing the aquaculture site(s) appears to hold moderate numbers, but habitat characteristics or other factors suggest that the birds are likely to be concentrated in sections of the subsite(s) around the aquaculture site(s) Subsite(s) containing the aquaculture site(s) appears to hold large numbers, and habitat characteristics or other factors suggest that the birds will make significant use of the aquaculture site(s)

Impacts on population trends

2.66 There has been aquaculture activity in the River Shannon and River Fergus Estuaries SPA since at least the 1970s (CLAMS, 2002). Therefore, in theory, analysis of the waterbird population trends in relation to the development of the aquaculture activity could reveal evidence about the nature of any impacts from aquaculture on the waterbird populations. However, the information on the timing of the development of aquaculture activity in the River Shannon and River Fergus Estuaries SPA is very limited, while the issues with I-WeBS coverage affect the reliability of the data on waterbird population trends in the River Shannon and River Fergus Estuaries SPA[4]. Therefore, we do not consider that it would be appropriate to attempt to assess the potential impact of past aquaculture development on waterbird population trends in the River Shannon and River Fergus Estuaries SPA.

Assessment of significance

2.67 The significance of any potential impacts identified has been assessed with reference to the attributes and targets specified by NPWS (2012b, 2016a, b and c). Potential negative impacts are either assessed as significant (if the assessment indicates that they will have a detectable effect on the attributes and targets) or not significant. The significance levels of potential positive impacts have not been assessed.

[4] For all species, except Whooper Swan and Wigeon, where population trends were assessed by NPWS (2012c), a moderate or high level of caution was assigned to the assessed trend, and site conservation condition was only categorised for Whooper Swan and Wigeon.

River Shannon and River Fergus Estuaries SPA wintering waterbird SCIs

Attribute 2 – Distribution

2.68 For these SCIs, we have focused on attribute 2 (distribution) of the conservation objectives.

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

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

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

2.72 In this assessment, we have not calculated quantitative displacement levels (for the reasons discussed above; see paragraph 2.64). Instead we have taken a substantial displacement impact in one AQUA, or a combination of moderate displacement impacts across more than one AQUA, as being equivalent to exceeding the threshold of a 5% displacement level.

Attribute 1 - Population trends

2.73 Impacts on this attribute are only likely to occur if there are high levels of displacement impacts. However, there is a high level of uncertainty about the magnitude of the displacement impacts that

are likely to occur. Therefore, we do not consider that it would be appropriate to attempt to assess the impact on this attribute given the current level of available data.

River Shannon and River Fergus Estuaries SPA breeding Cormorant SCI

2.74 We used the relevant attributes and targets to qualitatively assess the significance of potential impacts to the breeding Cormorant SCI of the River Shannon and River Fergus Estuaries SPA.

Ballyallia Lough SPA SCIs

2.75 NPWS have only published generic conservation objectives for this SPAs. However, as the SCIs screened in from this SPA are wintering waterbird populations, we have assumed that the same attributes and targets apply as for the River Shannon and River Fergus Estuaries SPA wintering waterbird SCIs.

Kerry Head and Loop Head SPA SCIs

2.76 Three SCIs were screened in from these SPAs: the Fulmar breeding population in the Kerry Head SPA and the Kittiwake and Guillemot breeding population in the Loop Head SPA.

2.77 NPWS have only published generic conservation objectives for these SPAs. However, for the Fulmar, purposes of our assessment, we have assumed that the attributes and targets specified for the Kittiwake and Guillemot breeding populations in the Saltee Islands SPA (NPWS, 2011a) also apply to these SCIs.

2.78 We used these attributes and targets to qualitatively assess the significance of potential impacts to these three SCIs.

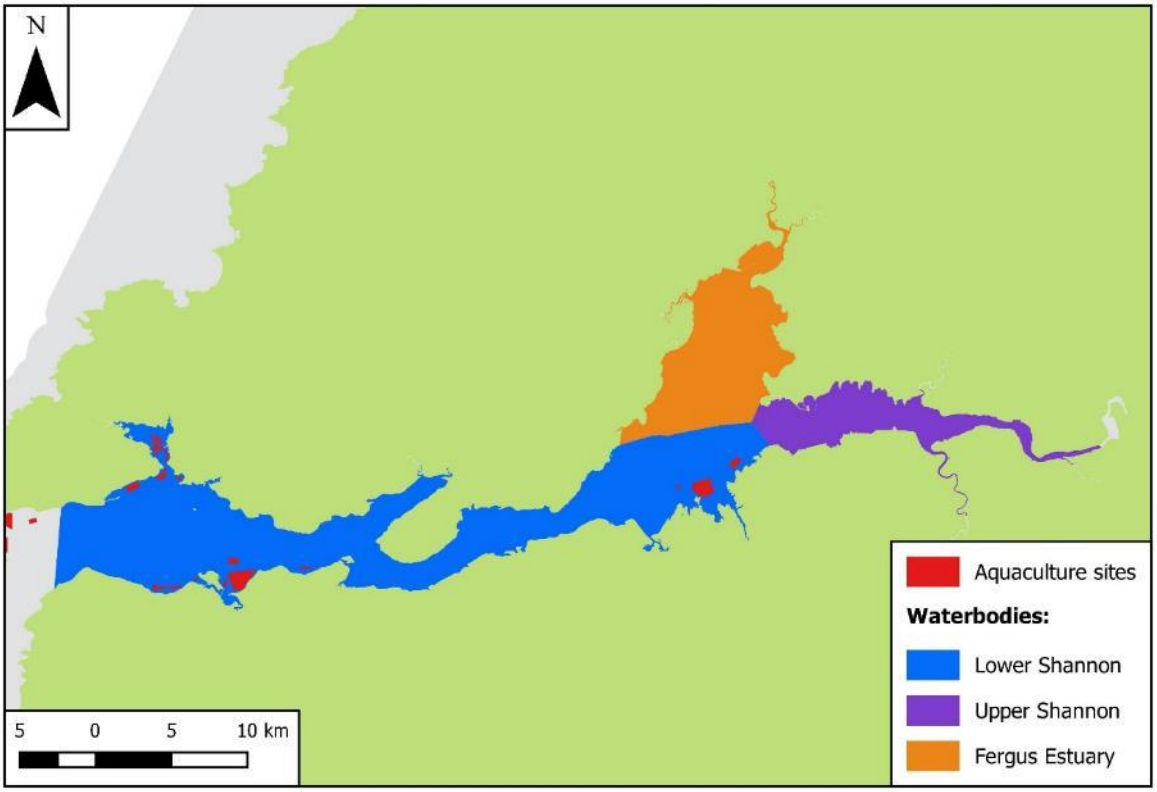

Figure 2.1 Waterbodies used for broad divisions of the River Shannon and River Fergus Estuaries SPA.

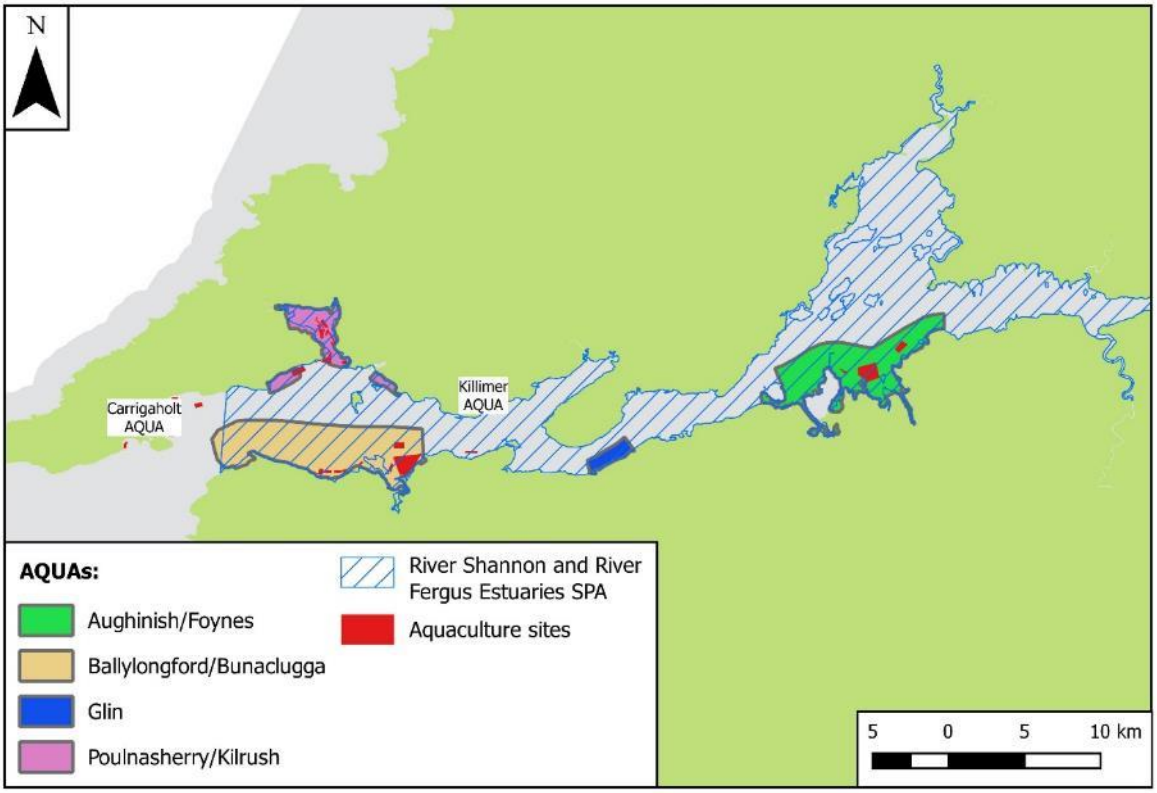

Figure 2.2 Aquaculture Areas (AQUAs) used for detailed assessments.

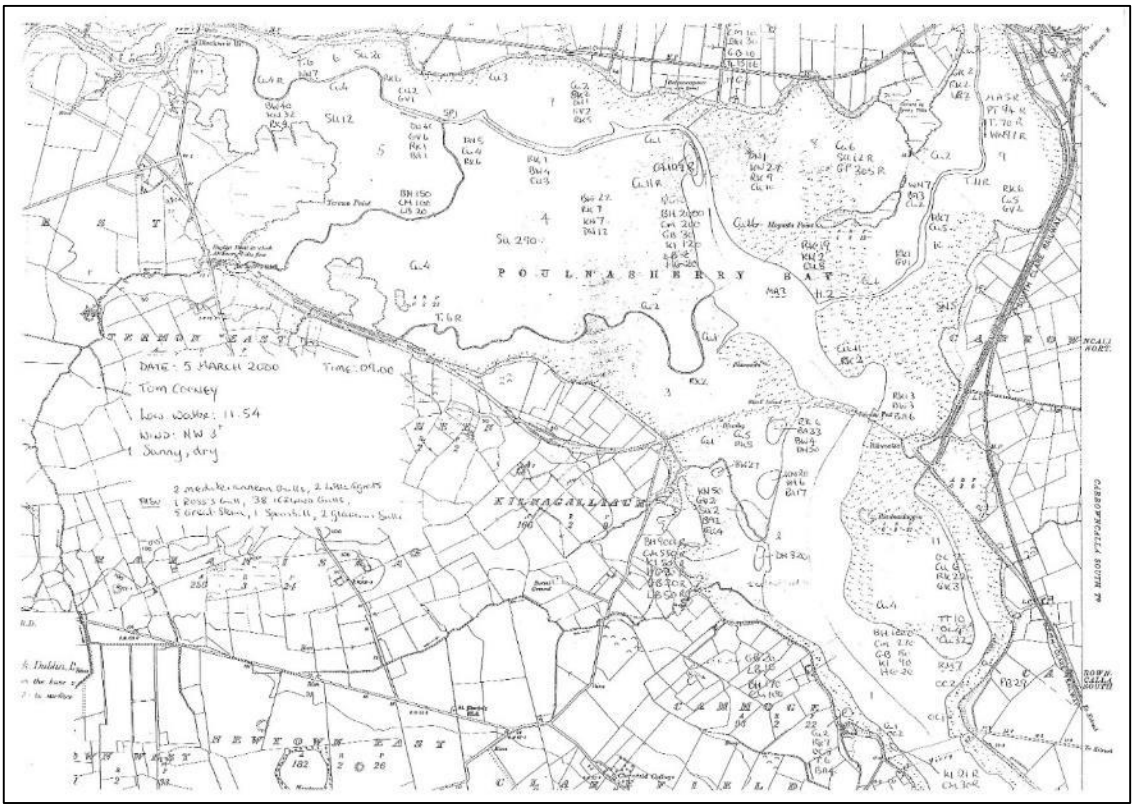

Figure 2.3 Example of a count map from the NPWS bird usage counts.

3. Screening

Introduction

3.1 In addition to the River Shannon and Fergus Estuaries SPA, there are five other SPAs within 15 km of the aquaculture sites in the Shannon Estuary: the Illaunonearaun SPA, the Kerry Head SPA, the Loop Head SPA, the Mid-Clare Coast SPA, and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Figure 3.1). There is also potential connectivity with the Ballyallia Lough SPA (Figure 3.1).

River Shannon and Fergus Estuaries SPA

Waterbird SCIs

3.2 All of the SCI species (Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank and Black-headed Gull) make significant use of subtidal and/or intertidal habitat in the River Shannon and Fergus Estuaries. The aquaculture activities covered in this assessment will affect 631 ha of intertidal and subtidal habitat and have the potential to cause significant changes to habitat structure and/or food availability. Therefore, the activities being assessed could potentially have significant impacts on SCIs that use subtidal and/or intertidal habitat.

Wetlands and waterbirds

3.3 The Conservation Objectives define the favourable conservation condition of the wetlands and waterbird SCI in the River Shannon and Fergus Estuaries SPA purely in terms of habitat area.

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

Illaunonearaun SPA

3.5 The only SCI of the Illaunonearaun SPA (site code 004114) is Barnacle Goose. This species has not been recorded in any of the available waterbird counts for the River Shannon and Fergus Estuaries. Therefore, the Illaunonearaun SPA can be screened out from further assessment.

Kerry Head SPA

3.6 The SCIs of the Kerry Head SPA (site code 004189) are Fulmar and Chough.

3.7 Fulmar has a mean foraging range of 47.5 km, which would bring the aquaculture sites in the outer part of the Shannon Estuary into the potential range of birds from the Kerry Head colony. Therefore, the Fulmar SCI of the Kerry Head SPA has been screened in for further assessment.

3.8 Chough does not make significant use of intertidal or subtidal habitat. Therefore, this SCI can be screened out from further assessment.

Loop Head SPA

3.9 The SCIs of the Loop Head SPA (site code 004119) are Kittiwake and Guillemot. Kittiwake has a mean foraging range of 24.8 km, and Guillemot has a mean foraging range of 37.8 km. Therefore, the aquaculture sites in the outer part of the Shannon Estuary are within the potential range of birds from the Loop Head colony and these SCIs have been screened in for further assessment.

Mid-Clare Coast SPA

3.10 The Mid-Clare Coast SPA (site code 004182) is 7km from the nearest aquaculture sites in the Shannon Estuary. However, this SPA is on the northern side of the Loop Head peninsula, and the distance for a bird travelling around the coast is around 40km.

3.11 The SCIs of the Mid-Clare Coast SPA are Barnacle Goose, Cormorant, Ringed Plover, Turnstone, Sanderling, Dunlin and Purple Sandpiper.

3.12 Barnacle Goose can be screened out from further assessment as it does not occur in the River Shannon and Fergus Estuaries (see above).

3.13 Ringed Plover, Turnstone, Sanderling, Dunlin and Purple Sandpiper are all species that are classified as having high site fidelity (NPWS, 2014). Therefore, given the distance of the Mid-Clare Coast SPA from the River Shannon and Fergus Estuaries, and the fact that all these species are unlikely to make inland movements, these SCIs can all be screened out from further assessment.

3.14 Cormorant is listed as a SCI of the Mid-Clare Coast SPA for its breeding population. The Cormorant breeding colony in the Mid-Clare Coast SPA occurs on Mattle Island. This is around 14.5km from the aquaculture sites in Poulnasherry Bay, which are the nearest aquaculture sites in the Shannon Estuary, and around 45km for a bird travelling around the coast from the aquaculture sites in Carrigaholt Bay, which are the nearest aquaculture sites in the Shannon Estuary for a bird travelling around the coast. The mean foraging range of Cormorant from breeding colonies is 8.5km, and the mean maximum is 25km. Cormorant do regularly travel overland. However, even for birds travelling overland the aquaculture sites in the Shannon Estuary are outside the likely core foraging range for birds from the Mattle Island breeding colony. Therefore, this SCI has been screened out from further assessment.

Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA

3.15 The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (site code 004161) is 3km from the nearest aquaculture sites in the Shannon Estuary. The only SCI of this SPA is its breeding population of Hen Harrier. This species does not make significant use of intertidal or subtidal habitat. Therefore, this SCI can be screened out from further assessment.

Ballyallia Lough SPA

3.16 Ballyallia Lough SPA (site code 004041) is 24 km from the nearest aquaculture sites in the Shannon Estuary. However it is in the catchment of the River Fergus and is only 6 km from the upper edge of the River Shannon and River Fergus Estuaries SPA. Therefore, there is significant potential for waterbird movements between Ballyallia Lough and the River Shannon and River Fergus Estuaries SPA.

3.17 The SCIs of the Ballyallia Lough SPA are Wigeon, Gadwall, Teal, Mallard, Shoveler, Coot and Black-tailed Godwit. Black-tailed Godwit has high site fidelity (NPWS, 2012c), but given the nature of the species wintering behaviour in Ireland, and the proximity of Ballyallia Lough to the Fergus Estuary, movements between Ballyallia Lough and the Fergus Estuary are likely to occur. Therefore, this SCI has been screened in for further assessment. The other species all have moderate, weak or unknown site fidelity (NPWS, 2011b, 2012c). Gadwall rarely occur in the Shannon and Fergus Estuaries (only eleven records across all I-WeBS counts), while Coot generally do not use intertidal or subtidal habitat. Therefore, these species have been screened out from further assessment. Wigeon, Teal, Mallard and Shoveler regularly occur in the Shannon and Fergus Estuaries and these SCIs have been screened in for further assessment.

3.18 Note that Wigeon, Teal, Shoveler and Black-tailed Godwit are all also SCIs of the River Shannon and River Fergus Estuaries SPA.

Other SPAs

3.19 Other SPAs in the wider vicinity of the Shannon Estuary were also reviewed during this screening exercise. No potential for significant connectivity between SCIs of these SPAs and the aquaculture activities in the Shannon Estuary was identified due to the distance of these SPAs from the aquaculture sites, the presence of physical barriers to movement (e.g. the configuration of the coastline) and/or the ecology of the species concerned.

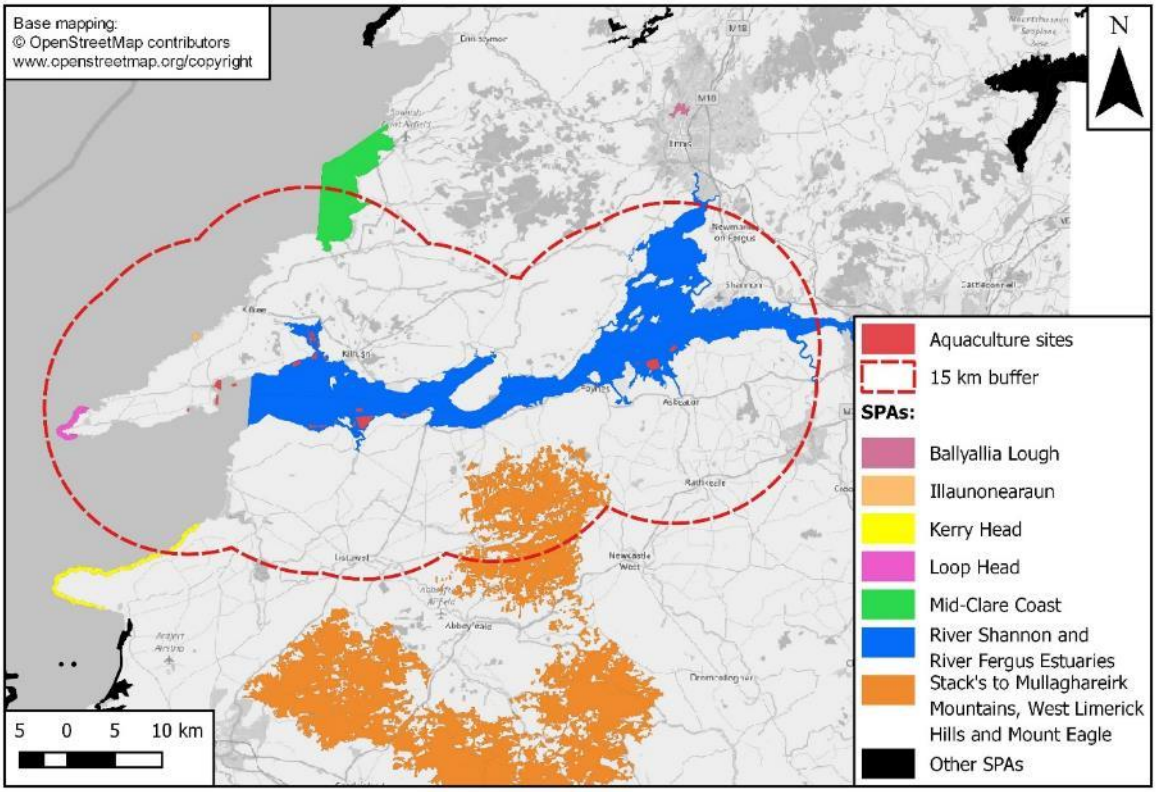

Figure 3.1 SPAs in the wider vicinity of the Shannon Estuary.

4. Conservation objectives

River Shannon and Fergus Estuaries SPA

SCIs listed for their wintering populations

4.1 The conservation objectives for the wintering populations of Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Cormorant, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank and Black-headed Gull in the River Shannon and Fergus Estuaries SPA are to maintain their favourable conservation condition (NPWS, 2012b).

4.2 The favourable conservation conditions of these SCIs in the River Shannon and Fergus Estuaries SPA are defined by various attributes and targets, which are shown in Table 4.1.

Table 4.1 - Attributes and targets for the conservation objectives for the wintering populations of Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Cormorant, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank and Black-headed Gull in the River Shannon and Fergus Estuaries SPA.

Attribute	Measure	Target	Notes
1 Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the Conservation Objectives Supporting Document
2 Distribution	Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing and intensity of use of areas used by the … [SCI species] other than that occurring from natural patterns of variation	As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2010/11 waterbird survey programme is discussed in part five of the conservation objectives supporting document

Source: NPWS (2012b).

Attributes are not numbered in NPWS (2012b), but are numbered here for convenience.

SCI listed for its breeding population

4.3 The conservation objective for the breeding population of Cormorant in the River Shannon and Fergus Estuaries SPA is to maintain its favourable conservation condition (NPWS, 2012b). The favourable conservation condition of this population is defined by the following attributes: breeding population abundance, productivity rate, distribution of breeding colonies, availability of prey biomass, barriers to connectivity, and disturbance at the breeding site.

Kerry Head SPA

4.4 The conservation objective for the breeding population of Fulmar in the Kerry Head SPA is to maintain or restore its favourable conservation condition (NPWS, 2016b). Site-specific conservation objectives have not been published for this SPA.

Loop Head SPA

4.5 The conservation objective for the breeding populations of Kittiwake and Guillemot in the Loop Head SPA is to maintain or restore its favourable conservation condition (NPWS, 2016c). Site-specific conservation objectives have not been published for this SPA.

Ballyallia Lough SPA

4.6 The conservation objective for the populations of Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit in the Ballyallia Lough SPA are to maintain or restore their favourable conservation condition (NPWS, 2016a). Site-specific conservation objectives have not been published for this SPA.

5. Status and habitats and distribution of the SCI species

Status of the SCI species

River Shannon and Fergus Estuaries

5.1 The population trends and site conservation conditions assessed by NPWS (2012c) for the wintering waterbird SCIs of the River Shannon and River Fergus Estuaries SPA are shown in Table 7.5. Most species for which the trends have been assessed appear to show large declines over the period covered by the assessment (1994/95 to 2008/09). However, high, or moderate, levels of caution apply to these population trends. Site conservation condition categories have only been assigned for two species: Whooper Swan, which is assessed as being in favourable condition, and Wigeon, which is assessed as being in highly unfavourable condition.

Table 5.1 - Population trends and site conservation conditions for the wintering waterbird SCIs of the River Shannon and River Fergus Estuaries SPA.

Species	Population trend	Level of caution applied	Site conservation condition
Whooper Swan	Increase	Low	Favourable
Light-bellied Brent Goose	Decline >50%	Moderate	Undetermined
Shelduck	Decline >50%	Moderate	Undetermined
Wigeon	Decline >50%	Low	Highly unfavourable
Teal	Decline >50%	Moderate	Undetermined
Pintail	-		Undetermined
Shoveler	-		Undetermined
Cormorant	Decline 1.0 – 24.9%	Moderate	Undetermined
Golden Plover	Decline >50%	Moderate	Undetermined
Grey Plover	Decline >50%	Moderate	Undetermined
Lapwing	Decline >50%	Moderate	Undetermined
Ringed Plover	Decline >50%	High	Undetermined
Curlew	Decline >50%	Moderate	Undetermined
Black-tailed Godwit	Decline >50%	High	Undetermined
Bar-tailed Godwit	-		Undetermined
Knot	Decline >50%	Moderate	Undetermined
Dunlin	Decline >50%	High	Undetermined
Greenshank	Decline -25.0% to -49.9%	High	Undetermined
Redshank	Decline >50%	Moderate	Undetermined
Black-headed Gull	Decline -25.0% to -49.9%	Moderate	Undetermined

Source: Table 4.2 in NPWS (2012c).

5.2 The Cormorant breeding population of the River Shannon and River Fergus Estuaries SPA was estimated as 93 occupied nests in 2010 (NPWS, unpublished data). There is no information available on the population trends of this population of the River Shannon and River Fergus Estuaries SPA, and its conservation condition has not been assessed by NPWS.

Other SPAs

5.3 The conservation conditions of the SCIs screened in from other SPAs for this assessment have not been assessed by NPWS.

Waterbird habitats and distribution in the River Shannon and Fergus Estuaries

Waterbird habitats

Intertidal habitats

5.4 A total of around 8,500 ha of intertidal littoral sediment and rock habitat was mapped by NPWS in their marine community types mapping of the River Shannon and River Fergus Estuaries SPA (NPWS, 2012b). Potential sources of error associated within this mapping are discussed in paragraphs 2.8-2.9. Most of the intertidal habitat occurs in the Fergus Estuary and in the upper section of the Shannon Estuary. Downstream of Foynes Island, there is generally only a narrow intertidal zone, with more extensive areas of intertidal habitat being restricted to a few bays and inlets such as Clonderlaw Bay and Poulnasherry Bay on the northern shore and Tarbert Bay and Ballylongford Bay on the southern shore (Figure 5.1).

5.5 The intertidal littoral sediment and rock habitat was classified by NPWS (2012b) into three marine community types: the *fucoid-dominated intertidal reef community complex*, the *intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex* and then *intertidal sand with Scolelepis squamata and Pontocrates spp. community.*

5.6 The *intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex* includes most of the intertidal littoral sediment habitat within the River Shannon and River Fergus Estuaries SPA and covers a wide range of variation in sediment types from soft muddy sediments in the upper parts of the SPA and in the estuaries and bays in the lower parts of the SPA, to firm sandflat type habitat along the exposed shorelines in the lower parts of the SPA, and also includes areas of mixed sediment habitat with gravel and cobbles mixed in muddy and/or sandy sediments.

5.7 The *intertidal sand with Scolelepis squamata and Pontocrates spp. community* only occurs in the outer part of the River Shannon and River Fergus Estuaries SPA along the southern shoreline to the west of Carrig Island. This appears to represent areas with shores of loose, dry sand and the mapped area corresponds to the area mapped as *beach* on the OS Discovery mapping.

5.8 The *fucoid-dominated intertidal reef community complex* appears to represent a range of littoral rock habitats. It occurs extensively along the shoreline of the lower parts of the River Shannon and River Fergus Estuaries SPA, both in narrow bands along steeply shelving sections of shoreline, where it is the only mapped intertidal habitat, and around the upper edges of more extensive intertidal areas in bays and inlets.

5.9 *Zostera noltii* was recorded in Poulnasherry Bay by Falvey *et al*. (1997). However, no *Zostera* beds have been identified in the NPWS marine community types classification of the River Shannon and River Fergus Estuaries SPA. We understand that the site is to be resurveyed by the EPA in 2018.

5.10 More detailed analysis of the intertidal habitats in the AQUAs is included in Chapter 7.

Subtidal habitats

5.11 The majority of subtidal habitat within the River Shannon and River Fergus Estuaries SPA is deep subtidal habitat, with depths ranging from around 5-40 m below chart datum. Moderately deep subtidal habitat (0-5 m below chart datum) only occurs in narrow bands around 50-200 m wide along most of the shoreline of the Lower Shannon waterbody, but with more extensive areas in the Aughinish/Foynes area, Clonderlaw Bay, Poulnasherry Bay and Ballylongford Bay. The distribution of shallow subtidal habitat (areas of water depth less than 0.5 m deep at low tide) reflects the distribution of intertidal habitat.

Habitat use

5.12 The majority of the waterbird species considered in this assessment are typically associated with intertidal habitat and in the WSP low tide counts, most species were mainly recorded in intertidal habitat (Table 5.2). The exceptions were Whooper Swan and Shoveler. The Whooper Swan wintering population in the Shannon Estuary area mainly forage on agricultural fields outside the River Shannon and River Fergus Estuaries SPA boundary (NPWS, 2012c). Therefore, their recorded distribution during the WSP counts was not an accurate reflection of the overall distribution of the habitats used by this population. Shoveler were mainly recorded in the Shannon Airport lagoon, and at Mangan's Lough on Aughinish Island, although a flock of 37 was recorded from intertidal habitat in Poulnasherry Bay during the high tide count.

5.13 The other species that typically feed in fields (Golden Plover, Lapwing, Black-tailed Godwit, Curlew and Black-headed Gull) were rarely, or never, recorded in the terrestrial zone during the WSP counts. However, again, this presumably reflects the survey methodology and does not necessarily indicate an absence of field feeding behaviour by these species.

5.14 The high percentage of Cormorant in the intertidal zone might seem surprising, as this species normally feeds in subtidal habitat. However, all the birds recorded feeding were in subtidal habitat. The high percentage in the intertidal zone reflects the habit of this species in forming daytime roosts in the intertidal zone.

Table 5.2 - Habitat use in the 2010/11 WSP low tide counts.

Species	Mean percentage of total count in habitat zones:			
	Intertidal	Subtidal	Supratidal	Terrestrial
Whooper Swan	31%	12%	0%	57%
Light-bellied Brent Goose	70%	0%	0%	30%
Shelduck	95%	5%	0%	0%
Wigeon	65%	20%	1%	14%
Teal	78%	10%	1%	11%
Mallard	53%	32%	1%	14%
Pintail	91%	4%	2%	4%
Shoveler	4%	4%	0%	92%
Scaup	0%	100%	0%	0%
Cormorant	64%	18%	14%	4%
Golden Plover	97%	0%	0%	3%
Grey Plover	99%	0%	0%	1%
Lapwing	94%	0%	0%	5%
Ringed Plover	97%	3%	0%	0%
Curlew	94%	2%	1%	3%

Species	Mean percentage of total count in habitat zones:			
	Intertidal	Subtidal	Supratidal	Terrestrial
Black-tailed Godwit	96%	1%	0%	4%
Bar-tailed Godwit	100%	0%	0%	0%
Knot	100%	0%	0%	0%
Dunlin	98%	1%	0%	1%
Greenshank	86%	9%	0%	4%
Redshank	99%	0%	0%	1%
Black-headed Gull	74%	22%	0%	4%

Data source: 2010/11 Waterbird Survey Programme as undertaken by the National Parks & Wildlife Service.
Sample sizes: n = 4 for all species, except Whooper Swan and Scaup (n = 1) and Light-bellied Brent Goose (n =2).

Distribution

5.15 The broad patterns of distribution of waterbird species during the WSP low tide counts is summarised in Table 5.3. This indicates that some species are more or less uniformly distributed across the site (e.g., Dunlin, Curlew and Redshank), while others are concentrated in particular waterbodies: e.g., Light-bellied Brent Goose, Cormorant, Ringed Plover, Grey Plover, Curlew and Greenshank in the Lower Shannon; and Golden Plover, Black-tailed Godwit, Knot and Dunlin in the Upper Shannon and Fergus Estuaries).

5.16 The occurrence of the waterbird species in the aquaculture areas during the WSP low tide counts is summarised in Table 5.4 and discussed in more detail in the relevant sections of Chapters 7 and 8.

5.17 The Cormorant breeding colony in the River Shannon and River Fergus Estuaries SPA occurs at Bunlicky Lake in the Upper Shannon. Based on typical Cormorant foraging ranges from breeding colonies the potential foraging range from this colony is likely to be mainly within the Upper Shannon and Fergus Estuary waterbodies (Figure 5.2).

Table 5.3 - Mean percentage distribution of waterbird species between the three waterbodies defined for the River Shannon and River Fergus Estuaries SPA, during the 2010/11 WSP low tide counts.

Species	Lower Shannon	Upper Shannon	Fergus Estuary
Whooper Swan	92%	0%	8%
Light-bellied Brent Goose	100%	0%	0%
Shelduck	56%	33%	11%
Wigeon	47%	15%	38%
Teal	61%	18%	22%
Mallard	57%	11%	32%
Pintail	100%	0%	0%
Shoveler	72%	0%	28%
Scaup	100%	0%	0%
Cormorant	61%	6%	33%
Golden Plover	24%	35%	42%
Grey Plover	61%	29%	9%
Lapwing	37%	9%	54%
Ringed Plover	99%	0%	1%
Curlew	72%	13%	15%
Black-tailed Godwit	25%	40%	35%
Bar-tailed Godwit	60%	38%	3%
Knot	20%	62%	17%
Dunlin	20%	46%	34%
Greenshank	78%	13%	9%
Redshank	49%	28%	24%
Black-headed Gull	36%	13%	51%

Data source: 2010/11 Waterbird Survey Programme as undertaken by the National Parks & Wildlife Service.

Sample sizes: n = 5 for all species, except: Whooper Swan, Shoveler and Scaup (n = 1); Light-bellied Brent Goose (n= 2); and Pintail and Golden Plover (n = 4).

Table 5.4 - Mean percentage occurrence of waterbird species in the AQUAs, during the 2010/11 WSP low tide counts.

Species	Ballylongford /Bunaclugga	Poulnasherry/ Kilrush	Glin	Aughinish/ Foynes	Other
Whooper Swan	0%	54%	25%	0%	21%
Light-bellied Brent Goose	54%	45%	0%	0%	0%
Shelduck	2%	25%	0%	9%	64%
Wigeon	19%	3%	1%	9%	67%
Teal	4%	23%	1%	12%	60%
Mallard	8%	13%	1%	18%	61%
Pintail	1%	99%	0%	0%	0%
Shoveler	0%	54%	0%	18%	28%
Scaup	0%	10%	0%	0%	90%
Cormorant	6%	2%	0%	5%	86%
Golden Plover	12%	0%	1%	2%	85%
Grey Plover	16%	16%	0%	23%	46%
Lapwing	9%	2%	1%	16%	72%
Ringed Plover	55%	5%	10%	2%	28%
Curlew	12%	7%	2%	15%	64%
Black-tailed Godwit	1%	0%	0%	24%	75%
Bar-tailed Godwit	11%	3%	0%	13%	73%
Knot	1%	2%	0%	3%	94%
Dunlin	4%	1%	0%	3%	91%
Greenshank	14%	7%	5%	21%	53%
Redshank	5%	4%	1%	13%	77%
Black-headed Gull	9%	1%	1%	10%	78%

Data source: 2010/11 Waterbird Survey Programme as undertaken by the National Parks & Wildlife Service.

Sample sizes: n = 5 for all species, except: Whooper Swan, Shoveler and Scaup (n = 1); Light-bellied Brent Goose (n= 2); and Pintail and Golden Plover (n = 4).

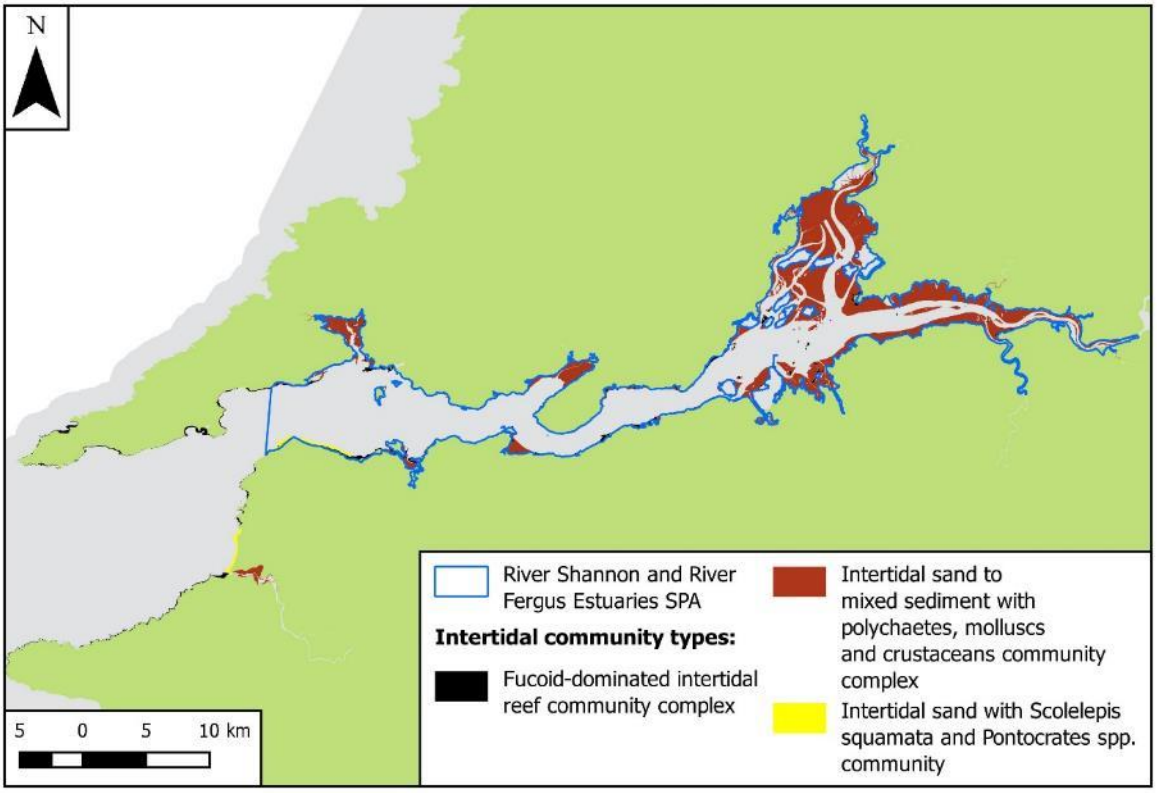

Figure 5.1 Distribution of intertidal community types mapped by NPWS in the River Shannon and River Fergus Estuaries SPA.

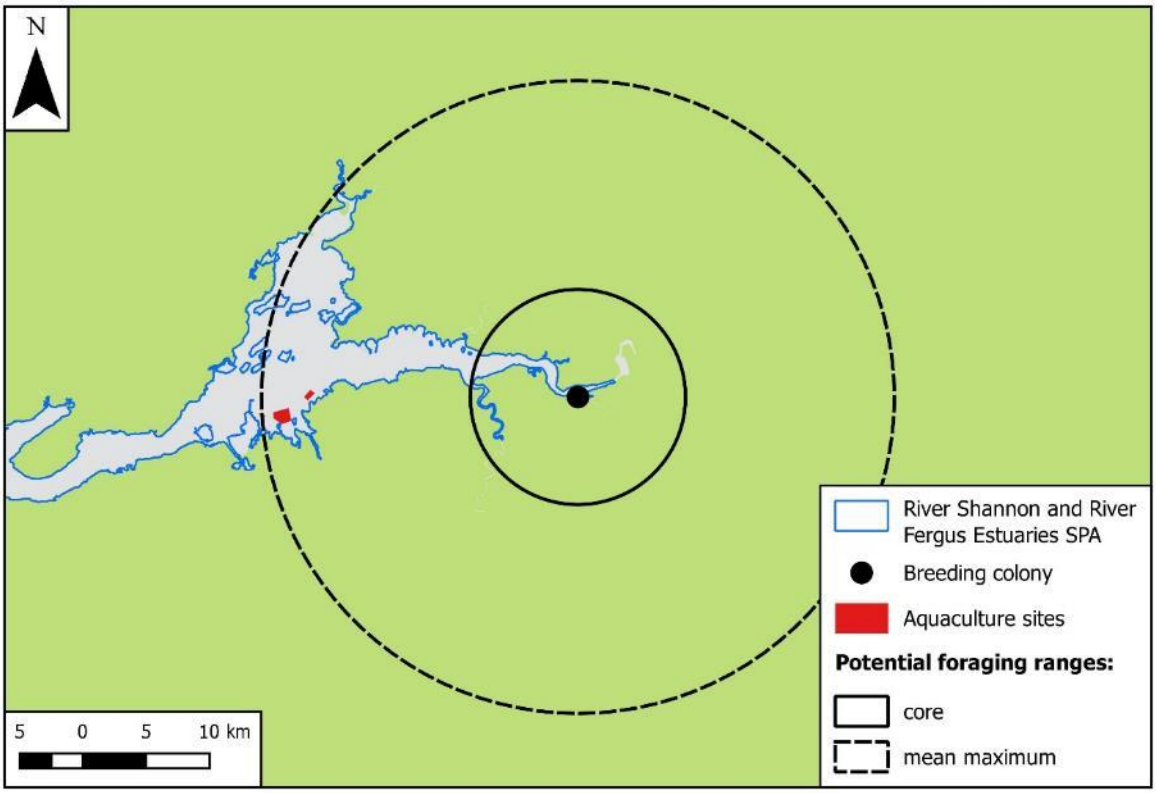

Figure 5.2 Location of the Cormorant breeding colony and potential foraging ranges from this colony.

6. Aquaculture activities within the Shannon Estuary

Scope of activity

6.1 Within the Shannon Estuary, there are a total of 60 aquaculture sites, covering a total area of 631 ha. These include seven renewal sites with a total area of 112 ha, and 53 application sites with a total area of 520 ha. The distribution of these aquaculture sites is shown in Figure 6.1 and summarised in Table 6.1. Five of the sites are located outside the River Shannon and River Fergus Estuaries SPA in Carrigaholt and Rinnevella Bays. All the sites within the SPA are located in the Lower Shannon waterbody.

Table 6.1 - Distribution of aquaculture sites.

AQUA	Number of sites	Area (ha)
Carrigaholt	5	107
Ballylongford/Bunaclugga	9	229
Poulnasherry/Kilrush	41	133
Glin	1	0.7
Killimer	1	0.7
Aughinish/Foynes	3	162

6.2 Most of the sites are predominantly located within the intertidal zone (Figure 6.2).

6.3 There are eight cultivation types that are currently being used, or that are being proposed, in the aquaculture sites: bottom, bouchet and longline cultivation of mussels; bottom, longline and trestle cultivation of oysters; trestle cultivation of scallops; and longline cultivation of seaweed (Table 2.1). The distribution of the main species/cultivation types is shown in Figure 6.3. More detailed maps of the distribution of the aquaculture sites within the Ballylongford/Bunaclugga, Poulnasherry/Kilrush, GLIN and Aughinish/Foynes AQUAs are included in Chapter 7.

Table 6.2 - Species and cultivation methods.

Species	Culture method	Number of sites	Area (ha)
Mussels	subtidal (bottom)	4	312
Mussels	intertidal (bouchet)	2	129
Mussels	subtidal (longlines)	2	29
Oysters	subtidal (bottom)	3	97
Oysters	intertidal (trestles)	52	199
Scallops	intertidal (trestles)	1	8
Seaweed	subtidal (longlines)	2	29

Note that some sites are being/will be used for more than one species/cultivation type, so the total numbers and areas of sites will not be the same as in Table 6.1.

6.4 In addition to the aquaculture sites, there are three areas within the Shannon Estuary covered by Fishery Orders (Figure 6.4). These areas are not the subject of the present assessment, but are included within the in-combination assessment (Chapter 9).

History of activity

6.5 The CLAMS report (CLAMS, 2002) provides some information on the development of aquaculture activity in the Shannon Estuary. Oyster trestle cultivation began in Poulnasherry Bay in the 1970s. Bottom oyster farming trials began in Carrigaholt Bay in 1999-2000. Bottom mussel farming trials began in 1996.

6.6 Aquaculture production data for the Shannon Estuary is summarised in Table 6.3. Note that a strong “health warning” applies to this data. In the Carrigaholt and Ballylongford/Bunaclugga AQUAs, there appear to have been declines in production levels in recent years, and, on our site visits, we noted a reduction in the extent of active trestles in Ballylongford/Bunaclugga between 2010 and 2017. In the Poulnasherry/Kilrush AQUA, production levels appear to have remained fairly constant over most of the period, but with an apparent increase in production levels in 2013-2015. However, trestle mapping indicates that there had been a substantial increase in the area of trestles by 2010 (Figure 6.5). In the Aughinish/Foynes AQUA, the production data indicates very little activity occurring before 2008.

Table 6.3 - Aquaculture production data (tonnes) for the Shannon Estuary.

Year	Carrigaholt	Ballylongford/ Bunaclugga	Poulnasherry/ Kilrush	Aughinish/Foynes	Total
2000	40	51	110	2	202
2001	40	45	111	0	196
2002	40	43	119	2	204
2003	80	18	131	2	231
2004	0	11	79	2	91
2005	0	12	107	1	119
2006	60	24	138	0	222
2007	0	9	163	0	172
2008	0	1	89	35	125
2009	20	26	147	0	193
2010	50	9	113	30	202
2011	10	5	109	6	130
2012	10	14	120	30	174
2013	10	4	214	18	246
2014	0	0	189	18	207
2015	0	0	231	15	246

Data supplied by BIM.

Intertidal oyster cultivation

6.7 Intertidal oyster cultivation is the most widespread aquaculture activity within the Shannon Estuary (Table 6.4).

Table 6.4 - Intertidal oyster cultivation sites within the Shannon Estuary.

AQUA	Parameter	Renewal sites	Application sites
Carrigaholt	Number of sites	2	3
	Area (ha)	11	13.5
Ballylongford/Bunaclugga	Number of sites	3	3
	Area (ha)	23	26
Poulnasherry/Kilrush	Number of sites	32	9
	Area (ha)	61	110
Glin	Number of sites	0	1
	Area (ha)	0	1
Kill	Number of sites	0	1
	Area (ha)	0	1
Aughinish/Foynes	Number of sites	1	0
	Area (ha)	6	0

6.8 All the existing and proposed intertidal oyster cultivation sites involve suspended oyster cultivation using the bag and trestle method. Four sites in Ballylongford/Bunaclugga plan to use oyster longlines as well, while some of the sites in Poulnasherry/Kilrush are planning to also use hanging baskets. Suspended oyster cultivation using the bag and trestle method also takes place within Fishery Order T08/080FO, with about 25% of the area currently in use.

6.9 The oyster longlines method involves placing a line approximately 120 m long made from steel rope on the intertidal. The rope will be kept upright with two strainer posts at each end, with upright posts in between along the line. Approximately four or five baskets (0.6 m x 9m dimensions) will be placed between each stay/upright with the baskets hanging around 0.5 m above the substrate. This cultivation method can be used both for seed and for ongrowing.

6.10 The hanging baskets method involves attaching plastic baskets to the trestles using clips to allow the baskets to pivot from the trestles thereby letting the tide turn the oysters. This allows the oysters to open and feed when the tide is in as they are in the water. When the tide goes out, the oysters are exposed to the air which helps to harden the shell. Tidal movement will allow the oysters to move freely in the baskets allowing better shape and meat content.

6.11 The bag and trestle method and the hanging baskets method are essentially the same in terms of their potential impacts on waterbirds. Therefore, in this assessment, the two methods are collectively referred to as *oyster trestle cultivation*.

Bottom oyster cultivation

6.12 There are three sites (two renewals and one application) for bottom oyster cultivation in Carrigaholt Bay. All of these sites are subtidal sites and are outside the River Shannon and River Fergus Estuaries SPA. These sites cover a total area of 97 ha, of which 82 ha are in the renewal sites. These sites are/will be used for ongrowing of oysters from the trestle sites in Carrigaholt Bay. No further details about the cultivation of oysters on these sites are available.

6.13 Oyster bottom culture also takes place in Fishery Order T08/004A, in which around 34 ha is used to finish oysters from the trestle site in the Aughinish/Foynes AQUA (T07/007). No further details about the cultivation of oysters in this Fishery Order area are available.

Bouchet pole mussel cultivation

6.14 There are two sites that are planned to be used for bouchet pole mussel cultivation in the Aughinish/Foynes AQUA. The total area covered by these site is 130 ha. However, these sites have multiple uses planned, so not all of this area will be used for bouchet pole cultivation.

6.15 Bouchet pole mussel cultivation involves attaching ropes of mussels to tall wooden poles placed in the intertidal zone. The poles will be spread in blocks of two rows, with the poles spaced 1 m apart in each row, and with a spacing of 10 m between each pair of rows. This equates to a density of 2,000 poles/ha. In year 1 it is envisaged to pilot the method using 1 ha.

6.16 In year one after the initial deployment of the poles the site will be tended to once every 4-6 weeks. Thinning will happen once during the growth cycle and this will last maybe 1-2 weeks

6.17 Harvesting from poles will be at half-tide. The boat will come alongside the poles and the mussels will be scraped off the poles

Bottom mussel cultivation

6.18 There are four sites (two applications and two renewal) for bottom mussel cultivation in Ballylongford/Bunaclugga and Aughinish/Foynes. Two of the sites are subtidal sites and one is an intertidal site. These sites cover a total area of 313 ha, of which 21 ha are in the renewal site.

Table 6.5 - Bottom mussel cultivation sites.

LOCATION	Values	Renewal	Application
Ballylongford/Bunaclugga	Number of sites	1	0
	Area (ha)	151	0
Aughinish/Foynes	Number of sites	1	2
	Area (ha)	6	156

6.19 The site in the Ballylongford/Bunaclugga AQUA (T06/233) has not been extensively utilised over the years but there are plans to further utilise the site in coming years. The site is used for on growing of mussels using seed sourced from the east coast. The seed will be relaid during the seed season (August-September) by pumping it, mixed with seawater, from the hold of the boat onto the site. Relaying will take place during a few weeks each year, depending on seed availability. Normally this will be during September on two tides per month. The vessels are fitted with a pumping system. This pattern of relaying is achieved by the vessels moving across the site during pumping in an effort to achieve an even distribution of mussel on the site in order to maximise survival and growth. Mussels are harvested during October-December in the second winter following planting. The dredge uses 2-4 single dredges while harvesting. The type of dredges used are 2 m mussel dredges with a flat bar that is designed to skim the surface of the substrate and separate mussel seed from the underlying sediment of the substrate and remove the mussel seed. Harvesting will take place on approximately 1-2 days/week between November and January.

6.20 The two sites in the Aughinish/Foynes AQUA (T07/12 and T07/14) will be used for relaying mussel seed sourced from one of the mussel longline sites in the Ballylongford/Bunaclugga AQUA (site T06/394), or from another approved site. The seed will be relaid in August-September. On each site, relaying will take place on 5-10 days per year. At site T07/12, which is predominantly in the intertidal zone, the relaying of the seed will take approximately 1-2 hours during the high tide period. At site T07/14, the relaying of the seed can take place at any stage of the tide as this site is subtidal and, therefore, there is always 2-3 m of water on the site. The mussels will be harvested in during October-December in the second winter following planting. At site T07/12, harvesting will take place

at high tide over a maximum period of four hours on approximately two days per week. At site T07/14, harvesting can take place at any stage of the tide as the site is sub-tidal, but a similar level, and duration, of harvesting activity is anticipated.

Mussel longline cultivation

6.21 There are two application sites for subtidal mussel cultivation using mussel longlines in the Ballylongford/Bunaclugga AQUA. These sites cover a total area of 29 ha. These sites will be used as collector sites for mussel seed which will then be used for bouchet mussel production and bottom mussel production in the Aughinish/Foynes AQUA.

6.22 These sites will be accessed once a week, to check lines on an ongoing basis. Harvesting will take place over a 2-3 week period during August and September.

Other species

6.23 It is planned to also produce seaweed on the two mussel longline sites in the Ballylongford/Bunaclugga AQUA (T06/394A and T06/394B). The seaweed will be seeded onto the lines using ropes produced from the Tralee Bay Oyster Hatchery. The seaweed to be cultured will be seaweed indigenous to the area such as Red Seaweeds (*Palmarias*) and Brown Seaweeds (*Laminarias*). No non-native seaweeds will be grown.

6.24 Scallops are/will be grown in hanging baskets on the oyster trestles in site T08/055 in the Carrigaholt AQUA.

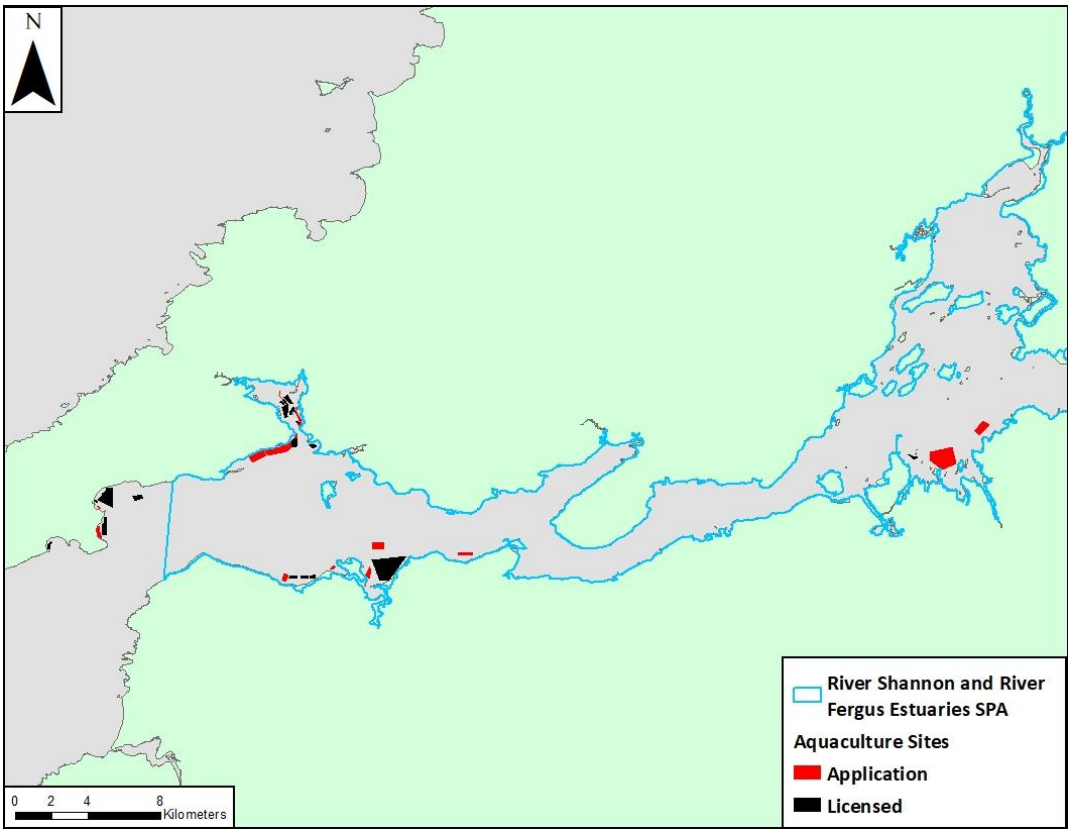

Figure 6.1 Aquaculture sites classified by site status.

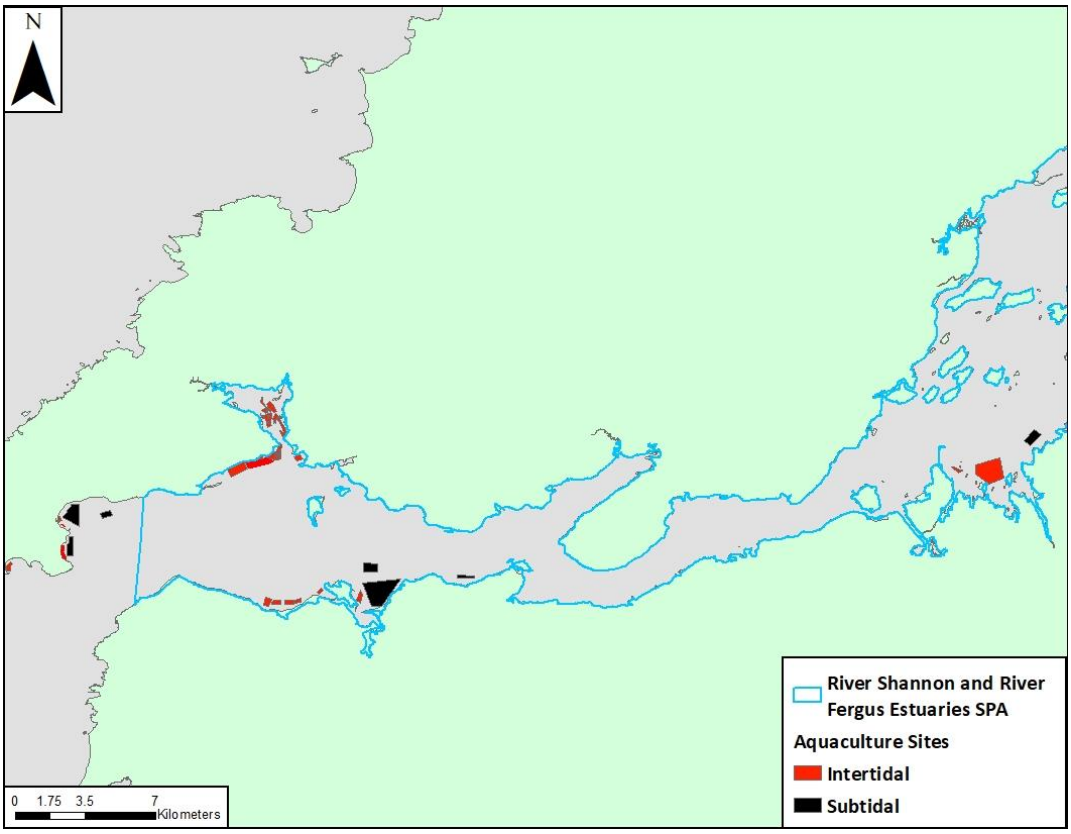

Figure 6.2 Aquaculture sites classified by predominant tidal zone.

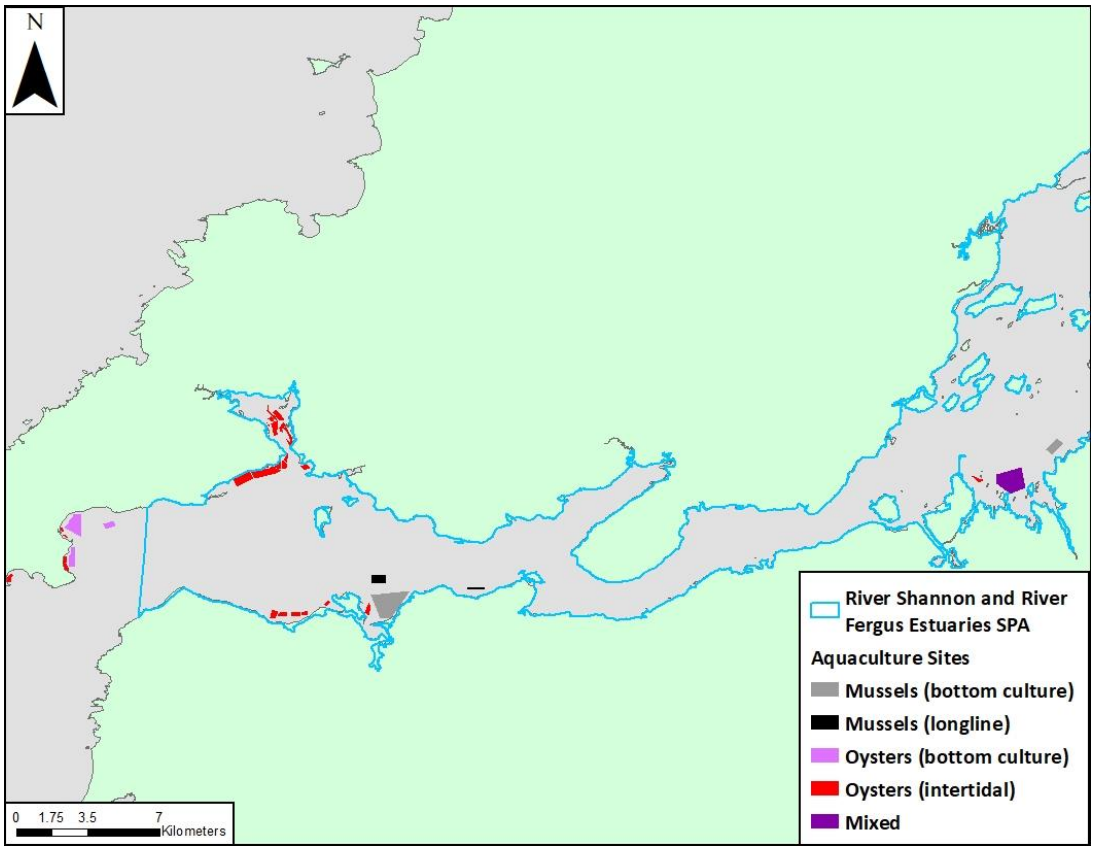

Figure 6.3 Aquaculture sites classified by predominant species and cultivation method.

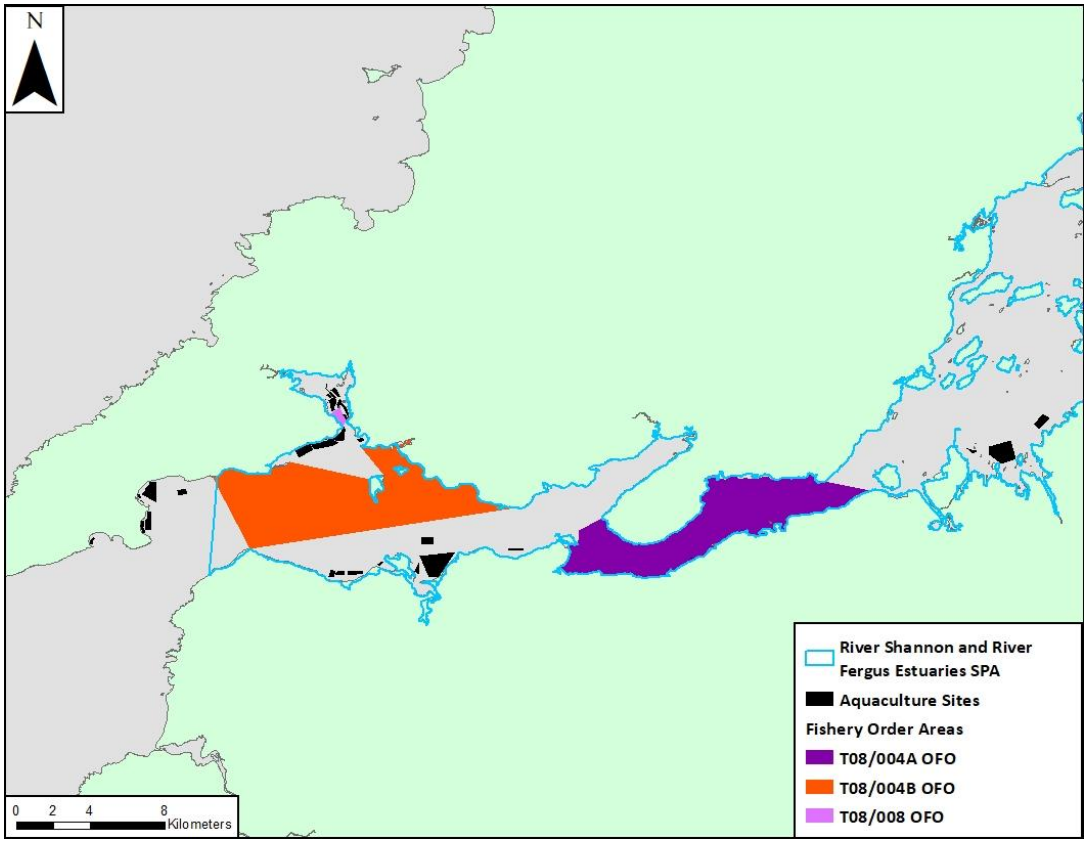

Figure 6.4 Fishery Order areas within the Shannon Estuary.

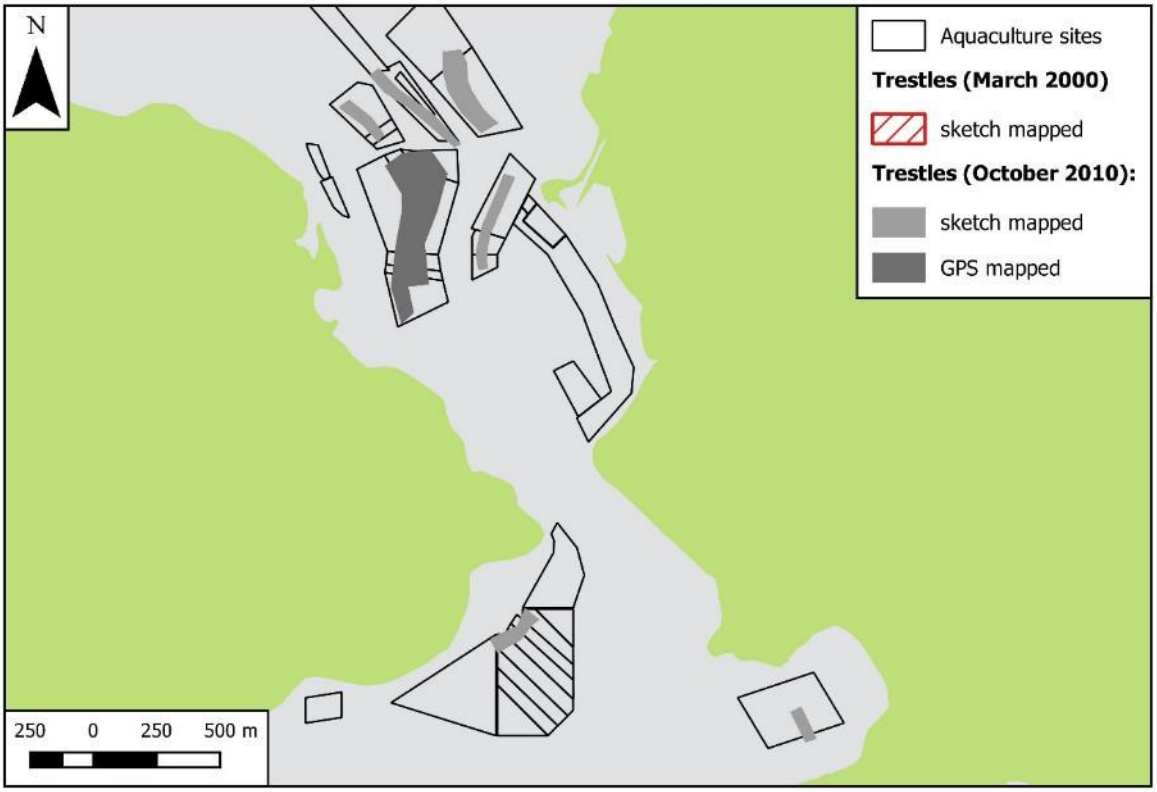

Figure 6.5 Oyster trestles in Poulnasherry Bay.

7. Assessment of impacts to birds using intertidal habitats

Introduction

7.1 This chapter assesses the potential impacts of aquaculture activity on SCIs using intertidal and shallow subtidal habitats. The following SCIs are assessed in this chapter: Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank, and Black-headed Gull. The impacts of aquaculture activity on Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard and Black-headed Gull when they are using moderately deep, or deep subtidal habitats are assessed in Chapter 8.

7.2 The impacts of intertidal aquaculture activity on SCIs that may potentially use the affected habitat at high tide (Scaup, Cormorant, Fulmar, Kittiwake and Guillemot) are assessed in Chapter 8, as at this time the habitat becomes moderately deep subtidal habitat.

7.3 The assessment in this chapter is structured by the AQUAs, as it makes most sense to consider the potential impacts from all the aquaculture sites together within each AQUA. However, we have assessed the potential impact on Whooper Swan, and potential disturbance impacts to the intertidal zone from subtidal aquaculture activity, across all AQUAs combined, due to the general nature of these assessments.

Potential impacts

Oyster trestle cultivation

Habitat structure

7.4 Oyster trestle cultivation causes a significant alteration to the three-dimensional structure of the intertidal habitat (which includes the airspace occupied by birds feeding on the habitat) through the placement of physical structures (oyster trestles) on the intertidal habitat. This alteration may alter the suitability of the habitat for waterbirds by interfering with sightlines and/or creating barriers to movement. Based on the characteristics of species showing positive/neutral or negative responses to trestles, we have hypothesised that trestles may interfere with flocking behaviour causing species that typically occur in large, tightly packed flocks to avoid the trestles. Trestles could also interfere with the visibility of potential predators causing increased vigilance and reduced foraging time (Gittings and O'Donoghue, 2012, 2016b).

Food resources (benthic fauna)

7.5 Oyster trestle cultivation may cause impacts to benthic invertebrates and this could potentially affect food resources for waterbird species.

7.6 In a review of the literature, Dumbauld *et al*. (2009) found variation in the effects of intertidal oyster cultivation on the benthic fauna. In studies in England, France and New Zealand, intertidal oyster cultivation caused increased biodeposition, lower sediment redox potential and reduced diversity and abundance of the benthic fauna. However in studies in Ireland and Canada, few changes in the benthic fauna were reported, due to high currents preventing accumulation of biodeposits.

7.7 The Irish study referred to above was carried out at Dungarvan Harbour (De Grave *et al*., 1998). This study compared an oyster trestle block (in the north-eastern section of the main block of trestles) with a control site approximately 300 m away, with both areas being at the mean tide level. Within the trestle block areas underneath trestles and areas in access lanes were compared. The study found no evidence of elevated levels of organic matter or high densities of organic enrichment indicator species within the trestle blocks. There were minor differences in the benthic community between the control area and the areas sampled under the trestles (higher densities of *Nephtys hombergii*, *Bathyporeia guiiliamsoniana*, *Gammarus crinicomis*, *Microprotopus maculatus* and *Tellina tenuis* including increased abundance of *Capiteila capitata* in the latter area), but these were considered to be probably due to increased predation by epifaunal decapods and fishes. There appeared to be stronger changes in the benthic community in the access lanes with increased densities of three polychaete species (*Scolopos armiger*, *Eteone longa* and *Sigalion mathildae*) and higher overall diversity, and these changes were considered to be due to the compaction of the habitat by vehicular traffic.

7.8 In more recent work commissioned by the Marine Institute, Forde *et al*. (2015) looked at benthic invertebrates along access tracks, under trestles and in close controls at a four sites along the west and south coasts of Ireland. There was a strong site effect from the study in that significant differences were observed using a variety of invertebrate response (dependent) variables among the sites. Access routes were considered more disturbed than trestle and control locations; most likely due to the influence of compaction from regular vehicle movements. Abundance (among other variables) was significantly higher in control and trestle samples when compared with those derived from access routes. No noticeable difference between control and trestle samples was detected. This research indicates that oyster trestle cultivation in typical Irish sites is unlikely to have had major impacts on food resources for waterbirds that feed on benthic fauna.

7.9 The potential impacts of oyster trestle cultivation on food resources for fish eating waterbirds are reviewed in Chapter 8.

Disturbance

7.10 Oyster trestle cultivation requires intensive husbandry activity and this may cause impacts to waterbirds using intertidal and/or shallow subtidal habitats through disturbance. Disturbance will not affect high tide roosts, or waterbirds that mainly, or only, use trestle areas when they are covered at high tide (such as Cormorant and Scaup), because no husbandry activity takes place during the high tide period.

7.11 There is a very extensive literature on the impact of disturbance from human activity on waterbirds. However, the trestle study (Gittings and O'Donoghue, 2012, 2016b) examined the combined potential effects of habitat alteration and disturbance from husbandry activity. The sites included in the study included some with very high levels of husbandry activity. Therefore, it is not necessary to consider the disturbance component of the potential impacts separately for the species covered by the trestle study.

Waterbird responses

7.12 The results of the trestle study (Gittings and O'Donoghue, 2012, 2016b) allowed us to categorise the nature of the association between oyster trestles and bird distribution patterns for many of the species included in this assessment. The overall response of the waterbird species to oyster trestles is summarised in Table 7.1, along with evidence about their response to oyster trestles at Poulnasherry Bay (where available). The latter is presented in the form of Jacobs Index (D) values, which represent the degree of positive or negative association with oyster trestles: D can vary from -1 (indicating complete avoidance) to +1 (strong preference).

7.13 Ringed Plover, Grey Plover and Knot appear to be completely excluded from areas occupied by oyster trestles. This was first demonstrated in the data from the trestle study and has been further supported by subsequent monitoring work at Donegal Bay (O'Donoghue and Trewby, 2016) and Dungarvan Harbour (Gittings and O'Donoghue, 2015). These species did not occur in sufficient numbers in the trestle study counts to calculate D index values for Poulnasherry Bay.

7.14 Dunlin and Bar-tailed Godwit both showed strong avoidance of oyster trestles in the data from the trestle study and this avoidance was further supported by subsequent monitoring work at Dungarvan Harbour (Gittings and O'Donoghue, 2015 and unpublished data). The D index value from Poulnasherry Bay for Dunlin conforms to this pattern.

7.15 Light-bellied Brent Goose showed a variable response pattern in the trestle study with neutral/positive patterns of association at some sites, and negative patterns at other sites. These species did not occur in sufficient numbers in the trestle study counts to calculate D index values for Poulnasherry Bay. This species often feeds on the algae that attaches to the trestle bags and at some sites large numbers can be present on the trestles on the ebb/flood tides to exploit this food source. Wigeon also can feeds on the attached algae, and was similarly classified as having a variable response.

7.16 Curlew and Black-headed Gull showed a variable response pattern in the trestle study with neutral/positive patterns of association at some sites, and negative patterns at other sites[5]. The D index values from Poulnasherry Bay indicate a neutral association for Curlew and a negative association for Black-headed Gull. However, these should be interpreted with caution given that these are based on the data from only four counts.

7.17 In the trestle study report, Redshank was classified as having an overall neutral/positive pattern of association with oyster trestles. The D index value from Poulnasherry Bay conforms to this pattern.

Table 7.1 - Summary of patterns of association with oyster trestles.

Species	Overall response	Jacobs index (D) values for Poulnasherry Bay
Light-bellied Brent Goose	Variable	-
Wigeon	(Variable)	-
Mallard	(Negative)	
Ringed Plover	Negative	-
Grey Plover	Negative	-
Knot	Negative	-
Dunlin	Negative	-0.45
Black-tailed Godwit	(Negative)	-
Bar-tailed Godwit	Negative	-
Curlew	Variable	0.07
Redshank	Neutral/Positive	0.73
Black-headed Gull	Variable	-0.45

Overall response is as classified by Gittings and O'Donoghue (2016). Responses in parentheses indicate that the evidence base supporting the response categorisation is limited.

7.18 The other species included in this assessment are: Shelduck, Teal, Pintail, Shoveler, Golden Plover, Lapwing, Black-tailed Godwit and Greenshank. These species were not recorded in

[5] Note that Curlew was classified as having a neutral/positive pattern of association in Gittings and O'Donoghue (2012), but based on further analysis of the dataset re-classified the as variable in Gittings and O'Donoghue (2016b).

sufficient numbers in the trestle study to carry out formal analyses of their association with trestles across sites. This reflects that fact that these species tend to occur on muddier sediments, unlike the sandier sediments typically used for intertidal oyster cultivation. However, for Shelduck, Lapwing, Black-tailed Godwit and Greenshank, the trestle study found some weak evidence of negative (Shelduck, Lapwing and Black-tailed Godwit), or positive (Greenshank) association with trestles, from ordination analyses and/or qualitative assessment of count data (Gittings and O'Donoghue, 2012). For Golden Plover, we have some evidence of a negative association with trestles from other work (Gittings and O'Donoghue, 2015 and unpublished data).

7.19 Shelduck are large ducks that stand over 0.5 m tall. Therefore, trestles may impede their movements while foraging as, unlike smaller waders, they will not be able to freely move under the trestles.

7.20 Golden Plover and Lapwing mainly use intertidal areas for roosting. Golden Plover typically roost in large expanses of open mudflat or sandflat, while Lapwing use more varied substrates for roosting, including mixed sediments and rocky shores. It is very unlikely that Golden Plover would roost within trestle blocks but one could imagine that Lapwing might roost on trestles. Monitoring work at Dungarvan Harbour has provided some evidence that roosting Golden Plover flocks avoid trestles (Gittings and O'Donoghue, 2015 and unpublished data).

7.21 Black-tailed Godwit is behaviourally and ecologically similar to Bar-tailed Godwit, as indicated by the fact that small numbers of Bar-tailed Godwits often associate with Black-tailed Godwits in Cork Harbour. Therefore, it seems likely that Black-tailed Godwit will show a similarly strong negative response to trestles, as shown by Bar-tailed Godwit.

7.22 We have no evidence about the nature of the response of Teal, Mallard, Pintail and Shoveler to trestles. For these species, we have made a precautionary classification of a negative response.

Oyster longline cultivation

7.23 Oyster longline cultivation may have similar interactions with benthic invertebrates, as discussed above for oyster trestle cultivation.

7.24 The potential impacts of intertidal longline oyster culture was studied by Connolly and Colwell (2005) at Humboldt Bay, California. The longline oyster culture at their study site involved lines of oysters suspended from plastic pipes inserted vertically into the substrate. The lines were usually spaced into rows 70 cm wide, and the photograph in Figure 2 of Connolly and Colwell (2005) indicates that the height of the lines above the substrate was similar to this width. At three sites, every fifth row was 1.5 m wide, and at all sites there were regular 2 m wide aisles perpendicular to the rows. They used five study sites, with a longline plot paired with a control plot that was similar in area, shape, substrate, micro-channelization and elevation.

7.25 They compared waterbird abundances on longline and control plots separately for each study site. In 32 of the 68 pairwise comparisons, there were significant differences between longline and control plots, with higher numbers in the longline plots in 25 of these comparisons. Species that were more abundant in longline plots (number of sites in parentheses) were: Peeps (2), Dowitcher (1), Whimbrel (4), Willet (4) and Black Turnstone (2). Species that were more abundant in control plots (number of sites in parentheses) were: Great Blue Heron (1) and Grey Plover[6] (2). Species with mixed responses were: Dunlin (more abundant on longline plots in 1 site, more abundant on control plots in 2 sites), Marbled Godwit (3, 1) and Long-billed Curlew (1, 1). Species diversity was

[6] Referred to as Black-bellied Plover in Connolly and Colwell (2005).

greater on longline plots compared to control plots. In 15 of 60 comparisons, bird use of wide areas exceeded availability, with the strongest preference for wide rows being among the larger species.

Bottom mussel cultivation

7.26 The potential impacts of bottom mussel cultivation on habitat structure and benthic fauna are reviewed in Chapter 8.

7.27 In the intertidal zone, bottom mussel cultivation may also have potential impacts on waterbirds by altering the physical structure of the habitat. If an area of open intertidal sediment habitat is changed by mussel relaying to a mussel bed, with accumulation of mussels over a period of years, birds associated with open intertidal sediment habitat may be displaced. This impact could result from birds being deterred from using the habitat due to reduced sightlines, which may interfere with visibility of predators and/or flocking behaviour (notably in the case of smaller species). However, any such impacts may be difficult to distinguish from impacts due to changes in prey resources.

7.28 Work carried out at Castlemaine Harbour indicates that, of the species assessed in this chapter, Curlew, Redshank and Greenshank are likely to have a neutral or positive response to intertidal mussel cover (Gittings and O'Donoghue, 2011a and unpublished data). In addition, Knot feed on mussel beds and are, therefore, also likely to have a neutral or positive response. Therefore, these species can be screened out from further assessment relating to bottom mussel cultivation. Similarly, Caldow *et al*. (2003) also found neutral or positive responses from Curlew, Redshank and Black-headed Gull following mussel relay in intertidal habitats, although there was some indication of decreases in Redshank in the areas with the highest densities of mussels.

7.29 Species mainly associated with open intertidal habitats might be expected to be negatively affected by the development of intertidal mussel beds. However, work carried out by Waser *et al*. (2016) in the Dutch Wadden Sea found that most waterbird species showed positive associations with bivalve beds compared with open intertidal habitats; this may in part be associated with the greater habitat heterogeneity of bivalve beds. The species showing positive associations included Greenshank and Redshank (preference factors of 13.3-15.2), Golden Plover, Curlew and Knot (preference factors of 5.8-8.9) and Shelduck, Mallard, Pintail, Grey Plover, Bar-tailed Godwit, Dunlin and Black-headed Gull (preference factors of 1.2-4.9). Only three species showed negative associations (Ringed Plover, Sanderling and Great Black-backed Gull), with a preference factor of 0.2 for Ringed Plover indicating a significant decrease in abundance on bivalve beds.

Bouchet pole mussel cultivation

7.30 There is no detailed information available about the potential impacts of bouchet pole mussel cultivation on waterbirds, or on the habitats and food resources used by waterbirds. However, it has been noted that in bouchet pole farms in Brittany "*there are usually very few waterfowl and waders feeding*" in bouchet pole farms in Brittany, although they "*can attract large numbers of gulls*" (Guillaume Gélinaud, Bretagne Vivante-SEPNB, Réserve Naturelle des Marais de Séné, pers. comm.).

7.31 In terms of the physical structures used, bouchet pole cultivation appears to be somewhat analogous to the intertidal longline oyster culture studied by Connolly and Colwell (2005). The results of their study are summarised above.

Other potential disturbance impacts

7.32 There is potential for boat access to/from aquaculture sites, and/or husbandry activity in moderately deep, or deep, subtidal habitat to cause disturbance impacts to waterbirds roosting in intertidal and shoreline habitats at high tide and/or waterbirds using intertidal and shallow subtidal habitat at low

tide and/or on ebb/flood tides. A summary of the likely timing of boat access to the various relevant sites is provided in Chapter 8.

Preliminary screening

Aquaculture sites

7.33 The intertidal aquaculture sites in the Carrigaholt AQUA are outside the SPA. There is very limited intertidal habitat in the Carrigaholt AQUA and the area is around 8 km from the nearest area of intertidal habitat (Poulnasherry Bay), so significant utilisation of this area by the SCI populations covered by this section of the assessment is unlikely to occur. Furthermore, these sites are outside the SPA so, by definition, impacts to these sites will not affect attribute 2 of the conservation objectives for the SCI species.

7.34 There is no waterbird count data available for the Killimer AQUA. However, the only aquaculture site in this AQUA is a very small site (0.7 ha), located in narrow mixed sediment/rocky shore intertidal zone, and is not close to any significant areas of intertidal habitat. Therefore, the site does not provide a significant habitat resource for waterbirds using intertidal habitat.

7.35 For the above reasons, it can be concluded that the intertidal aquaculture sites in the Carrigaholt and Killimer AQUAs will not cause significant impacts to any of the SCI species assessed in this chapter (Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot, Dunlin, Greenshank, Redshank, and Black-headed Gull).

Species

7.36 Two of the SCI species assessed in this chapter (Greenshank and Redshank) have neutral/positive associations with oyster trestle cultivation (Gittings and O'Donoghue, 2012, 2016) and are likely also to have neutral/positive associations with bottom mussel cultivation (see paragraphs 7.28-7.29). There is no specific information available on the nature of their association with oyster longline cultivation or bouchet pole mussel cultivation. However, as these activities are less physically intrusive than oyster trestle cultivation and, in the case of bouchet pole mussel cultivation, will have lower potential disturbance impacts, it is reasonable to conclude that these species will also have neutral/positive associations with these activities. Therefore, these species have been screened out from further assessment in this chapter.

Assessments

Ballylongford/Bunaclugga AQUA

Habitats

7.37 The distribution of intertidal habitat in the Ballylongford/Bunaclugga AQUA is shown in Figure 7.1. The eastern section in subsite 0K509 has the estuary of Ballylongford Creek, which has extensive beds of *Spartina*. The shoreline to the east of this estuary has only a narrow shingle shore. In subsites 0K507 and 508, the intertidal habitat is mainly open sandflat, but with mixed sediment/rocky shoreline habitat in the eastern part of 0K508. The NPWS marine community types map classifies the littoral sediment habitat in subsite 0K509 as the *intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex*, and the littoral sediment habitat in subsites 0K507 and 508 as the *intertidal sand with Scolelepis squamata and Pontocrates spp. community*. The latter corresponds to dry, sand shore type substrate. In the eastern part of 0K508,

littoral sediment habitat occurs below the mixed sediment/rocky shoreline habitat, but is not mapped by NPWS. This littoral sediment habitat is a firm sandflat-type substrate but muddier than the sand shore habitat, and may also continue to the west in the spring low tide zone below the sand shore habitat.

Waterbirds

7.38 The occurrence and distribution of waterbirds in the Ballylongford area during the WSP counts is shown in Table 7.2. This area is particularly important for Light-bellied Brent Goose and Ringed Plover, and also holds significant numbers of a number of other species. Shelduck, Wigeon, Teal, Golden Plover, Lapwing and Dunlin all appear to be concentrated in subsite 0K509, where they were presumably associated with the muddier estuarine habitat in Ballylongford Creek.

Table 7.2 - Occurrence and distribution of waterbirds in intertidal habitats in the Ballylongford/Bunaclugga AQUA during the WSP low tide counts.

Species	Mean % of		Mean count			Non-zero counts
	SPA	LS zone	0K507	0K508	0K509	
Light-bellied Brent Goose	49%	49%	37	7	7	4
Shelduck	2%	4%	0	0	12	1
Wigeon	14%	25%	0	87	95	4
Teal	3%	4%	0	3	67	4
Mallard	6%	10%	1	3	25	4
Golden Plover	12%	37%	33	0	226	4
Grey Plover	5%	9%	1	1	4	4
Lapwing	7%	19%	59	2	237	4
Ringed Plover	39%	40%	6	35	15	4
Curlew	8%	11%	22	70	47	4
Black-tailed Godwit	0%	9%	0	10	2	2
Bar-tailed Godwit	10%	14%	11	11	5	4
Knot	1%	5%	1	1	3	2
Dunlin	4%	26%	1	51	397	4
Black-headed Gull	9%	24%	68	77	80	4

This table shows: (1) the mean of each low tide count in the intertidal and subtidal zones across all the subsites in the Ballylongford/Bunaclugga AQUA as percentages of the total count across the whole SPA, and across the Lower Shannon zone, respectively; and (2) the mean low tide count in each of the Ballylongford/Bunaclugga AQUA subsites.

7.39 The WSP flock maps from the low tide counts show that the mapped flock positions were concentrated in the south-western section of 0K507, the eastern section of 0K508 and the inner parts of 0K509 (Appendix B). These maps indicate an avoidance by most waterbirds of the dry sand shore habitat in the northern part of 0K507 and the western part of 0K508, as might be expected from the nature of the habitat.

Aquaculture

7.40 There are seven aquaculture sites that include intertidal habitat in the Ballylongford/Bunaclugga AQUA. Six of these are oyster trestle cultivation sites, and one is a bottom mussel culture site. The five oyster trestle cultivation sites to the west of Carrig Island may also be used for oyster longline cultivation. However, for the purposes of this assessment, we have assumed that the entire area of each of these sites will be used for oyster trestle cultivation, as this is likely to have more negative impacts on waterbirds.

7.41 One of the oyster trestle cultivation sites is located on the eastern side of Carrig Island in subsite 0K509. The other five sites are located along a 3 km stretch of shoreline to the west of Carrig Island, with one of these being in subsite 0K509 and the other four in subsite 0K508. All the sites are low down on the shore and are mainly within, or below, the spring low tide zone as defined for this assessment. Only the westernmost of the sites includes a significant area within the mean low tide zone. However, based on our observations during site visits, the mapping used to define the exposure of intertidal habitat in this area significantly underestimates the exposure of intertidal habitat to the west of Carrig Island: for example on 9th February 2009 on a 0.4 m low tide (Tarbert), site T06/370, which appears to be below the spring low tide zone according to the mapping, was almost fully exposed by about one hour before low tide.

7.42 Because the oyster trestle cultivation sites are mainly below the mean low tide zone, most of the area occupied by the sites are classified as subtidal community types by NPWS. The site to the east of Carrig Island (T06/331A) includes a mixed sediment shingle ridge with muddy sand occupying the adjoining intertidal. The sites to west of Carrig Island are generally occupied by a firmer, more sandy, substrate, although the upper edges of sites T06/347A, T06/347B and T06/347C extend into mixed sediment habitat. The westernmost site (T06/386A) overlaps the area mapped as the *intertidal sand with Scolelepis squamata and Pontocrates spp. community* type by NPWS, which, from our observations, appears to correspond to much drier sand shore habitat.

7.43 The bottom mussel culture site (T06/233) occupies a large area of subtidal habitat on the eastern side of Carrig Island. This site just about extends into the intertidal zone along the south-eastern side of Ballylongford Bay. However, this is a steeply shelving shingle shoreline and, unlike the areas to the west of Carrig Island, there does not appear to be any significant exposure of additional intertidal habitat below the mapped extent. Therefore, given the nature of the proposed activity, we have assumed that the overlap with the intertidal zone is a mapping artefact and there will not be any aquaculture activity within the intertidal zone in this site.

Impact assessment

7.44 The assessment of potential impacts in this area is complicated by the fact that part of the area occupied by the aquaculture sites are below the mapped extent of intertidal habitat. Therefore, simple quantification of the area of intertidal habitat affected, based on the mapped extent of intertidal habitat, will underestimate the actual impact. As we do not know the true distribution of intertidal habitat in this area, it is not possible to quantify the actual impact in terms of the percentage of the available habitat that will be affected under various tidal conditions. However, based on both the mapping data, and our own observations, it does appear that most of the intertidal habitat affected will only be exposed on spring low tides. Therefore, oyster trestle cultivation in this area only has the potential to cause measurable displacement impacts on less than half the low tides.

7.45 The intertidal habitat to the west of Carrig Island can be divided into two distinct zones: a muddy sand zone with mixed sediment/rocky substrate along the upper shore extending from Carrig Island to around site T06/386A and a dry sand zone extending west from this point. The flock mapping data indicates that most of the waterbird records from subsite 0K508 were concentrated into eastern section of the subsite, indicating that they were associated with the muddy sand zone. The aquaculture sites occupy approximately 50-60% of the shoreline length in the muddy sand zone. Therefore, on spring low tides there is potential for high levels of displacement of species associated with intertidal sediment from this subsite. However, Ringed Plover, the species for which the Ballylongford/Bunaclugga AQUA is most important for, is more likely to use the full extent of intertidal habitat in this subsite, as it is often associated with dry sand shore habitat (there were only two flock map records of this species in this subsite).

7.46 To the east of Carrig Island, the oyster trestle cultivation site occupies around 35% of the intertidal habitat in the outer part of the Ballylongford Creek estuary. On spring low tides, a lot of the waterbirds in Ballylongford Creek are likely to move out to this area, although some will probably remain in the upper part of the creek as waterbirds in estuarine habitats are less constrained by the tideline than in open sandflat habitat.

7.47 The magnitude of the potential displacement impact for each SCI species is categorised in Table 7.3.

7.48 Ringed Plover appears to be completely excluded from oyster trestles. The Ballylongford / Bunaclugga area appears to hold a relatively high proportion of the total SPA Ringed Plover population so the potential displacement impact to this species could be significant. However, the birds may be widely spread across the full extent of intertidal habitat within this area, in which case the potential displacement impact will be of lower magnitude. Therefore, the potential impact is assessed as moderate.

7.49 Light-bellied Brent Goose shows a variable pattern of association with oyster trestles. However, the available count data indicates that the species may be associated with the western part of the AQUA area away from any of the aquaculture sites. Therefore, the potential impact magnitude has been assessed as minor-moderate with low confidence about any impact occurring.

7.50 Black-headed Gull also shows a variable pattern of association with oyster trestles. However, in southern Ireland peak usage of intertidal habitat by Black-headed Gull appears to occur in late summer/autumn (outside the period covered by the WSP count data. Therefore, the potential displacement impact to this species cannot be assessed with any degree of confidence due to lack of appropriate data.

7.51 Impacts to the other species have been assessed as negligible where the species are likely to be predominantly concentrated in Ballylongford Creek, and otherwise as minor-moderate (depending on the relative numbers of the species).

Table 7.3 - Assessment of potential displacement impact from intertidal aquaculture in the Ballylongford/Bunaclugga AQUA.

Species	Likelihood of negative impact	Assessment of impact magnitude	
		SPA	LS zone
Light-bellied Brent Goose	1	minor-moderate	minor-moderate
Shelduck	2	negligible	negligible
Wigeon	1	moderate	moderate
Teal	2	negligible	negligible
Mallard	2	negligible	negligible
Golden Plover	2	negligible	negligible
Grey Plover	3	minor	minor
Lapwing	2	negligible	negligible
Ringed Plover	3	moderate	moderate
Curlew	1	minor	minor
Black-tailed Godwit	2	negligible	minor
Bar-tailed Godwit	3	moderate	moderate
Knot	3	negligible	negligible
Dunlin	3	negligible	minor

Species	Likelihood of negative impact	Assessment of impact magnitude	
		SPA	LS zone
Black-headed Gull	1	not assessed	not assessed

Likelihood of a negative impact: 1 = species shows a variable response to oyster trestles, so a neutral or positive impact may occur; 2 = species considered to show a negative response to oyster trestles but evidence for this is weak; 3 = strong evidence that species shows a negative response to oyster trestles.

Impact magnitude levels are defined in Table 2.2. The confidence level for all impact magnitude assessments is low.

Poulnasherry/Kilrush AQUA

Habitats

7.52 The distribution of intertidal habitat in the Poulnasherry/Kilrush AQUA is shown in Figure 7.2. There are extensive areas of soft sediment intertidal habitat within the estuary, although there is extensive algal cover on the upper areas of mudflat. Outside the bay, most of the soft sediment intertidal habitat is only exposed at low tide.

7.53 All the soft sediment intertidal habitat in the Poulnasherry/Kilrush AQUA is classified as the *intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex* by NPWS. However, there are clear visual differences between the intertidal habitat within Poulnasherry Bay and the intertidal habitat in the outer parts of the Poulnasherry/Kilrush AQUA. The former is soft intertidal mudflat/muddy sand, while the latter comprises much firmer sandflat type substrate. There are also extensive areas of intertidal habitat within Poulnasherry Bay that are covered by algal growth. This is a feature that was recorded in a survey in 1996 (Falvey *et al*., 1997), which recorded up to 80% cover of filamentous green algae on the upper 300 m of the intertidal, and which we noted this on site visits in both 2010 and 2017. The algal cover persists through the winter, as there was still extensive algal growth in March 2017.

7.54 Mixed sediment shore habitat occurs extensively around the shoreline of Poulnasherry Bay, as well as around small islands in the middle of Poulnasherry Bay and its distribution pattern is more complex than mapped. There are also extensive areas of this mixed sediment/rocky shore habitat in the outer sections of the Poulnasherry/Kilrush AQUA to the east, but only a narrow strip of shingle shoreline to the west. Large beds of *Spartina* occur around the upper/inner sections of Poulnasherry Bay.

Waterbirds

7.55 The distribution of waterbirds in the WSP counts is shown in Table 7.4. The Poulnasherry/Kilrush AQUA held the entire SPA population of Pintail during these counts, and was also important for Shelduck, Teal and Grey Plover.

Table 7.4 - Occurrence and distribution of waterbirds in intertidal habitats in the Poulnasherry/Kilrush AQUA during the WSP low tide counts.

Species	Mean % of		Mean count					Non-zero counts
			Poulnasherry Bay		outer sections			
	SPA	LS zone	0H519	0H520	0H507	0H517	0H518	
Whooper Swan	25%	30%	4	0	0	0	0	2
Light-bellied Brent Goose	30%	30%	8	6	0	0	0	3
Shelduck	25%	41%	115	0	0	0	0	4
Wigeon	3%	5%	40	0	0	4	0	4

Species	Mean % of		Mean count					Non-zero counts
			Poulnasherry Bay		outer sections			
	SPA	LS zone	0H519	0H520	0H507	0H517	0H518	
Teal	21%	36%	402	0	0	94	0	4
Mallard	11%	19%	56	0	0	1	0	4
Pintail	99%	99%	47	0	0	0	0	3
Grey Plover	16%	29%	24	0	0	0	0	4
Lapwing	2%	5%	46	0	0	12	6	2
Ringed Plover	5%	5%	7	0	0	5	0	1
Curlew	7%	10%	124	1	0	7	21	4
Black-tailed Godwit	0%	1%	5	0	0	0	0	2
Bar-tailed Godwit	3%	6%	0	10	0	0	0	4
Knot	2%	12%	11	0	0	0	0	2
Dunlin	1%	8%	230	0	0	2	3	4
Black-headed Gull	1%	4%	29	0	3	1	0	4

This table shows: (1) the mean of each low tide count in the intertidal and subtidal zones across all the subsites in the Poulnasherry/Kilrush AQUA as percentages of the total count across the whole SPA, and across the Lower Shannon zone, respectively; and (2) the mean low tide count in each of the Poulnasherry/Kilrush AQUA subsites.

7.56 A series of low tide waterbird counts was also carried out in Poulnasherry Bay the winters of 1999/00-2001/02. The species numbers recorded in these counts are compared with the numbers recorded in the WSP counts in Table 7.5. The comparisons have to be interpreted with caution, due to the low number of WSP counts. Nevertheless, most species appear to have declined in numbers in Poulnasherry Bay, which is in accordance with the overall population trends reported for the SPA by NPWS (2012c).

Table 7.5 - Comparison of waterbird counts from Poulnasherry Bay.

Species	2000/01-2001/02		2010/11		SPA trend
	mean	range	mean	range	
Whooper Swan	0	-	4	0-13	Increase
Light-bellied Brent Goose	77	7-170	8	0-18	Decline 3
Shelduck	139	22-212	115	25-196	Decline 3
Wigeon	258	9-579	40	2-61	Decline 3
Teal	217	83-503	402	301-510	Decline 3
Mallard	18	0-39	56	23-98	-
Pintail	43	2-91	47	0-94	-
Shoveler	1	0-5	1	0-4	-
Golden Plover	585	0-1560	2	0-7	Decline 3
Grey Plover	53	20-114	24	15-37	Decline 3
Lapwing	526	0-1848	46	0-155	Decline 3
Ringed Plover	23	8-61	7	0-28	Decline 3
Curlew	305	0-702	124	0-205	Decline 3
Black-tailed Godwit	2	0-22	5	0-10	Decline 3
Bar-tailed Godwit	47	0-70	0	-	-
Knot	229	18-499	11	0-33	Decline 3

Species	2000/01-2001/02		2010/11		SPA trend
	mean	range	mean	range	
Dunlin	1397	322-2320	230	100-457	Decline 3
Black-headed Gull	36	0-135	29	19-41	Decline 2

This table compares the count data from the months of November-February in the 2000/01-2001/02 low tide count dataset (n = 10), with the low tide count data from subsite 0H519 in the 2010/11 dataset (n= 4).

SPA trends from NPWS (2012c): Decline 2 = 25-50% decline; Decline 3 = > 50% decline. Note, moderate, or high, levels of caution apply to these trends.

7.57 The 1999/00-2001/02 counts included mapping of the approximate positions of most of the birds counted (see example in Figure 2.3). This mapping is summarised in Appendix C.

7.58 Shelduck, Wigeon, Teal, Pintail, Golden Plover and Lapwing all showed associations with the upper sections of the estuary and/or with shoreline areas in the lower sections. This distribution pattern was noted for Shelduck, Wigeon and Teal, on our site visit in March 2017, with the Shelduck distribution appearing to be concentrated in the areas of heavy algal growth (no Pintail, Golden Plover or Lapwing were present).

7.59 Most of the other species were fairly widely distributed through the available habitat in the NPWS bird usage counts, but with Grey Plover, Ringed Plover, Bar-tailed Godwit, Knot and Dunlin all appearing to avoid the mixed sediment shoreline areas. For these species, there is some indication in these distribution patterns of an association with the more central areas of the estuary, which may reflect association with the tideline/lower intertidal. However, there is evidence from a number of studies that algal cover can modify wader distribution and/or feeding behaviour (Cabral *et al*., 1999; Lewis and Kelly, 2001; Lopes *et al*., 2006; Lewis *et al*., 2014; Green *et al*., 2015). Although the evidence is mixed (Múrias *et al*., 1996), and we not know the extent of algal growth in the early 2000s, it is possible that the above distribution patterns may be influenced by this factor.

Aquaculture

7.60 All the aquaculture sites in the Poulnasherry/Kilrush AQUA are oyster trestle cultivation sites.

7.61 There are 28 sites in the inner part of Poulnasherry Bay, which are mainly distributed along the central tidal channel in the middle of the bay. Parts of some of these sites extend below the mapped intertidal zone, but, based on our observations, all of these sites are likely to be more or less fully exposed on spring low tides.

7.62 A further 13 sites occur in the outer sections of the Poulnasherry/Kilrush AQUA, with the majority of the area occupied by these sites being in the spring low tide zone (as mapped).

Displacement

7.63 The aquaculture sites in the outer part of the Poulnasherry/Kilrush AQUA occur in subsites that appear to hold very low numbers of waterbirds and are mainly only exposed on spring low tides. Therefore, any displacement impacts from these sites are likely to be very minor.

7.64 The aquaculture sites in Poulnasherry Bay overlap areas that are used by relatively large numbers of waterbirds. For the purposes of this assessment we have assumed that all of the areas occupied by these sites are exposed on spring low tides so that the total area of intertidal habitat exposed within this subsite on spring low tides is the mapped extent plus the extra area of the aquaculture sites. Therefore, based on the mapped extent of intertidal habitat, and the above assumption, the sites will occupy around 12% of the intertidal habitat at mean low tide, and around 18% at spring low tide. If the area of intertidal habitat occupied by heavy algal growth is excluded then the

aquaculture sites occupy around 16% of the intertidal habitat at mean low tide, and around 24% at spring low tide.

7.65 Shelduck, Wigeon, Teal, Mallard, Pintail, Golden Plover and Lapwing mainly occur in the upper sections of the estuary and/or in shoreline areas in the lower sections, away from the aquaculture sites. Therefore, development of the aquaculture sites is unlikely to cause measurable displacement impacts to these species and the potential impact is assessed as negligible.

7.66 Grey Plover appears to be completely excluded from oyster trestles. Poulnasherry Bay appears to hold a relatively high proportion of the total River Shannon and River Fergus Estuaries SPA Grey Plover population so the potential displacement impact to this species may be significant. As Grey Plover is a visual feeder it may avoid areas of heavy algal growth (Cabral *et al*., 1999; Green *et al*., 2015) increasing the potential displacement impact. Therefore, the potential impact is assessed as substantial.

7.67 Ringed Plover, Bar-tailed Godwit, Knot and Dunlin also show strong patterns of negative association with oyster trestles, and these species may show an association with the middle/lower part of the bay where the aquaculture sites are concentrated. Poulnasherry Bay does not appear to hold significant proportions of the SPA populations of these species (although the bird usage counts indicate that this area may have been more important for Dunlin in the early 2000s). Therefore, the potential displacement impact is likely to be minor at the SPA scale but moderate at the Lower Shannon (LS) scale

7.68 Black-tailed Godwit also probably shows strong patterns of negative association with oyster trestles. However, it does not appear to occur regularly, and/or in significant number in Poulnasherry Bay. Therefore, the potential displacement impact is likely to be negligible at both the SPA scale and the Lower Shannon scale.

7.69 Light-bellied Brent Goose shows a variable pattern of association with oyster trestles. At Poulnasherry Bay it was not observed feeding on trestles during the trestle study counts, but the overall numbers observed during those counts were very low (mean count of 3 birds). Small numbers were observed feeding on trestles on our site visit in March 2017. The Poulnasherry/Kilrush AQUA appears to be relatively important for the SPA population. However, the birds are likely to use the mixed sediment shore habitat both in Poulnasherry Bay and in the outer sections of the Poulnasherry/Kilrush AQUA, and may also feed on the algal covered mudflats in Poulnasherry Bay. Therefore, even if it is potentially negatively affected by oyster trestle cultivation in the Poulnasherry/Kilrush AQUA, it is less sensitive to the potential impacts than the wader species discussed above. Therefore, the potential impact magnitude has been assessed as moderate negative with low confidence about any negative impact actually occurring.

7.70 Curlew also shows a variable pattern of association with oyster trestles. In the trestle study, there was a neutral pattern of association between Curlew and trestles at Poulnasherry Bay. However, as this is only based on four counts, some caution needs to be applied. The distribution pattern of this species in Poulnasherry/Kilrush also indicates that it is less sensitive to potential displacement impacts. The potential impact magnitude has been assessed as moderate negative with low confidence about any negative impact actually occurring.

7.71 The numbers of Black-headed Gull recorded at Poulnasherry/Kilrush during both the WSP counts were very low, and similar numbers were also recorded during the 2000/01 and 2001/02 bird usage counts. However, very high numbers of Black-headed Gull were recorded in the bird usage counts in March 2001. As discussed above, the potential displacement impact to Black-headed Gull cannot be assessed with any degree of confidence due to lack of appropriate data due to the likely seasonal timing of its peak period of usage of intertidal habitat. However, it should be noted that in

the trestle study, there was a negative pattern of association between Black-headed Gull and trestles at POU; although as this is only based on four counts, some caution needs to be applied.

Table 7.6 - Assessment of potential displacement impact from intertidal aquaculture in the Poulnasherry/Kilrush AQUA.

Species	Likelihood of negative impact	Assessment of impact magnitude	
		SPA	LS zone
Light-bellied Brent Goose	1	moderate	moderate
Shelduck	2	negligible	negligible
Wigeon	1	negligible	negligible
Teal	2	negligible	negligible
Mallard	2	negligible	negligible
Pintail	2	negligible	negligible
Grey Plover	3	substantial	substantial
Lapwing	2	negligible	negligible
Ringed Plover	3	minor	minor
Curlew	1	moderate	moderate
Black-tailed Godwit	2	negligible	negligible
Bar-tailed Godwit	3	minor	moderate
Knot	3	minor	moderate
Dunlin	3	minor	moderate
Black-headed Gull	1	not assessed	not assessed

Likelihood of a negative impact: 1 = species shows a variable response to oyster trestles, so a neutral or positive impact may occur; 2 = species considered to show a negative response to oyster trestles but evidence for this is weak; 3 = strong evidence that species shows a negative response to oyster trestles.

Impact magnitude levels are defined in Table 2.2. The confidence level for all impact magnitude assessments is low.

Glin AQUA

Habitats

7.72 The distribution of intertidal habitat in the Glin AQUA is shown in Figure 7.3. This area has a narrow intertidal zone, which mainly consists of mixed sediment/rocky shore habitat (mapped by NPWS as the *fucoid-dominated intertidal reef community complex*). Some intertidal sediment occurs, mainly in the eastern section, although this is not recognised in the NPWS mapping. The Admiralty Chart indicates that there is a steeply shelving shoreline below the intertidal zone and there does not appear to be an extensive area of lower intertidal exposed on spring low tides.

Waterbirds

7.73 The distribution of waterbirds in the WSP counts is shown in Table 7.2. As these are relatively small subsites, the overall numbers recorded for most species were low. However, the area did hold a high percentage of the SPA Ringed Plover population. The mapped flock positions Ringed Plover in these subsites were all in, or on the edge of, areas of intertidal sediment (Figure 7.3).

Table 7.7 - Occurrence and distribution of waterbirds in intertidal habitats in the Glin AQUA during the WSP low tide counts.

Species	Mean % of		Mean count		Non-zero counts
	SPA	LS zone	0I442	0I443	
Whooper Swan	12%	14%	0	1	1
Wigeon	1%	2%	6	10	4
Teal	0%	1%	5	4	4
Mallard	1%	1%	2	1	3
Golden Plover	1%	6%	0	78	2
Grey Plover	0%	0%	0	0	0
Lapwing	1%	1%	0	27	2
Ringed Plover	10%	10%	6	6	4
Curlew	1%	2%	3	25	4
Dunlin	0%	2%	10	30	4
Black-headed Gull	1%	3%	26	8	4

This table shows: (1) the mean of each low tide count in the intertidal and subtidal zones across all the subsites in the Glin AQUA as percentages of the total count across the whole SPA, and across the Lower Shannon zone, respectively; and (2) the mean low tide count in each of the Glin AQUA subsites.

Aquaculture

7.74 The single aquaculture site in the Glin AQUA (T07/13A) is an oyster trestle cultivation site, with an area of 0.72 ha. This site occupies a narrow section of shoreline in the western section of subsite 0I443. Around half of the site is on rocky shore habitat in the mean low tide zone and half is on intertidal sediment habitat in the spring low tide zone.

Impact assessment

7.75 Ringed Plover is a species that is probably completely excluded from areas occupied by oyster trestles. However, the oyster trestle cultivation site in the Glin AQUA is only likely to cause displacement of Ringed Plover on spring low tides as the habitat occupied by the site in the mean low tide zone is rocky shore. The total area of intertidal sediment habitat exposed on spring low tides is around 27 ha and the site will occupy around 1% of this area in a peripheral zone of the habitat. Unlike many other waders, Ringed Plover do not appear to be strongly associated with tideline areas, even in open sandflat habitats. Therefore, the overall displacement impact of development of site T07/13A on Ringed Plover is likely to be negligible.

7.76 All the other waterbird species appear to occur in very low numbers in this area. Therefore, any displacement impacts from development of site T07/13A on these species are likely to be negligible.

Aughinish/Foynes AQUA

Habitats

7.77 The distribution of intertidal habitat in the Aughinish/Foynes AQUA is shown in Figure 7.4. This area has a complex configuration of intertidal habitat. There are extensive areas of intertidal habitat in the open bays between Foynes Island and Aughinish, and between Aughinish and Beagh Castle, as well as upper intertidal habitat along the Robertstown River, Poulaweela Creek and the River Deel. There is a complex mixture of intertidal sediment and mixed sediment/rocky shore habitat, and the mapped extent of these habitat types is a simplification of the true distribution patterns. Significant areas mapped by NPWS as *1140 tidal mudlfats and sandflats* are occupied by *Spartina*

beds and have been excluded from the mapped extent of intertidal habitat used for this assessment. Over most of this area, the mapped extent of the additional intertidal area exposed on spring low tides is quite small, but there is a large area of this zone mapped in area to the east of Aughinish Island. All the soft sediment intertidal habitat in this area is classified as the *intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex* by NPWS.

Waterbirds

7.78 The distribution of waterbirds in the WSP counts is shown in Table 7.2. The Aughinish/Foynes AQUA appears to hold significant components of the SPA populations of a number of waterbird species. In the outer section, the bay to the east of Aughinish Island (subsites 0I437 and 491) appear to hold the main concentrations of waterbirds, while significant numbers of some species occur along Robertstown River and Poulaweela Creek (subsites 0I439 and 436).

7.79 The concentrations of waterbirds indicated by the flock mapping data from the WSP counts does not correspond to the distribution patterns indicated by the count data. There are very few flocks mapped in subsite 0I491, or in the outer parts of 0I437, despite the relatively large numbers of most species that occurred in these subsites, while the distribution between subsites of mapped flocks of several species does not correspond to the relative numbers that occurred in the subsites. This may reflect difficulties in coverage of these areas and could possibly indicate that the outer parts of these subsites were poorly covered.

Table 7.8 - Occurrence and distribution of waterbirds in intertidal habitats in the Aughinish/Foynes AQUA during the WSP low tide counts.

Species	Mean % of		Mean count								Non-zero counts
			outer subsites					inner subsites			
	SPA	LS zone	0I440	0I438	0I437	0I491	0I432	0I439	0I436	0I458	
Shelduck	7%	14%	2	9	11	3	1	4	0	2	4
Wigeon	7%	13%	0	0	27	51	0	4	16	0	4
Teal	10%	15%	11	0	56	50	3	21	79	17	4
Mallard	14%	23%	0	5	23	14	2	5	14	1	4
Golden Plover	2%	6%	0	0	0	42	0	71	0	0	3
Grey Plover	19%	35%	0	0	26	0	1	0	0	3	4
Lapwing	10%	25%	1	0	12	134	7	109	63	0	4
Ringed Plover	2%	2%	0	2	0	0	0	0	0	0	1
Curlew	11%	15%	4	25	22	26	15	35	30	6	4
Black-tailed Godwit	16%	82%	1	2	135	5	14	15	104	1	4
Bar-tailed Godwit	13%	16%	3	1	25	0	0	4	0	0	3
Knot	3%	15%	0	1	0	0	6	0	0	10	4
Dunlin	2%	12%	0	85	83	40	6	2	0	0	4
Black-headed Gull	8%	25%	47	99	40	10	10	71	20	0	4

This table shows: (1) the mean of each low tide count in the intertidal and subtidal zones across all the subsites in the Aughinish/Foynes AQUA as percentages of the total count across the whole SPA, and across the Lower Shannon zone, respectively; and (2) the mean low tide count in each of the Aughinish/Foynes AQUA subsites.

Aquaculture

7.80 There are two aquaculture sites in the Aughinish/Foynes AQUA that occupy intertidal habitat: sites T07/007 and T07/012A.

7.81 Site T07/007 covers an area of 5.6 ha of intertidal habitat within the mean low tide zone on a sandbank off the eastern side of the Aughinish Island. This area was mapped as mixed rock/sediment habitat by Aquafact (2011a). However, aerial imagery indicates that over 80% of the site is soft sediment. This site will be used for oyster trestle cultivation and bouchet pole mussel cultivation.

7.82 Site T07/012A covers an area of 124 ha of mainly intertidal soft sediment habitat in the middle of the bay to the east of Aughinish Island. Over half of the intertidal habitat in this site is within the spring low tide zone. The site also includes small areas of tidal channel habitat that are likely to be permanently flooded. This site will be used for bouchet pole and bottom mussel cultivation. While no details have been provided, it seems reasonable to assume that the bouchet pole cultivation will take place in the higher elevation sections of the site.

Impact assessment

7.83 The assessment of potential impacts from development of sites T07/007 and T07/012A is complicated by lack of information about: the distribution of waterbirds within the large, and heterogeneous subsites that contain the sites; the impacts of bouchet mussel and bottom mussel cultivation on intertidal waterbirds; and the planned division of the activities within the sites. Therefore, a very low degree of confidence applies to all the following assessments given these constraints.

7.84 The two sites together occupy 45 ha of intertidal habitat within the mapped mean low tide zone and further 63 ha of intertidal habitat within the mapped spring low tide zone. This amounts to around 8%, and 17%, respectively of the total mapped extent of intertidal habitat exposed at mean and spring, low tides in subsites 0I437 and 491.

7.85 Of the species that occur in relatively high number in the Aughinish/Foynes AQUA, Grey Plover is probably the most sensitive to potential displacement impacts from the development of sites T07/007 and T07/012A. This species is likely to utilise the type of open intertidal habitat occupied by the aquaculture sites and two of the three mapped flock positions from the WSP counts were adjacent to site T07/007. This species was also shown to be potentially displaced by intertidal longline oyster cultivation, which can be viewed as somewhat analogous to bouchet pole mussel cultivation (see paragraph 7.31). Therefore, the potential displacement impact to this species has been assessed as being substantial at both the SPA and Lower Shannon scales.

7.86 Bar-tailed Godwit is also likely to utilise the outer intertidal habitats occupied by the aquaculture sites, although it may be less sensitive to displacement impacts than Grey Plover (it is not completely excluded from areas occupied by oyster trestles). Therefore, the potential displacement impact to this species has been assessed as being substantial at both the SPA and Lower Shannon scales.

7.87 Black-tailed Godwit also appears to occur in relatively high numbers in the Aughinish/Foynes AQUA, particularly in the Lower Shannon context. However, this species is more likely to be associated with muddier sediments in the inner parts of subsites 0I437 and 491, than with the outer areas occupied by sites T07/007 and T07/012A. Therefore, potential displacement impact to this species has been assessed as being minor at the SPA level, but still being substantial at the Lower Shannon scale due to the relative numbers that occur within this area.

7.88 Knot and Dunlin may also make significant use of the outer intertidal areas occupied by the aquaculture sites, although they appear to be less concentrated in these areas than Grey Plover and Bar-tailed Godwit. The numbers of these species that appear to occur in the Aughinish/Foynes AQUA are very low in the SPA context, but more significant in the Lower Shannon context. Therefore, the potential displacement impacts to these species have been assessed as being negligible at the SPA scale, but moderate at the Lower Shannon scale.

7.89 As discussed above, the potential displacement impact to Black-headed Gull cannot be assessed with any degree of confidence due to lack of appropriate data due to the likely seasonal timing of its peak period of usage of intertidal habitat.

7.90 The other SCI waterbird species that occur in the Aughinish/Foynes AQUA are likely to be mainly associated with the upper/inner intertidal areas (Shelduck, Wigeon, Teal, Mallard, Golden Plover and Lapwing), or widely distributed throughout the area without particular concentrations in the outer intertidal area (Curlew). Therefore, the potential impacts to these species have been assessed as being negligible at the SPA scale and negligible-minor at the Lower Shannon scale, depending upon the relative numbers that occur in this AQUA and the likely degree of concentration in the upper/inner intertidal areas.

Table 7.9 - Assessment of potential displacement impact from intertidal aquaculture in the Aughinish/Foynes AQUA.

Species	Likelihood of negative impact	Assessment of impact magnitude	
		SPA	LS zone
Shelduck	2	negligible	minor
Wigeon	1	negligible	minor
Teal	2	negligible	minor
Mallard	2	minor	moderate
Golden Plover	2	negligible	negligible
Grey Plover	3	substantial	substantial
Lapwing	2	negligible	minor
Ringed Plover	3	negligible	negligible
Curlew	1	negligible	minor
Black-tailed Godwit	2	minor	substantial
Bar-tailed Godwit	3	substantial	substantial
Knot	3	negligible	moderate
Dunlin	3	negligible	moderate
Black-headed Gull	1	not assessed	not assessed

Likelihood of a negative impact: 1 = species shows a variable response to oyster trestles, so a neutral or positive impact may occur; 2 = species considered to show a negative response to oyster trestles but evidence for this is weak; 3 = strong evidence that species shows a negative response to oyster trestles.

Impact magnitude levels are defined in Table 2.2. The confidence level for all impact magnitude assessments is low.

Whooper Swan

7.91 The Whooper Swan wintering population in the Shannon Estuary area mainly forage on agricultural fields outside the River Shannon and River Fergus Estuaries SPA boundary (NPWS, 2012c). However, they have been recorded on tidal habitats within the River Shannon and River Fergus Estuaries SPA during both WSP and I-WeBS counts. In general, Whooper Swan are likely to mainly used tidal habitats as roosting sites, either as disturbance refuges during the day, or as nocturnal roost sites (Gittings and O'Donoghue, 2013, 2016b). In the WSP counts, two of the five records from tidal habitats involved feeding birds. However, all the records on the WSP counts involved

small numbers of birds (1-13 birds) and it is likely that significant numbers of Whooper Swan only use tidal habitats within the River Shannon and River Fergus Estuaries SPA for roosting.

7.92 During the WSP counts, there were two records of Whooper Swan from subsite 0H519, which covers the outer part of Poulnasherry Bay. The records of birds on two of the four low tide counts in Poulnasherry Bay might be interpreted as indicating regular usage of this area. However, during the NPWS bird usage counts, Whooper Swan was only recorded on one out of the 21 counts (547 birds in the south-eastern part of the inner bay on 21st March 2001). During I-WeBS counts, Whooper Swan have only been recorded from Poulnasherry Bay on three counts across the entire period for which data is available, all of which were in the same winter (3-5 birds between 18th October and 31st December 1998). There are also a further three I-WeBS records from the eastern side of the Poulnasherry/Kilrush AQUA, away from any of the aquaculture sites[7]. Therefore, the frequency of records from this area during the WSP counts appears to be misleading, and Whooper Swan does not appear to regularly make use of tidal habitats in Poulnasherry Bay.

7.93 Whooper Swan have also been recorded from the Ballylongford/Bunaclugga, GLIN and Aughinish/Foynes AQUAS, but again the frequency of records is very low: three records from I-WeBS counts in the Ballylongford/Bunaclugga AQUA (2-8 birds); one record from the WSP counts in the GLIN AQUA, and three records from I-WeBS counts in the Aughinish/Foynes AQUA (7-22 birds)[7].

7.94 Overall, therefore, the available data indicates that Whooper Swan does not make regular daytime use of tidal habitats in any of the AQUA areas. However, we do not have any information on the location of the nocturnal roost sites used by Whooper Swan in the Shannon Estuary area.

7.95 The response of Whooper Swan to intertidal aquaculture activity is not known. However, it seems reasonable to assume that Whooper Swan would be deterred from using areas occupied by significant physical structures (such as oyster trestles and bouchet poles), while husbandry activity would be likely to cause disturbance impacts. However, as Whooper Swan do not appear to make significant daytime use of any of the AQUA areas, any such impacts are not likely to significantly affect the daytime habitat use by the SHSAP Whooper Swan population.

7.96 The possibility of aquaculture development affecting nocturnal roost sites used by Whooper Swan cannot be discounted as we have no information on the location of these roost sites.

Disturbance impacts to the intertidal zone from subtidal aquaculture activity

Waterbird species roosting in intertidal and shallow subtidal habitat

7.97 Boat access to/from aquaculture sites, and/or husbandry activity in moderately deep, or deep subtidal habitat could potentially cause disturbance impacts to waterbirds roosting in intertidal and shoreline habitats at high tide. Waterbirds using these types of roosts are typically more sensitive to disturbance than waterbirds roosting in subtidal habitat because the availability of suitable habitat in each roost site is usually tightly constrained. This means that if the birds are disturbed they will often flush and abandon the roost site completely, while birds roosting in subtidal habitat can usually move short distances to a safe distance away from the disturbance source.

7.98 The WSP high tide roost survey identified a number of small roost sites (each holding 1-50 birds) in the outer part of Ballylongford Creek and along the south-eastern shoreline of Ballylongford Bay (Figure 8.1). These sites could potentially be affected by disturbance from boat activity associated

[7] Note that records from I-WeBS counts may include birds on non-tidal habitat.

with travel to/from sites T06/233, T06/394A and T06/394B, and/or husbandry activity in site T06/233.

7.99 The survey also identified a number of mainly small roost sites (each holding 1-50 birds), and one larger roost site (holding 50-99 birds) along the lower part of the River Deel tidal channel and in the outer part of subsite 0I437. These roosts could potentially be affected by disturbance from boat activity associated with travel to/from sites T07/007, T07/012A and T07/014A, and/or husbandry activity in site T07/012A (Figure 8.2).

7.100 The small numbers of birds using these roost sites and the proximity of alternative roost sites that displaced birds could potentially move to, suggest that any such disturbance impacts would not be significant. However, the mapping of high tide roost sites is based on a survey carried out on a single day. Waterbird usage of high tide roost sites can be very variable. There can be significant seasonal variation in roost site usage, while other factors such as the spring-neap cycle and water conditions can affect high roost distribution. Therefore, without more detailed information on usage of high tide roost sites in these areas it is not possible to exclude the possibility that development of sites T06/233, T06/394A, T06/394B, T07/007, T07/012A and T07/014A may cause significant disturbance impacts to important high tide roost sites for the SCI species covered by this assessment.

Waterbirds feeding in intertidal and shallow subtidal habitat

7.101 Boat access to/from aquaculture sites, and/or husbandry activity in moderately deep, or deep subtidal habitat could potentially cause disturbance impacts to waterbirds using intertidal and shallow subtidal habitat at low tide and/or on ebb/flood tides.

7.102 The potential disturbance impacts of boats travelling to/from aquaculture sites are likely to be very minor, as there are only likely to be two movements (at most) per tidal cycle and birds on adjacent intertidal and shallow subtidal habitat can move a short distance away if disturbed and then return when the boat has passed.

7.103 The only sites where husbandry activity could have the potential to cause disturbance to birds using intertidal and shallow subtidal habitat are site T06/233 in the Ballylongford/Bunaclugga AQUA and site T07/014A in the Aughinish/Foynes AQUA.

7.104 Site T06/233 includes intertidal habitat along the south-eastern shoreline of Ballylongford Bay. However, this intertidal habitat is a steeply shelving shingle shore that is likely to only be used by very low numbers of a few species such as Curlew. Therefore, any disturbance impacts to birds using this shoreline would not affect significant numbers of birds.

7.105 Site T06/233 also extends to within around 70-150 m of the mapped extent of intertidal habitat exposed on spring low tides on the western side of Ballylongford Bay. However, it is likely that husbandry activity will not take place on spring low tides as the much of the site would probably not be accessible by boat.

7.106 Site T07/014A extends to within around 10-15 m of the mapped extent of intertidal habitat exposed on spring low tides, and to within around 100 m of the mapped extent of intertidal habitat exposed on mean low tides. However, it is likely that husbandry activity will not take place on spring low tides as the upper parts of the site will probably not be accessible by boat. The intertidal habitat adjacent to this site is within subsite 0I432, and this subsite appears to support relatively low numbers of birds (see Table 7.8).

7.107 Waterbirds using intertidal and shallow subtidal habitat at low tide do not appear to be very sensitive to disturbance from boat activity in adjacent subtidal habitat. For example, in two winters of low tide

surveys in the mussel beds in Castlemaine Harbour, we did not observe any incidences of disturbance to waterbirds in intertidal and shallow subtidal zones from regular mussel dredging activity within a few 100 m of the tideline.

7.108 Therefore, given the nature and distribution the associated boat activity, the nature of the bird utilisation of the areas potentially affected by disturbance and the low sensitivity of waterbirds to disturbance impacts from this type of activity, it can be concluded the development of aquaculture sites in moderately deep and deep subtidal habitat will not cause significant disturbance impacts to waterbirds using intertidal and shallow subtidal habitat at low tide and/or on ebb/flood tides.

Conclusions

7.109 The assessments of potential impacts of intertidal aquaculture in each individual AQUA are summarised in Table 7.10 (SPA scale) and Table 7.11 (Lower Shannon scale). At the SPA scale significant overall impacts are considered likely for Grey Plover and Bar-tailed Godwit, and possible for Light-bellied Brent Goose and Ringed Plover. At the Lower Shannon scale significant overall impacts are considered likely for Grey Plover and Bar-tailed Godwit, and possible for Light-bellied Brent Goose, Ringed Plover, Black-tailed Godwit, Knot and Dunlin. However, it should be noted that for Light-bellied Brent Goose the likelihood of any negative impact occurring is uncertain.

7.110 The potential impact of intertidal aquaculture on Black-headed Gull cannot be assessed at this stage, due to lack of data on Black-headed Gull distribution within the River Shannon and River Fergus Estuaries SPA at the time of its likely peak usage of the area. However, it should be noted that for Black-headed Gull the likelihood of any negative impact occurring is uncertain.

7.111 Intertidal aquaculture is unlikely to significantly affect the daytime habitat use by the River Shannon and River Fergus Estuaries SPA Whooper Swan population, but possible impacts on nocturnal roost sites used by Whooper Swan cannot be discounted due to lack of information.

7.112 The possibility that vessel activity associated with the development of sites T06/233, T06/394A, T06/394B, T07/007, T07/012A and T07/014A may cause significant disturbance impacts to important high tide roost sites for the SCI species covered by this assessment cannot be excluded due to lack of information about the usage of high tide roost sites in these areas.

Table 7.10 - Summary of potential impact magnitudes assessed for each AQUA, and the probability of a significant overall impact, at the SPA scale.

Species	Likelihood of negative impact	AQUA				Probability of significant overall impact
		Ballylongford/ Bunaclugga	Poulnasherry/ Kilrush	Glin	Aughinish/ Foynes	
Light-bellied Brent Goose	1	minor-moderate	moderate	-	-	possible
Shelduck	2	negligible	negligible	-	negligible	unlikely
Wigeon	1	moderate	negligible	negligible	negligible	unlikely
Teal	2	negligible	negligible	negligible	negligible	unlikely
Mallard	2	negligible	negligible	negligible	minor	unlikely
Pintail	2		negligible			unlikely
Golden Plover	2	negligible	-	negligible	negligible	unlikely
Grey Plover	3	minor	substantial	negligible	substantial	likely
Lapwing	2	negligible	negligible	negligible	negligible	unlikely
Ringed Plover	3	moderate-substantial	minor	negligible	negligible	possible
Curlew	1	minor	moderate	negligible	negligible	unlikely
Black-tailed Godwit	2	negligible	negligible	-	minor	unlikely
Bar-tailed Godwit	3	moderate	minor		substantial	likely
Knot	3	negligible	minor		negligible	unlikely
Dunlin	3	negligible	minor	negligible	negligible	unlikely
Black-headed Gull	1	not assessed	not assessed	not assessed	not assessed	not assessed

Likelihood of a negative impact: 1 = species shows a variable response to oyster trestles, so a neutral or positive impact may occur; 2 = species considered to show a negative response to oyster trestles but evidence for this is weak; 3 = strong evidence that species shows a negative response to oyster trestles.

Impact magnitude levels are defined in Table 2.2. The confidence level for all impact magnitude assessments is low.

Table 7.11 - Summary of potential impact magnitudes assessed for each AQUA, and the probability of a significant overall impact, at the LS scale.

Species	Likelihood of negative impact	AQUA				Probability of significant overall impact
		Ballylongford/ Bunaclugga	Poulnasherry/ Kilrush	Glin	Aughinish/ Foynes	
Light-bellied Brent Goose	1	minor-moderate	moderate	-	-	possible
Shelduck	2	negligible	negligible		minor	unlikely
Wigeon	1	moderate	negligible	negligible	minor	unlikely
Teal	2	negligible	negligible	negligible	minor	unlikely
Mallard	2	negligible	negligible	negligible	moderate	unlikely
Pintail	2	-	negligible	-	-	unlikely
Golden Plover	2	negligible	-	negligible	negligible	unlikely
Grey Plover	3	minor	substantial	negligible	substantial	likely
Lapwing	2	negligible	negligible	negligible	minor	unlikely
Ringed Plover	3	moderate-substantial	minor	negligible	negligible	possible
Curlew	1	minor	moderate	negligible	minor	unlikely
Black-tailed Godwit	2	minor	negligible	-	substantial	possible
Bar-tailed Godwit	3	moderate	moderate	-	substantial	likely
Knot	3	negligible	moderate	-	moderate	possible
Dunlin	3	minor	moderate	negligible	moderate	possible
Black-headed Gull	1	not assessed	not assessed	not assessed	not assessed	not assessed

Likelihood of a negative impact: 1 = species shows a variable response to oyster trestles, so a neutral or positive impact may occur; 2 = species considered to show a negative response to oyster trestles but evidence for this is weak; 3 = strong evidence that species shows a negative response to oyster trestles.

Impact magnitude levels are defined in Table 2.2. The confidence level for all impact magnitude assessments is low.

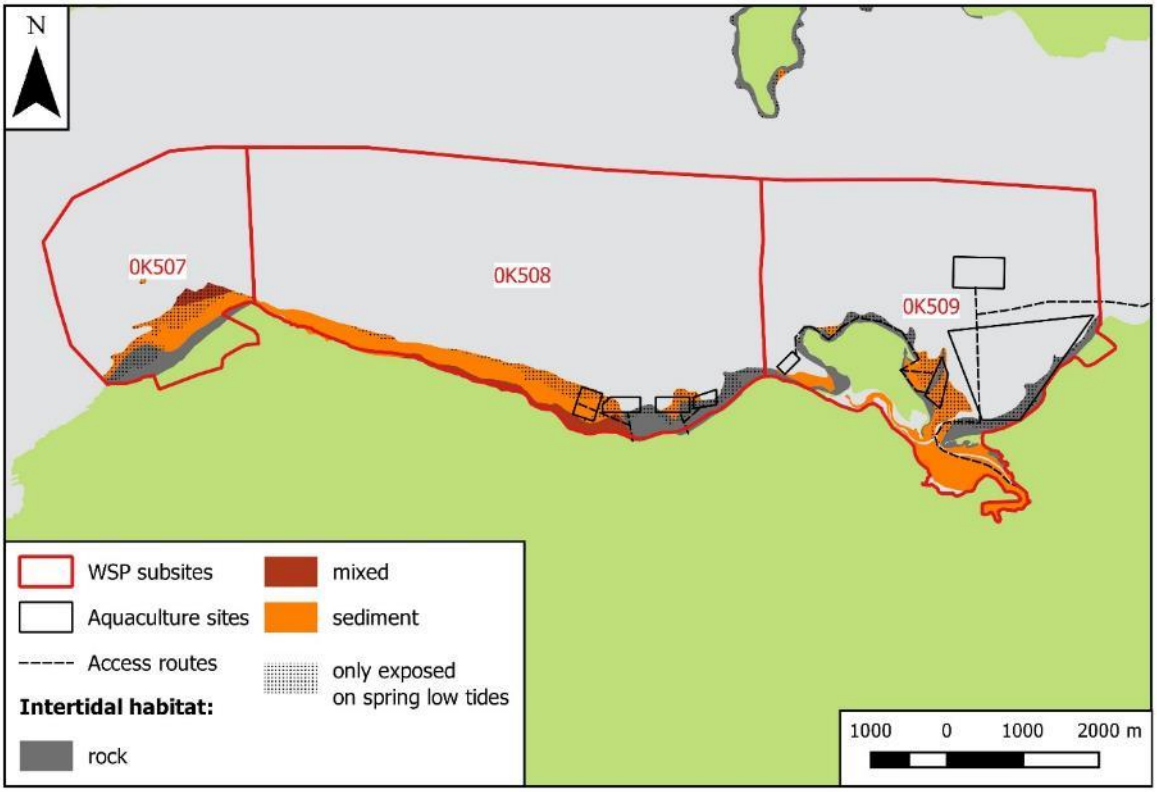

Figure 7.1 Distribution of intertidal habitat in the Ballylongford/Bunaclugga AQUA.

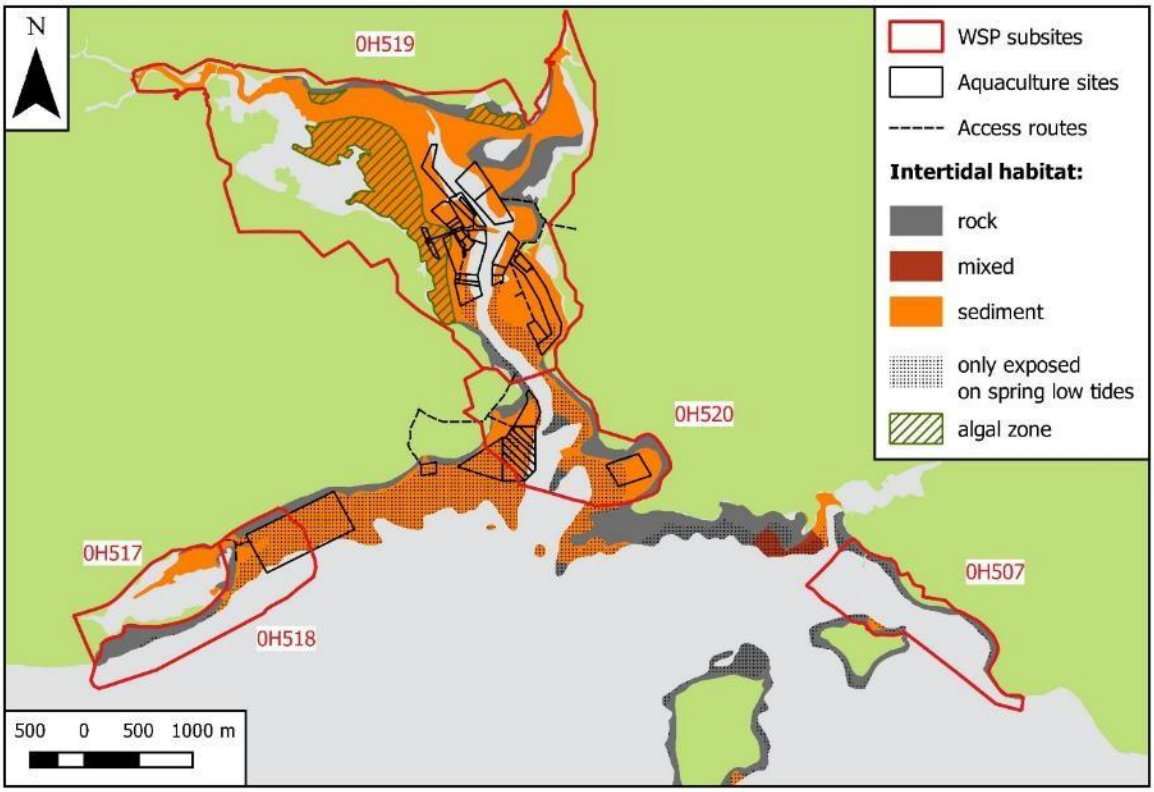

Figure 7.2 Distribution of intertidal habitat in the Poulnasherry/Kilrush AQUA.

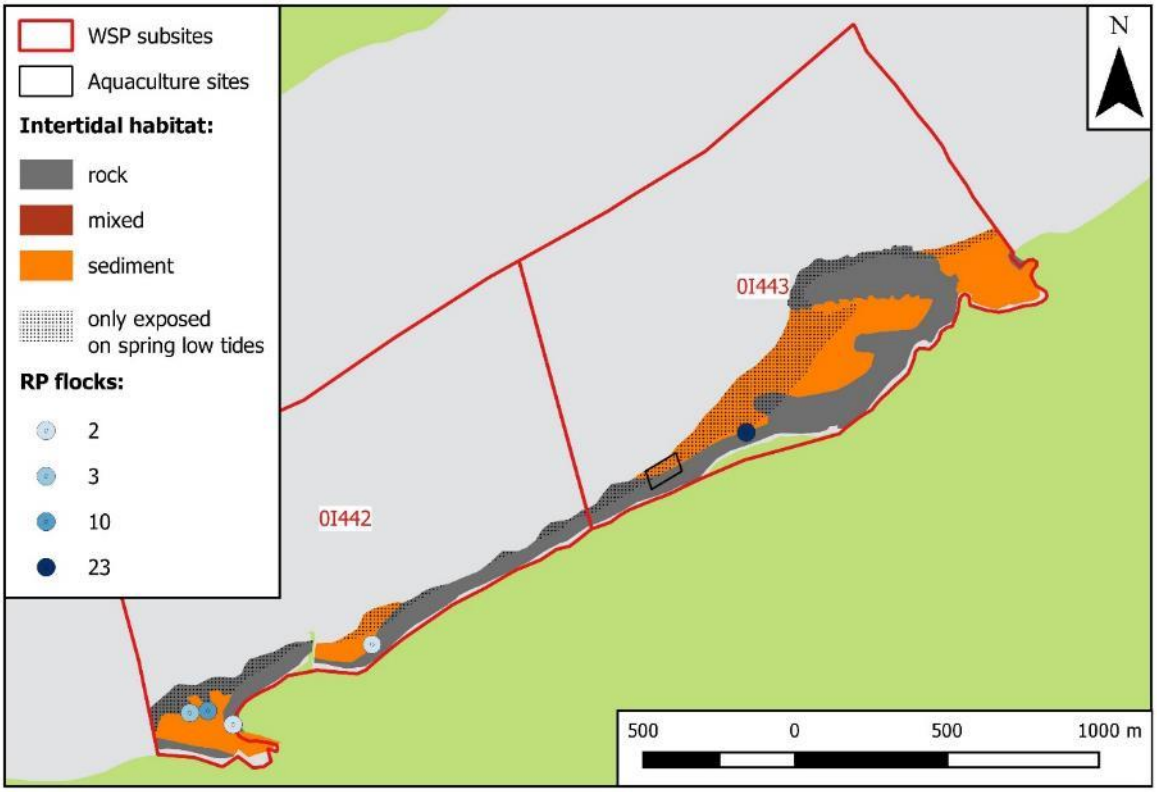

Figure 7.3 Distribution of intertidal habitat in the Glin AQUA.

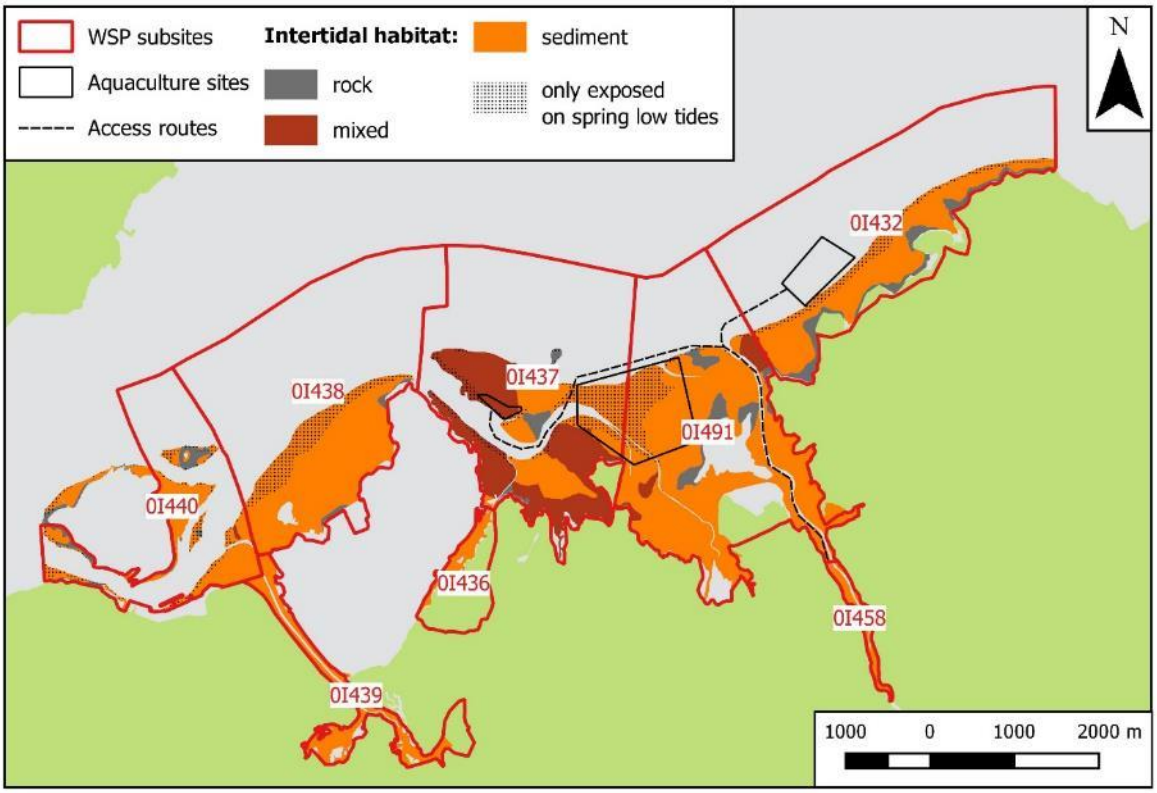

Figure 7.4 Distribution of intertidal habitat in the Aughinish/Foynes AQUA.

8. Assessment of impacts on birds using subtidal habitats

Introduction

8.1 This chapter assesses the potential impacts of aquaculture activity on SCIs using moderately deep, and deep, subtidal habitat. The following SCIs are assessed in this chapter: Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard, Pintail, Scaup, Fulmar, Cormorant, Kittiwake, Black-headed Gull and Guillemot.

8.2 This chapter includes assessment of the impacts of intertidal aquaculture activity on SCIs that may potentially use the affected habitat at high tide, as at this time the habitat becomes moderately deep subtidal habitat.

Sites

8.3 There are four aquaculture sites that occupy predominantly, or only, subtidal habitat within the River Shannon and River Fergus Estuaries SPA (Table 4.1). In addition, there are other aquaculture sites that are predominantly within the intertidal zone, but which appear to extend into permanent subtidal habitat, while intertidal aquaculture could potentially also affect birds using subtidal habitat during the high tide period when the sites are flooded.

Table 8.1 - Subtidal aquaculture sites within the River Shannon and River Fergus Estuaries SPA.

AQUA	Site	Type	Area (ha)
Ballylongford/ Bunaclugga	T06/233	Bottom mussels	151
	T06/394A	Mussel longlines and seaweed	18
	T06/394B	Mussel longlines and seaweed	11
Aughinish/ Foynes	T07/014A	Bottom mussels	32

Species

8.4 There are five screened-in SCI species (Scaup, Fulmar, Cormorant, Kittiwake and Guillemot) that are predominantly associated with subtidal habitat. Another two species (Whooper Swan and Black-headed Gull) may make significant use of subtidal habitat for foraging and/or roosting. Other species (Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard and Pintail) utilise shallow subtidal habitat (generally less than 0.5 m deep) as foraging habitat and may also use deeper subtidal habitat for roosting.

Potential impacts

8.5 The potential impacts of the development of aquaculture sites in the intertidal zone on species using shallow subtidal habitat are dealt with in Chapter 7. Therefore, this chapter is mainly concerned with potential impacts on species using moderately deep (0.5-5 m) or deep (> 5 m) subtidal habitat. These impacts may arise either from development of sites in the permanent subtidal zone, or from the impact of intertidal sites when they are flooded at high tide.

Habitat alteration impacts

Bottom mussel culture

8.6 Bottom culture of mussels can be disturbing to certain subtidal biotopes, due to extirpation of the characteristic infaunal species from the area covered by mussels, and, in some cases, the sensitivity of characteristic species to organic enrichment, smothering and/or physical disturbance from dredging (Marine Institute, 2013).

8.7 From a review of the literature (Appendix D), the following general patterns can be identified. Mussel culture beds can increase the diversity and abundance of epibenthic fauna by providing an additional food resource for species that predate on the mussels themselves or other species that may be attracted to the mussel bed to predate on the species that are attracted to the mussel beds for refuge. This change in epibenthic fauna contrasts with a reduction in diversity of infaunal species as increased organic rich sediments deposited by the mussels changes the characteristics of the sediments beneath the culture plot (assuming that deposition rates are high; Francis O'Beirn, Marine Institute, pers. comm.). There is disagreement as to the nature of the effect of mussel beds on the abundance of other filter feeding benthic species: a positive effect, by providing an additional habitat for larvae to establish; or a negative effect, by consuming the larvae of other species that may otherwise occupy the area. In general, it appears the effects of bottom mussel culture have been found to be localised in extent but may persist in time depending in the biotic and abiotic processes operating in the area.

8.8 Increasing the density of mussels has been demonstrated to cause reduced abundance and diversity of invertebrates. This is due to complete dominance of mussels in terms of space and quite likely filtration (competitive exclusion). There is very little reference to fishes in mussel literature and speculation might lead us to assume that tightly packed mussels will result in homogeneous habitat and little provision of refugia for fishes. This scenario would be more likely to refer to natural seed beds found intertidally which would not have been subject to any erosion or stratification due to aging of the mussels in the beds and which would be uniform in terms of age and size. However, if an area comprises patches of mussels (of varying densities) among sandy/muddy habitat then this could provide sufficient complexity of habitat to support a diverse fish assemblage. This scenario is more likely to apply to cultivated mussel beds (Francis O'Beirn, Marine Institute, pers. comm.).

8.9 In Wexford Harbour, which has the most intensive development of this activity in Ireland, analysis of aerial imagery indicates that the second scenario applies to the cultivated mussel beds (Gittings and O'Donoghue, 2016c). Furthermore, the draft SAC assessment for Wexford Harbour (Marine Institute, 2016) states that: "*in Wexford Harbour, mussel culture practices result in a mottled distribution of mussels on the seabed forming in a heterogeneous habitat structure" and that "such a structural arrangement is likely to benefit overall system diversity*" in line with the conclusions of other studies "*that mussel reef systems (on sedimentary habitats), as found in Wexford, enhance habitat heterogeneity and species diversity at the ecosystem level*".

8.10 If the patterns of bottom mussel cultivation in Wexford Harbour are typical of the likely development of this activity in the Shannon, it can be concluded that bottom culture of mussels is unlikely to reduce food resources for benthic invertebrate eating, and/or fish-eating, species.

Bottom oyster culture

8.11 Bottom culture of oysters can be disturbing to intertidal and subtidal biotopes when some of the characteristic species are sensitive to organic enrichment, smothering and/or physical disturbance from dredging (Marine Institute, 2013).

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

Suspended mussel culture

8.13 Subtidal mussel culture using longlines or rafts causes a physical alteration to the structure of the subtidal habitat through the placement of physical structures (anchors, longlines and rafts) in the subtidal habitat. It may also cause impacts to benthic invertebrates through sedimentation and eutrophication, and this could potentially affect food resources for waterbird species. However, it is likely to increase the abundance of fish, due to the structures attracting fish, and/or the prey resources provided by the epifauna associated with the structures (McKindsey *et al*., 2011).

Intertidal oyster cultivation

8.14 Dumbauld *et al*. (2009) reviewed studies of the effects of bivalve shellfish aquaculture on nekton (fish and mobile invertebrates such as crabs). There was only one study that specifically examined intertidal oyster cultivation using bags and trestles (Laffargue *et al*., 2006). This study found that, in an experimental pond mesocosm, sole used the oyster trestles as resting areas during the day, moving out into the open areas (which simulated tidal flats) to forage at night and the authors considered that the "*oyster trestles offered cover, camouflage, and safety and were therefore attractive to sole (as artificial reef-structuring effects)*". Similarly, De Grave *et al*., (1998) noted that the trestles in their Dungarvan Harbour study site acted as refuges for scavenging crabs and shrimps. There were also a number of studies reviewed by Dumbauld *et al*. (2009) of related types of oyster cultivation (included suspended culture in subtidal waters, rack and bag systems, longlines and oyster grow-out cages). These all involve placing physical structures in the intertidal or subtidal waters and the potential impacts from organic enrichment and benthic community changes associated with oyster cultivation, so provide some degree of analogous situations to intertidal oyster cultivation using bags and trestles. These have generally found either little differences between oyster cultivation areas and nearby uncultivated habitats, or higher densities of nekton in the oyster cultivation areas.

Disturbance

8.15 Subtidal bottom mussel cultivation, mussel longline cultivation and some of the intertidal cultivation could cause impacts to waterbirds using moderately deep, or deep, subtidal habitat through disturbance associated with husbandry activities and/or travel to/from the sites.

8.16 Both bottom mussel cultivation sites in the Aughinish/Foynes AQUA will be accessed by boat from the River Deel. Relaying at these sites will take place in August-September, while harvesting will take place in October-December on approximately two days per week. On site T07/12, husbandry activities will take place over the high tide period, while at site T07/14, husbandry activities can take place at any stage of the tide. The intertidal oyster cultivation/bouchet mussel cultivation site in the Aughinish/Foynes area will also be accessed by boat from the River Deel. As husbandry activity in this site will presumably take place at low tide, the boat access will presumably be on the ebb and flood tides.

8.17 The mussel cultivation sites in the Ballylongford/Bunaclugga AQUA will be accessed by boat from Ballylongford Creek. The timing of the husbandry activity in the bottom mussel site (site T06/233) will be the same as that for the sites in the Aughinish area. The mussel longline sites will be

accessed once a week to check lines, with harvesting taking place over a 2-3 week period during August and September. All the husbandry activity in the Ballylongford/Bunaclugga AQUA sites can presumably take place at any stage of the tide.

8.18 All the other aquaculture sites are predominantly intertidal sites (with some extending partly into the shallow subtidal zone). These sites will be accessed on foot/by tractor from the shoreline and husbandry activity will take place at low tide. Therefore, no potential impacts to species utilising moderately deep, or deep, subtidal habitat will arise from these sites.

Species responses

8.19 Roycroft *et al*. (2004; 2007) studied the interactions of waterbirds and seabirds (mainly divers, cormorants, gulls and auks) with suspended mussel culture using longlines in deep subtidal habitat in Bantry Bay. This study found no evidence of adverse impacts from suspended mussel culture on waterbirds and seabirds. The mussel sites in Roycroft *et al*.'s study varied in size from 7-43 ha, compared to 11-18 ha in the River Shannon and River Fergus Estuaries SPA sites. While no detail is provided of the level of husbandry activity in the mussel sites in Roycroft *et al*.'s study, it is reasonable to assume, from the size of the sites, that it would be of similar, or greater intensity, compared to the husbandry activity that will take place in the River Shannon and River Fergus Estuaries SPA sites. Roycroft *et al*.'s study included one of the SCI species that feed in subtidal habitat the River Shannon and River Fergus Estuaries SPA (Cormorant), as well as grouped data for gulls (including Black-headed Gull and Kittiwake) and auks (including Guillemot), and provides strong evidence that suspended mussel culture using longlines does not affect Cormorant, Black-headed Gull, Kittiwake or Guillemot. Moreover, the range of species covered by their study provides evidence that fish-eating species in general are not affected by suspended mussel culture, and suspended mussel culture may actually increase prey resources for these species (see above).

8.20 No information is available on the responses of species associated with subtidal habitat to habitat alteration caused by bottom mussel culture, bottom oyster culture or intertidal oyster cultivation. However, there is some evidence that mussel dredging activity associated with bottom mussel culture in Wexford Harbour may cause significant disturbance impacts to Red-breasted Merganser (Gittings and O'Donoghue, 2016a), and possibly some other species (Gittings and O'Donoghue, 2016c).

Assessments

Whooper Swan

8.21 Whooper Swan may use subtidal habitat within the River Shannon and River Fergus Estuaries SPA as disturbance refuges during the day and/or as nocturnal roost sites. The occurrence of Whooper Swan in tidal habitats within the River Shannon and River Fergus Estuaries SPA is reviewed in Chapter 7. Overall, the available data indicates that Whooper Swan does not make regular daytime use of tidal habitats in any of the AQUA areas. Therefore, the development of the subtidal aquaculture sites is not likely to significantly affect the daytime habitat use by the River Shannon and River Fergus Estuaries SPA Whooper Swan population.

8.22 Apart from known roost sites, such as Shannon Lagoon and Ballyalia Lake, there is no information is available on the location of nocturnal roost sites used by the River Shannon and River Fergus Estuaries SPA Whooper Swan population. However, any such roost sites in subtidal habitat are likely to be located in sheltered waters. Therefore, the mussel longline sites (T06/394A and T06/394B) in the Ballylongford/Bunaclugga AQUA, and the bottom mussel site in the Aughinish/Foynes AQUA (T07/014A) are unlikely to provide suitable roost sites. However, the bottom mussel site in the Ballylongford/Bunaclugga AQUA (T06/233) could potentially provide

suitable roosting habitat. In Wexford Harbour, some mussel dredging takes place at night (Gittings and O'Donoghue, 2016c), and the tidally constrained nature of site T06/233 suggests that nocturnal activity may also be required at this site. Whooper Swan are probably more sensitive to disturbance than the other waterbird species considered in this assessment, and birds roosting at night are also more likely to be sensitive to disturbance. Therefore, if Whooper Swan use site T06/233 as a nocturnal roost, night dredging activity in this site could cause significant disturbance impacts.

Scaup

8.23 During the WSP counts, very few Scaup were recorded. They were recorded on all four low tide counts in WSP subsite 0H519, which covers the outer part of Poulnasherry Bay (2-8 birds), and on two counts at Clonderalaw Bay (9-26 birds), which lies on the northern shore of the estuary opposite Tarbert.

8.24 During I-WeBS counts, the areas that produced most records of concentrations of Scaup (defined as counts of ten or more birds) were Clonderalaw Bay (I-WeBS subsite 0H496; 7 records with a mean flock size of 32); Poulnasherry Bay (I-WeBS subsite 0H498; 6 records with a mean flock size of 24); Tarbert-Aughinish (I-WeBS subsite 0I466; 6 records with a mean flock size of 64); and Tarbert Bay (I-WeBS subsite 0I492; 4 records with a mean flock size of 40). In the most recent five winter, most records of Scaup from I-WeBS counts have been from Coonagh Ponds (I-WeBS subsite 0I013; 10 records of 1-3 birds), and there have been single records of single birds from Limerick City (I-WeBS subsite 0I477) and Tarbert Bay (I-WeBS subsite 0I492).

8.25 Overall the available data on Scaup distribution indicate that the most favourable habitat for this species occurs in the outer part of the River Shannon and River Fergus Estuaries SPA. This pattern might appear to be contradicted by the distribution patterns from the most recent I-WeBS counts, but the latter probably just reflect the ease of seeing the species in relatively small, easily viewable, subsites.

8.26 The number of subsite counts of ten or more birds dropped from a mean of 5.0 per winter in 1994/95-1998/99 to 1.2 per winter in 2002/03-2006/07, and there have been no such records since 2006/07. Therefore, the low numbers recorded in the WSP counts appear to reflect a genuine decline in this species in the SPA.

Habitat impacts

8.27 Bottom culture of mussels is likely to cause reduced abundances of other bivalves within the relaid areas, but may cause increased abundances of various crustaceans. In marine habitats Scaup appear to feed predominantly on molluscs (Cramp and Simmons, 2004). However, based on typical sizes of relaid mussel and growth patterns in the bottom mussel culture sites in Wexford Harbour (Gittings and O'Donoghue, 2016c), the relaid mussels are likely to quickly grow above the typical size range consumed by Scaup. Therefore, for the period of time after the relaid mussels have grown out of the size range consumed by Scaup, there is likely to be a reduction in available food resources for Scaup within the relaid mussel beds. This time period will be all, or part, of the first winter following relay and the entire second winter following relay (because even after harvesting it will take a period of time for recovery to occur). Therefore, if the bottom mussel cultivation sites occupy particularly favourable habitat for Scaup, development of the sites could potentially cause some reduction in food resources for Scaup during some of growth cycle of the mussels. However, this could be offset by increased food resources during the early phases of the growth cycle (if the sites do not currently contain natural mussel beds providing similar resources).

8.28 The bottom mussel sites do not occur in any of the areas identified above as being particularly favourable for Scaup, although the limitations of the data have to be acknowledged. However, if suitable Scaup habitat is widely distributed throughout the lower sections of the SPA, then the area

occupied by the bottom mussel sites will be a very small proportion of the overall extent of the habitat.

8.29 The suspended mussel sites occur in water depths of greater than 5 m, so these sites are unlikely to provide suitable foraging habitat for Scaup.

8.30 The potential impact of intertidal oyster culture on benthic prey resources for Scaup at high tide is not known. The research discussed above (see paragraphs 8.6-8.10) suggests that intertidal oyster culture in Ireland generally does not cause large changes to benthic communities and should not, therefore, have significant effects on the availability of food resources for Scaup. However, it is possible that the trestles may impede access to the benthic habitat for diving birds. This could potentially have a significant impact on Scaup, which mainly feeds in the benthic zone. There are a number of intertidal oyster cultivation sites in Poulnasherry Bay. This area appears to be particularly favourable habitat for Scaup. The sites probably occupy around 15-30% of the total area of suitable habitat at high tide in Poulnasherry Bay. Therefore, if oyster trestles impede access to benthic habitat, the development of these sites could cause a significant reduction in the availability of suitable foraging habitat for Scaup in one of the main sites for the species in the SPA.

Disturbance impacts

8.31 Scaup numbers in Ireland generally peak in late winter (January-March), with very few occurring in the autumn (September-October) (Crowe, 2005). Therefore, the potential period of occurrence for Scaup in the SPA is unlikely to significantly overlap the seed relaying period, or the mussel longline harvesting period. There will be some overlap with the bottom mussel harvesting period. Also, weekly boat access to/from the mussel longline sites and regular access to/from intertidal oyster cultivation/bouchet mussel cultivation sites in the Aughinish/Foynes AQUA will take place throughout the winter. There will be no potentially disturbing to Scaup husbandry activity in the Poulnasherry/Kilrush AQUA. Overall, the scale, timing and distribution of husbandry activity associated with the aquaculture activity in the SPA is not likely to cause significant disturbance impacts to Scaup.

Conclusion

8.32 The potential for intertidal oyster cultivation to cause significant impacts to the availability of suitable foraging habitat for Scaup in the Poulnasherry/Kilrush AQUA cannot be excluded due to lack of knowledge about the effects of oyster trestles on Scaup foraging behaviour.

8.33 None of the other aquaculture activities covered by this assessment are likely to cause significant impacts to availability of suitable foraging habitat for Scaup, or to cause significant disturbance impacts to Scaup.

Cormorant

Distribution patterns

8.34 Cormorant is listed as a SCI of the River Shannon and River Fergus Estuaries SPA for both its breeding and wintering populations. The breeding colony is located at the eastern end of the SPA. The likely core foraging range of birds from this colony does not include any of the aquaculture sites, although some of the sites in the Aughinish/Foynes AQUA may be within the outer part of the foraging range (Figure 5.2).

8.35 Wintering birds are widely distributed throughout the SPA, although the WSP show concentrations of birds in certain areas, reflecting the presence of daytime roosting aggregations (see below).

Habitat impacts

8.36 Cormorant are fish-eating birds. In general bottom mussel, suspended mussel and intertidal oyster cultivation is likely to either have no effect on, or increase local abundances of fish (see paragraphs 8.6-8.14). Therefore, development of the aquaculture sites are not likely to have negative effects on the availability of food resources for Cormorant within the River Shannon and River Fergus Estuaries SPA.

Disturbance

8.37 Cormorant foraging in subtidal habitat tend to be widely dispersed, although occasional aggregations of feeding birds may occur. The boat activity associated with the development of the aquaculture sites in the River Shannon and River Fergus Estuaries SPA will only cause limited potential disturbance of small areas at any one time (e.g., a radius of 100-200 m around the boat). The Bantry Bay study (Roycroft *et al*., 2004, 2007; see paragraph 8.19) shows that the typical levels of husbandry activity associated with suspended mussel cultivation sites of similar size to those proposed for the River Shannon and River Fergus Estuaries SPA does not cause significant disturbance impacts to Cormorant using subtidal habitat. In Wexford Harbour, foraging Cormorant do not appear to show strong disturbance responses to vessel activity associated with bottom mussel culture (Gittings and O'Donoghue, 2016c). A similar, or lesser, level of activity as in the Bantry Bay study, and a lesser level of activity compared to Wexford Harbour, will be involved in the development of the bottom mussel cultivation sites, and access to the intertidal oyster cultivation/bouchet pole sites in the Aughinish/Foynes AQUA. Therefore, a similar lack of disturbance impacts can be predicted.

8.38 Cormorant daytime roosts in intertidal habitat, or night-time roosts in shoreline habitats, would be more sensitive to potential disturbance impacts. The distribution of these roost sites in the River Shannon and River Fergus Estuaries SPA is not known (apart from roosts mapped in the high tide roost survey, which will only represent a sample of the range of roost sites used). Small daytime roosts of 5-20 Cormorant are likely to be widely distributed but disturbance to such roost sites would not be significant as the birds could easily move to a nearby alternative roost site. However, there may be a small number of larger daytime roost sites, which may function, in part, as pre-roost gatherings for the night time roosts, and disturbance to such roost sites might be more significant.

8.39 During the WSP counts, significant numbers of roosting birds were not recorded in any of the subsites containing aquaculture sites, or containing boat access routes to aquaculture sites, indicating that important daytime roosts do not occur in the vicinity of these sites.

8.40 Cormorant night roosts generally occur along tree-lined shores, or secure areas of cliffs/rocky shores where the birds will be secure from disturbance and will not have to move in response to the tide during the night. While the distribution of Cormorant night roosts in the SPA is not known, none of the aquaculture sites occur in close proximity to shoreline areas that would be potentially suitable as night roost sites.

Conclusion

8.41 None of the aquaculture activities covered by this assessment are likely to cause significant impacts to availability of suitable foraging habitat for Cormorant, or to cause significant disturbance impacts to Cormorant.

Black-headed Gull

Distribution patterns

8.42 Black-headed Gull is widely distributed within the SPA.

Habitat impacts

8.43 Black-headed Gull have a wide and variable diet, but birds foraging in moderately deep and deep subtidal habitat within the River Shannon and River Fergus Estuaries SPA are likely to be predominantly feeding on fish. In general, bottom mussel, suspended mussel and intertidal oyster cultivation is likely to either have no effect on, or increase local abundances of fish (see paragraphs 8.6-8.14). Therefore, development of the aquaculture sites are not likely to have negative effects on the availability of subtidal food resources for Black-headed Gull within the SPA.

8.44 The potential impact of development of the aquaculture sites on intertidal food resources for Black-headed Gull within the River Shannon and River Fergus Estuaries SPA is assessed in Chapter 7.

Disturbance

8.45 Black-headed Gull foraging in subtidal habitat tend to be very tolerant of human activity, often following boats and aggregating around fishing discards, etc. In Wexford Harbour, we have observed Black-headed Gull following mussel dredgers while they were dredging for mussels (Gittings and O'Donoghue, 2016c). The Bantry Bay study (Roycroft *et al*., 2004, 2007; see paragraph 8.19) shows that the typical levels of husbandry activity associated with suspended mussel cultivation sites of similar size to those proposed for the SPA does not cause significant disturbance impacts to Black-headed Gull using subtidal habitat. As a similar, or lesser, level of activity will be involved in the development of the bottom mussel cultivation sites, and access to the intertidal oyster cultivation/bouchet pole sites in the Aughinish/Foynes AQUA, a similar lack of disturbance impacts can be predicted.

8.46 Flocks of roosting gulls can be flushed by human activity, but the birds will generally resettle nearby (unless there is a high level of very intense activity). In Cork Harbour, the main gull roost (which can hold in excess of 20,000 Black-headed Gulls) occurs in Lough Mahon, extending from the lower part of the River Lee channel, adjacent to Tivoli Docks, across Lough Mahon to the outer part of the Douglas Estuary and the Little Island and Rochestown shores. This roost occurs around the shipping channel into Tivoli Docks. Passage of large ships through the roost causes some localised movements of birds, but does not cause any major spatial displacement of birds and does not cause significant disturbance effects to the roost (Tom Gittings, personal observations). Therefore, development of the aquaculture sites is not likely to cause significant disturbance impacts to Black-headed Gull roosts within the River Shannon and River Fergus Estuaries SPA.

Conclusion

8.47 None of the aquaculture activities covered by this assessment are likely to cause significant impacts to availability of suitable subtidal foraging habitat for Black-headed Gull, or to cause significant disturbance impacts to Black-headed Gull roosting in subtidal habitat.

Other species

Roosting wildfowl in moderately deep, or deep, subtidal habitat

8.48 Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard and Pintail may use moderately deep, or deep subtidal habitat, as roosting sites, particularly where such habitat can provide secure

disturbance refuges close to important foraging areas. Therefore, such usage is most likely to occur in areas of sheltered waters that lie offshore from areas of intertidal and shallow subtidal habitat that hold significant concentrations of these species.

8.49 Site T06/233 in the Ballylongford/Bunaclugga AQUA provides potentially suitable conditions for this type of usage. The other sites in moderately deep, or deep subtidal habitat are too exposed and/or too distant from important intertidal and shallow subtidal habitat to be likely to be used in this way to any significant extent. However, even if site T06/233 is used in this way, the scale and level of husbandry activity within this site, relative to the size of the site, mean that any disturbance impacts are unlikely to be significant.

Seabirds

8.50 Three seabird species, which are SCIs of SPAs outside the Shannon Estuary, have been screened in for this assessment, because the aquaculture sites in the Shannon Estuary are within their potential foraging ranges. These are Fulmar, which is a SCI of the Kerry Head SPA, and Kittiwake and Guillemot, which are SCIs of the Loop Head SPA.

8.51 These seabird species all feed in subtidal habitat and generally do not come into tidal inlets, enclosed bays, etc. Therefore, the only aquaculture sites that could potentially overlap habitat regularly used by these species within the River Shannon and River Fergus Estuaries SPA are the mussel longline sites in the Ballylongford/Bunaclugga AQUA (sites T06/394A and T06/394B) and the subtidal bottom mussel cultivation site in the Aughinish/Foynes AQUA (site T07/014A). In addition, the oyster bottom cultivation sites in the Carrigaholt AQUA (sites T08/076A, T08/076B and T08/092A) could potentially overlap habitat regularly used by these species.

8.52 Fulmar, Kittiwake and Guillemot are all fish-easting species. In general, bottom mussel, bottom oyster and suspended mussel cultivation is likely to either have no effect on, or increase local abundances of fish (paragraphs 8.6-8.14). Therefore, development of these aquaculture sites are not likely to have negative effects on the availability of subtidal food resources for these species within the Shannon Estuary.

8.53 The Bantry Bay study (Roycroft *et al*., 2004, 2007; see paragraph 8.19) shows that the typical levels of husbandry activity associated with suspended mussel cultivation sites of similar size to those proposed for the SPA does not cause significant disturbance impacts to Kittiwake and Guillemot using subtidal habitat. As a similar, or lesser, level of activity will be involved in the development of the bottom mussel and oyster cultivation sites, a similar lack of disturbance impacts can be predicted.

8.54 Fulmar was not covered by the Bantry Bay study. However, as Fulmar is considered to have a lower sensitivity to disturbance than Kittiwake or Guillemot (Furness *et al*., 2013), a similar lack of disturbance impacts can also be predicted for this species.

Conclusions

8.55 Any night time activity occurs in site T06/233 could reduce the potential suitability of this site as a Whooper Swan nocturnal roost site.

8.56 The potential for intertidal oyster cultivation in the Poulnasherry/Kilrush AQUA to cause significant impacts to the availability of suitable foraging habitat for Scaup cannot be excluded due to lack of knowledge about the effects of oyster trestles on Scaup foraging behaviour (noting that trestles extend in subtidal waters).

8.57 No other potentially significant impacts were identified from the activities assessed in this chapter.

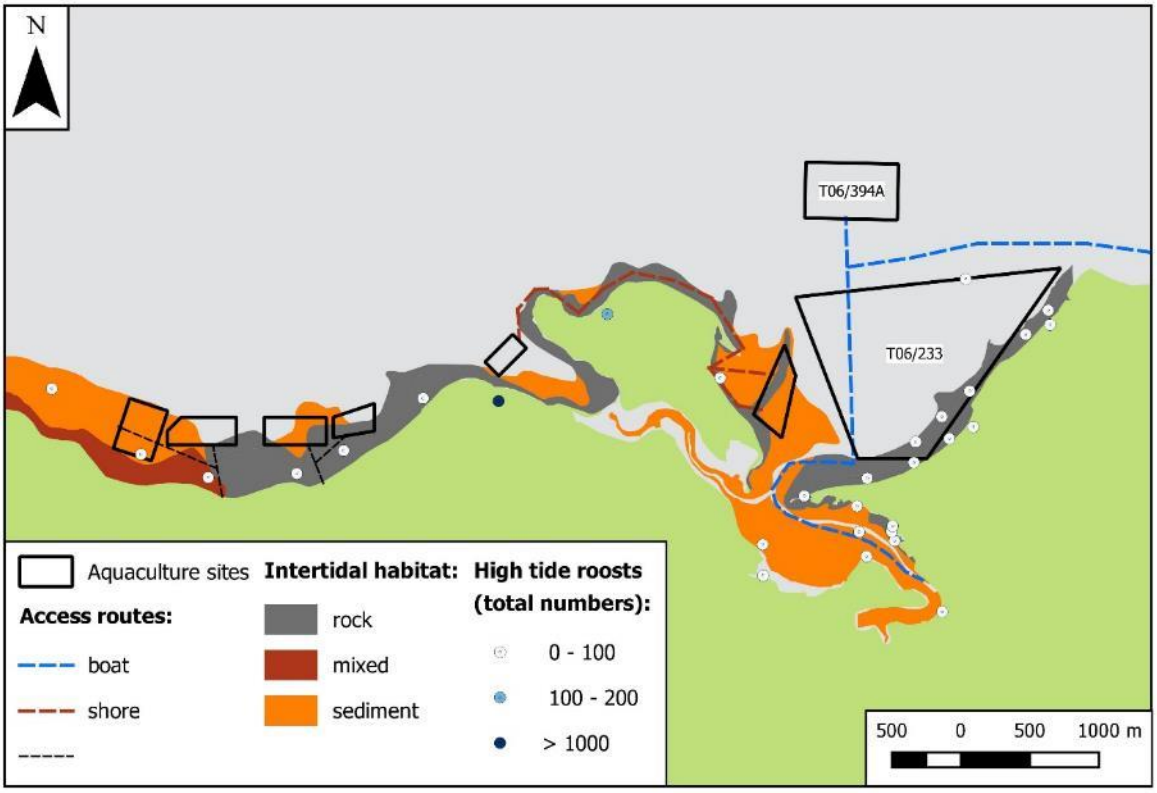

Figure 8.1 High tide roosts recorded in the Ballylongford/Bunaclugga AQUA by the WSP roost survey.

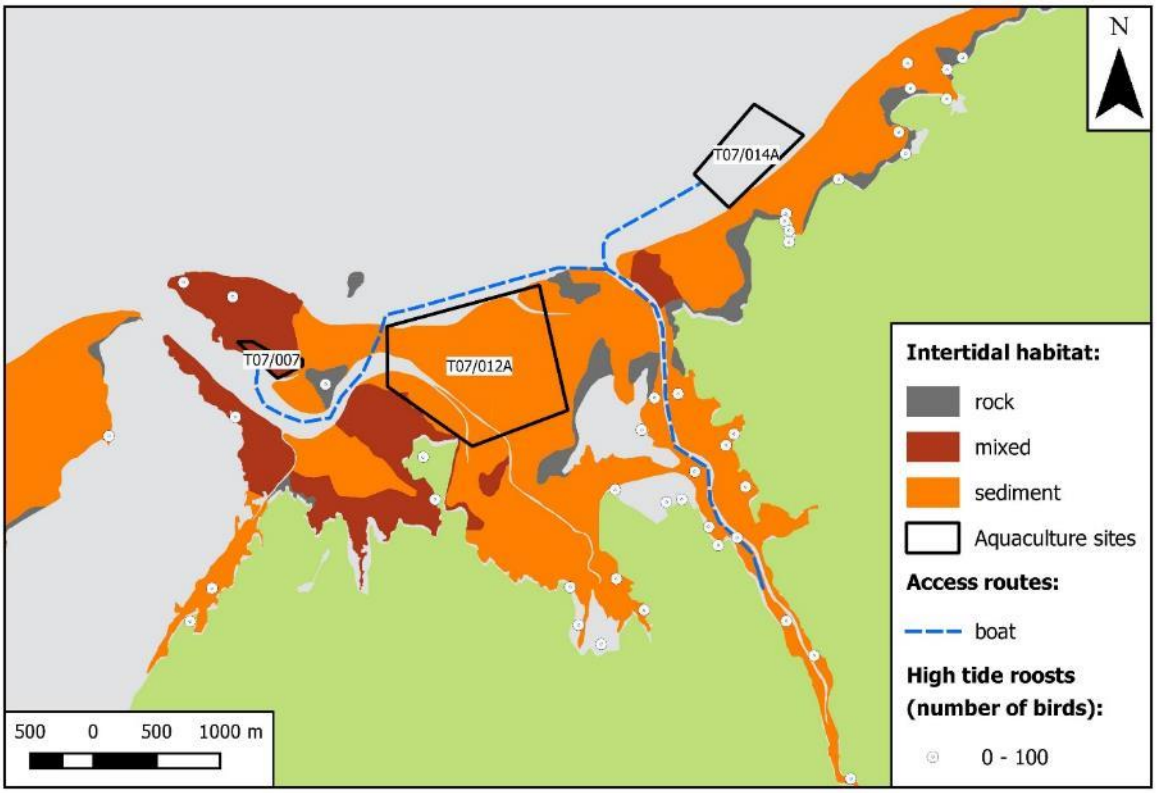

Figure 8.2 High tide roosts recorded in the eastern part of the Aughinish/Foynes AQUA by the WSP roost survey.

9. Assessment of cumulative impacts

Introduction

9.1 This chapter examines the potential for cumulative impacts from the aquaculture activities covered by this assessment in combination with other relevant activities. The chapter first considers two specific issues with particular relevance to this assessment: Fishery Orders, which permit additional aquaculture development in the River Shannon and River Fergus Estuaries SPA; and the Strategic Integrated Framework Plan for the Shannon Estuary, which provides the framework for the development of various marine-related industries and activities in and around the River Shannon and River Fergus Estuaries SPA. The chapter then reviews a wide range of other activities that occur in the Shannon Estuary and which have potential for impacts on waterbird populations.

Fishery Orders

Habitats and aquaculture activities

9.2 There are three areas within the River Shannon and River Fergus Estuaries SPA covered by Fishery Orders (Figure 9.1). The following is a description of the habitats and aquaculture activities in these areas. The description of the aquaculture activities is based on information supplied by BIM.

9.3 Fishery Order T8/004A is located in the middle section of the Lower Shannon waterbody and occupies a total area of 3,515 ha (Figure 9.2). Most of the area covered by this order comprises subtidal habitat with generally narrow hard substrate intertidal zones along both shores with a few small bays containing areas of soft sediment intertidal habitat. A more extensive intertidal area, with soft sediment habitat, occurs in Tarbert Bay. Currently one producer is working this Fishery Order. Around 34 ha are being utilised for the relaying of seed and half grown oysters, which are then harvested once they reach commercial size. No information is available on the location that is currently being used. However, from the description of the activity provided, we have assumed that the current activity takes place in the subtidal zone. As no information has been provided on plans to expand activities in this Fishery Order we have assumed that no such expansion will occur.

9.4 Fishery Order T8/004B is located in the outer section of the Lower Shannon waterbody and occupies a total area of 4,548 ha (Figure 9.3). Most of the area covered by this order comprises subtidal habitat with only very narrow mainly hard substrate intertidal zones along the northern shoreline and around Scattery and Inishbig Islands. This Fishery Order does not include any intertidal habitat along the southern shoreline. One producer has leased the entire area and plans to use different methods of oyster cultivation in various places depending on the suitability of the areas for the cultivation methods. These methods may include: rafts, longlines, floating flupsys[8], bottom culture, trestles, and tidal and sub-tidal frames. Based on the information provided, we have assumed that there is no current activity within this Fishery Order.

9.5 Fishery Order T8/008 is located in the lower section of the inner part of Poulnasherry Bay and occupies a total area of 40 ha (Figure 9.4). The area covered by this Fishery Order is mainly occupied by soft sediment intertidal habitat, with a permanent tidal channel running through the middle of the area. Around 25% of the order area is currently being used for oyster trestle cultivation. Potentially, in the future all the order area may be utilised, apart from, presumably, the tidal channel.

[8] floating upweller system.

Potential in-combination effects

9.6 Fishery Order T8/008 is located within Poulnasherry Bay and includes around 28 ha of intertidal habitat. The assessment of oyster trestle cultivation in the aquaculture sites in Poulnasherry Bay concluded that the potential displacement impacts could be substantial to Grey Plover, moderate to Light-bellied Brent Goose (but with a low likelihood), minor-moderate for Bar-tailed Godwit, Knot and Dunlin, and minor for Ringed Plover (see Chapter 7; Table 7.6). Full utilisation of the Fishery Order, combined with full development of the aquaculture sites, would substantially increase the percentage occupancy of intertidal habitat by oyster trestle cultivation in Poulnasherry Bay (Table 9.1). Therefore, the potential cumulative effects of oyster trestle cultivation in Fishery Order T8/008 in combination with oyster trestle cultivation in the aquaculture sites in Poulnasherry Bay is likely to increase the already potentially substantial impacts to Grey Plover, and could potentially cause significant impacts to other species.

Table 9.1 - Comparison of the percentage occupancy of intertidal habitat in Poulnasherry Bay by full development of the aquaculture sites only and full development of the aquaculture sites and the Fishery Order area.

Scenario	Tidal zone	% occupancy of intertidal habitat by:	
		aquaculture sites only	aquaculture sites and fishery order area
including algal zone	mean low tide	12%	16%
	spring low tide	18%	26%
excluding algal zone	mean low tide	16%	22%
	spring low tide	24%	35%

9.7 Oyster trestle cultivation in Poulnasherry Bay may also cause a reduction in the availability of foraging habitat for Scaup (see Chapter 8). The recorded distribution of Scaup in the WSP counts was in the outer part of the bay (subsite 0H520), outside the area occupied by Fishery Order T8/008. However, from general knowledge of Scaup habitat usage and distribution patterns, it seems likely that they would, at times, come into the lower part of the inner bay. Therefore, there is potential for the cumulative effects of oyster trestle cultivation in Fishery Order T8/008 in combination with oyster trestle cultivation in the aquaculture sites in Poulnasherry Bay to cause increased impacts to Scaup.

9.8 Fishery Order T8/004A only includes one significant area of intertidal habitat (Tarbert Bay), but the current activities within this Fishery Order area do not affect intertidal habitat. Fishery Order T8/004B does not include any significant areas of intertidal habitat. Therefore, the current and planned activities for Fishery Orders T8/004A and T8/004B in combination with development of the aquaculture sites covered by this assessment are not likely to cause significant cumulative impacts to waterbirds using intertidal habitat.

9.9 Fishery Orders T8/004A and T8/004B include large areas of subtidal habitat. Bottom culture of oysters occurs in T8/004A and is planned for T8/004B. There does not appear to be any information available about the suitability of oysters as a food resource for Scaup, but the name Scaup derives from its habit of feeding on beds of oyster and mussel shells, which were called *scawp* (Yarrell, 1845). Therefore, oyster beds may provide suitable foraging habitat for Scaup, but, if this is the case, the ducks will presumably only be able to feed on small oysters or other associated mollusc species. This means that bottom culture of oysters could potentially have complex effects on habitat quality for Scaup in a similar way to that discussed for bottom culture of mussels (see Chapter 8), with the balance between potential positive and negative effects depending on the timing of the growth of the relaid mussels in relation to the size classes that can be consumed by Scaup. Tarbert Bay in Fishery Order T8/004A is one of the areas that has held concentrations of Scaup in the past

(see Chapter 8). Therefore, depending upon the locations used and the net balance between potential positive and negative effects, there is potential for the cumulative effects of bottom culture of oysters in Fishery Orders T8/004A and T8/004B in combination with oyster trestle cultivation in the aquaculture sites in Poulnasherry Bay to cause increased impacts to Scaup.

9.10 Vessel activity associated with subtidal aquaculture activity in Fishery Orders T8/004A and T8/004B could cause disturbance to various waterbird species (see Chapter 8). However, without details of the likely extent and intensity of such activity it is not possible to assess these potential impacts.

Strategic Integrated Framework Plan for the Shannon Estuary

9.11 The Strategic Integrated Framework Plan for the Shannon Estuary *"is an inter-jurisdictional land and marine based framework plan to guide the future development and management of the Shannon Estuary*" (SIFP, 2013). The plan was developed by Clare County Council, Kerry County Council, Limerick City and County Councils, Shannon Development and the Shannon Foynes Port Company.

9.12 The plan includes general strategic policies as well as identification of specific land/marine areas for potential development of marine-related industry, tidal energy and aquaculture.

9.13 A number of the general policies within the plan have potential for impacts on waterbird SCIs of the River Shannon and River Fergus Estuaries SPA. These include policies supporting the growth of shipping movements (SPN 1.1), promoting the development of marina facilities (MTL 1.6), encouraging the expansion of marine based recreational activities (MTL 1.7), encouraging the development of sustainable commercial fishing and aquaculture activities (CPA 1.2), and supporting the provision of appropriate infrastructure for fishing and aquaculture activities (CPA 1.4).

9.14 The plan includes the identification of nine strategic development locations for marine-related industry, four areas of opportunity for tidal energy development and eight areas of opportunity for aquaculture (Figure 9.5). The strategic development locations are all land-based sites adjacent to the Shannon Estuary. The areas of opportunity for tidal energy development largely occur in subtidal habitat in the outer part of the estuary. However, the Tarbert Bay area of opportunity includes most of the intertidal habitat within the bay. The areas of opportunity for aquaculture largely reflect the distribution of the aquaculture sites assessed in the present report, so the potential impacts of the development of these sites have already been assessed. However, the area of opportunity at Clonderlaw Bay would represent an additional area of aquaculture development and could potentially affect a large area of intertidal habitat.

9.15 The plan also includes specific policies to ensure compliance with the Habitats Directive and other environmental legislation, and a Habitats Directive Assessment and a Strategic Environmental Assessment (RPS Group, 2013a, b) of the plan have been carried out. Because of the strategic nature of the plan, many of the potential impacts will need to be assessed by project-specific assessments. Therefore, there is limited scope to assess the potential cumulative impacts of the plan in-combination with the development of the aquaculture sites assessed in the present report.

9.16 The promotion of commercial shipping and growth in marine-related recreational activity, the development of the strategic locations for marine-related industry and the development of the areas of opportunity for tidal energy will mainly affect either offshore subtidal areas or adjacent terrestrial habitat. Therefore, they all generally have limited potential for impact on waterbird SCIs of the SPA as most of the waterbird SCIs are associated with intertidal and shallow subtidal habitat. However, there will be potential for disturbance impacts depending upon the specific details of the activities or developments. More specifically, there is also potential for impact on habitats used by field-feeding waterbirds from the development of the strategic locations for marine-related industry, while development of the Tarbert Bay area of opportunity for tidal energy could affect a significant area

of intertidal habitat. While aquaculture development in most of the areas of opportunity has already been assessed in the present report, the area of opportunity at Clonderlaw Bay would represent a significant expansion of aquaculture activity with the potential for significant impacts on waterbird SCIs of the River Shannon and River Fergus Estuaries SPA.

9.17 Based on the above, the main potential actions in the Strategic Integrated Framework Plan for the Shannon Estuary where there is potential for cumulative impacts in-combination with the development of the aquaculture sites assessed in the present report are the development of Tarbert Bay area of opportunity for tidal energy and the expansion of aquaculture activity into Clonderlaw Bay. While the development of the strategic locations for marine-related industry could have impacts on habitats used by field-feeding waterbirds, the potential for cumulative impacts is limited because the species most likely to be affected were generally assessed as having negligible risks of impact from development of the aquaculture sites.

Other activities

Disturbance generating activities

Types and distribution of activities

9.18 An indicative map of the general distribution of activities likely to cause disturbance to waterbirds across the River Shannon and River Fergus Estuaries SPA is shown in Figure 9.6.

9.19 Beach recreation areas occur in the outer part of the River Shannon and River Fergus Estuaries SPA. Beale Strand is an extensive sandy beach along the southern shore from Beal Point to Bunaclugga Bay. This beach is listed on the Discover Ireland and Wild Atlantic Way websites, but there is minimal development of tourism infrastructure indicating a relatively low degree of usage. Cappa Beach is a small rocky beach adjacent to Kilrush. This beach is a Blue Flag beach and has a lifeguard during the bathing season. There is also a small sandy beach at Doonaha on the northern shore west of Poulnasherry Bay. Elsewhere in the River Shannon and River Fergus Estuaries SPA, there is generally rather limited public access to the shoreline and the nature of the sediments do not provide attractive conditions for beach recreation. However, there is likely to be some degree of local, small-scale, recreational activity where public roads provide access to sections of shoreline with suitable conditions for walking. During the WSP counts, 28 instances of recreational activity (walking along the shoreline and/or dogs) were recorded. These were widely scattered throughout the River Shannon and River Fergus Estuaries SPA. Curiously, the subsite with the most frequent level of this activity recorded was 0H535 which is located on the northern shore at Mountshannon West, between Labasheeda Bay and Clonderlaw Bay, and which does not appear to have any particular features likely to attract recreational activity. However, the analysis by NPWS (2012c) indicated that subsite 0I428, in the Upper Shannon waterbody, had the highest potential disturbance impact from this activity due to the “frequency of occurrence and the regular presence of loose dogs in this subsite”.

9.20 No bait digging or hand collection of shellfish activity (such as winkle picking) was recorded during the WSP counts. However, winkle picking was recorded in Poulnasherry Bay on all four of the trestle study counts in January and February 2011, and on site visits in October 2010 and March 2017, and in Bunaclugga Bay on site visits in September 2010 and February 2017. Seven bait point locations are mapped in the outer part of the River Shannon and River Fergus Estuaries SPA by IFI (undated). Both these activities are likely to be widespread in suitable areas throughout the River Shannon and River Fergus Estuaries SPA but the lack of records from the WSP counts indicate that they do not occur at high intensity. Shore fishing is probably also widespread throughout most

of the River Shannon and River Fergus Estuaries SPA and 22 shore fishing locations are mapped by IFI (undated)[9].

9.21 Shooting (presumably wildfowling) was recorded relatively frequently during the WSP counts with a total of 20 instances recorded. However, these were concentrated in four subsites: three in the Fergus Estuary and one in the Upper Shannon.

9.22 Water-based recreational activities within the SFPA appear to be of relatively limited extent. There are marinas at Kilrush and Limerick City and yacht clubs at Foynes and Kilrush. Most boat angling takes place in the outer part of the SPA, west of Tarbert (IFI, undated). Inshore activities such as kayaking and windsurfing presumably occur but there is no information on the distribution of these activities, or their intensity.

9.23 There are some fishery activities towards the mouth of the River Shannon. These activities comprise shrimp potting (south shore of river near Ballylongford) and tangle net (crayfish), trammel net (baitfish), creel (lobster and crab) all at the mouth of the estuary (Marine Institute, 2015). All wild fisheries are confined to static gear and present no risk to habitat features.

9.24 Commercial ports are located at Foynes and Limerick Docks, with private port terminals at Aughinish, Moneypoint, Shannon Airport and Tarbet. The navigation channel runs the length of the Upper and Lower Shannon sections of the SPA. A car ferry runs between Tarbert and Killimer.

Potential impacts

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

9.26 The main concentration of activity in the intertidal is likely to be in the beach recreation areas at Beale Strand and Cappa Beach. While this will presumably mainly occur during summer, it may overlap with build-up of significant numbers of some of the SCI species in late summer/early autumn. The sandy areas likely to be favoured for recreational activities at Beale Strand appear to hold relatively few waterbirds (see Chapter 7). Cappa Beach only contains a small area of rocky intertidal habitat. Shellfish gathering and bait digging will also involve activity in the intertidal zone. However, the levels of these activities appear to be low and they are unlikely to cause significant disturbance impacts.

[9] The WSP disturbance recording methodology did not include a specific category for shore angling, so any instances of such activity that did occur on the counts would have been recorded under the *other* category. It is not possible to assess the frequency with which this activity occurred on the WSP counts from the available information.

9.27 Wildfowling causes direct mortality of quarry species, as well as wider disturbance impacts. The quarry species include Wigeon, Teal, Mallard, Pintail, Shoveler, Scaup and Golden Plover. Any shooting of Pintail, Shoveler and Scaup may have significant impacts on their River Shannon and River Fergus Estuaries SPA populations, due to the small sizes of these populations, while quarry species may be particularly sensitive to disturbance impacts (Laursen *et al*., 2005). These species mainly occur in the Lower Shannon away from the wildfowling areas in the Fergus Estuary and the Upper Shannon (assuming that the WSP data provides an accurate representation of the distribution of wildfowling in the River Shannon and River Fergus Estuaries SPA), although it is possible that the wildfowling is modifying their distribution patterns. Non-quarry species may also be affected by disturbance impacts. However, it is not possible to assess the potential cumulative impacts of wildfowling in-combination with aquaculture activity in the River Shannon and River Fergus Estuaries SPA due to the lack of detailed information on the distribution and intensity of wildfowling activity within the SPA.

9.28 Boat activity will generally not affect waterbirds in intertidal and shallow subtidal habitat. However, some types of recreational watersports activities can occur in very shallow waters and have been observed to cause disturbance to waterbirds. For example, we have observed jet skiers in Ballycotton Bay travelling up tidal channels and across shallowly flooded areas causing disturbance to important feeding and roosting areas. In Cork Harbour, kayakers and windsurfers in the Aghada area can come close into the shoreline causing disturbance to high tide roosts. These activities will mainly take place around the high tide period and may cause disturbance to feeding waterbirds in intertidal and shallow subtidal habitat on ebb/flood tides. However, given the nature and distribution of the main intertidal areas within the River Shannon and River Fergus Estuaries SPA it seems unlikely that such activities would overlap with significant numbers of waterbirds.

9.29 Boat traffic to/from quays and marinas may also cause disturbance to waterbirds roosting in shoreline areas or islands at high tide. The locations of the marinas and yacht clubs at Foynes, Kilrush and Limerick City indicate that boat traffic to/from these facilities is unlikely to pass close to sensitive roost sites. However, we have already identified the potential for disturbance to roost sites from vessel traffic associated with aquaculture activity from quays in Ballylongford Creek and the River Deel. Any additional boat traffic to from these locations, such as small fishing boats, could have significant cumulative impacts on high tide roosts in-combination with the vessel traffic generated by aquaculture activity.

Activities affecting waterbird food resources

Bait digging and shellfish collecting

9.30 Bait digging and shellfish collecting will remove food resources that would otherwise be available for consumption by waterbirds and may also cause mortality to non-target species (Masero *et al*., 2006). Therefore, if these activities are extensive and/or affect concentrated food resources they could affect waterbird distribution (by causing displacement from depleted areas) and/or survivorship (by reducing the overall carrying capacity of the system). However, the Masero *et al*. (2006) study involved an area with a high intensity of bait-digging activity with bait digger numbers of 46-544 throughout the year. In the River Shannon and River Fergus Estuaries SPA, bait digging and shellfish gathering appear to be low intensity activities. Therefore, it seems unlikely that bait digging or winkle picking is having measurable impacts in terms of resource depletion or physical habitat disturbance in River Shannon and River Fergus Estuaries SPA, and it is not necessary to consider potential in-combination effects with aquaculture activities.

Effluent discharge

9.31 Organic and nutrient inputs to estuaries increase productivity and may increase food resources for waterbirds. Therefore, adverse impacts to waterbirds might be expected to be caused by declines in organic and nutrient inputs associated with improvements in wastewater treatment. There are a

number of studies that document the effects of organic and nutrient loading from effluent discharges on the benthic fauna and typically the zones affected by individual discharges are restricted to within a few hundred metres of the outfall (Burton *et al*., 2002a). The available evidence on the effects of nutrient reductions on estuarine waterbird populations is limited but, to date, no significant impacts have been reported (Burton *et al*., 2002a, 2003). One study (Alves *et al*., 2012) has reported localised (within 100 m) association between wastewater inputs and bird distribution; in this study the outfalls discharged in the intertidal zone and streams of sewage ran across the intertidal habitat. Therefore, given the size of the River Shannon and River Fergus Estuaries SPA, and the fact that any impacts to waterbird populations from upgrades in wastewater treatment are likely to be localised to the immediate vicinity of the existing outfall locations, it is unlikely that such upgrades would have measurable impacts to populations at the SPA scale. Therefore, it is not necessary to consider potential in-combination effects of such upgrades with the aquaculture activities covered in this assessment.

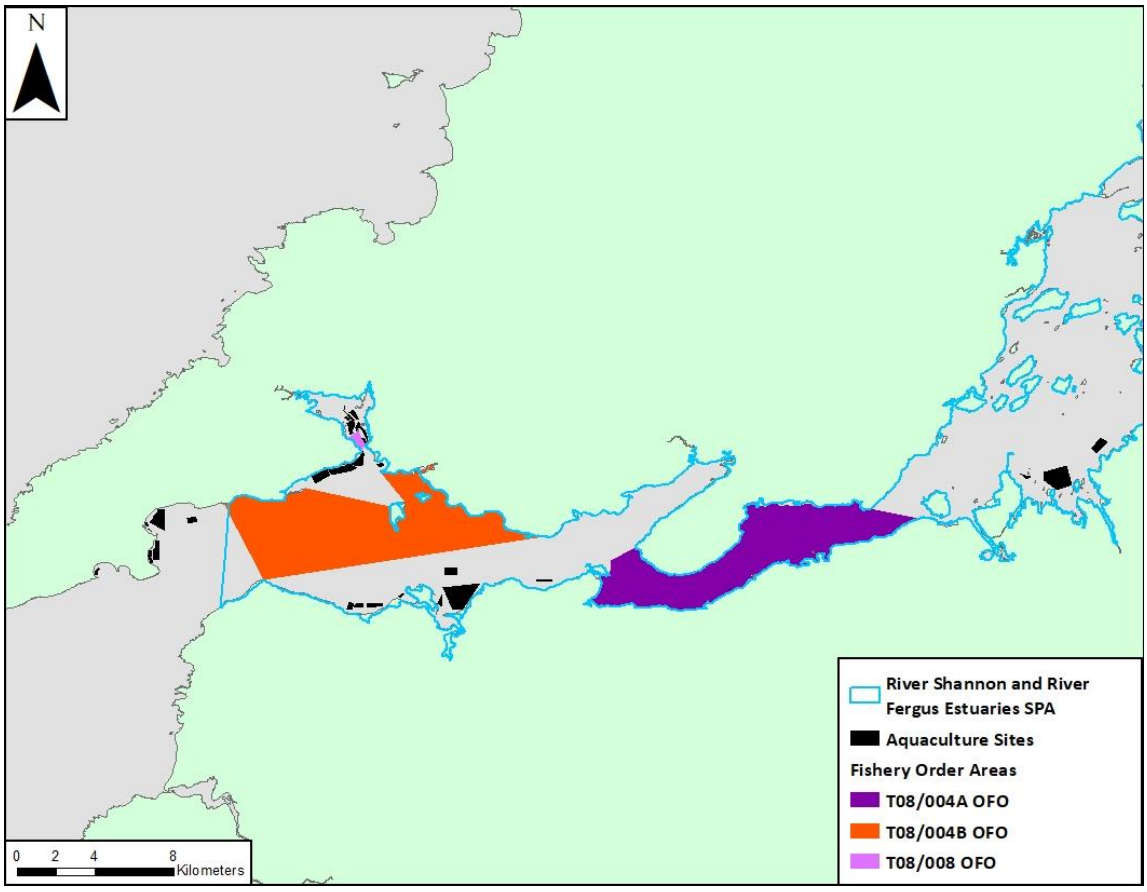

Figure 9.1 Fishery Order areas within the Shannon Estuary.

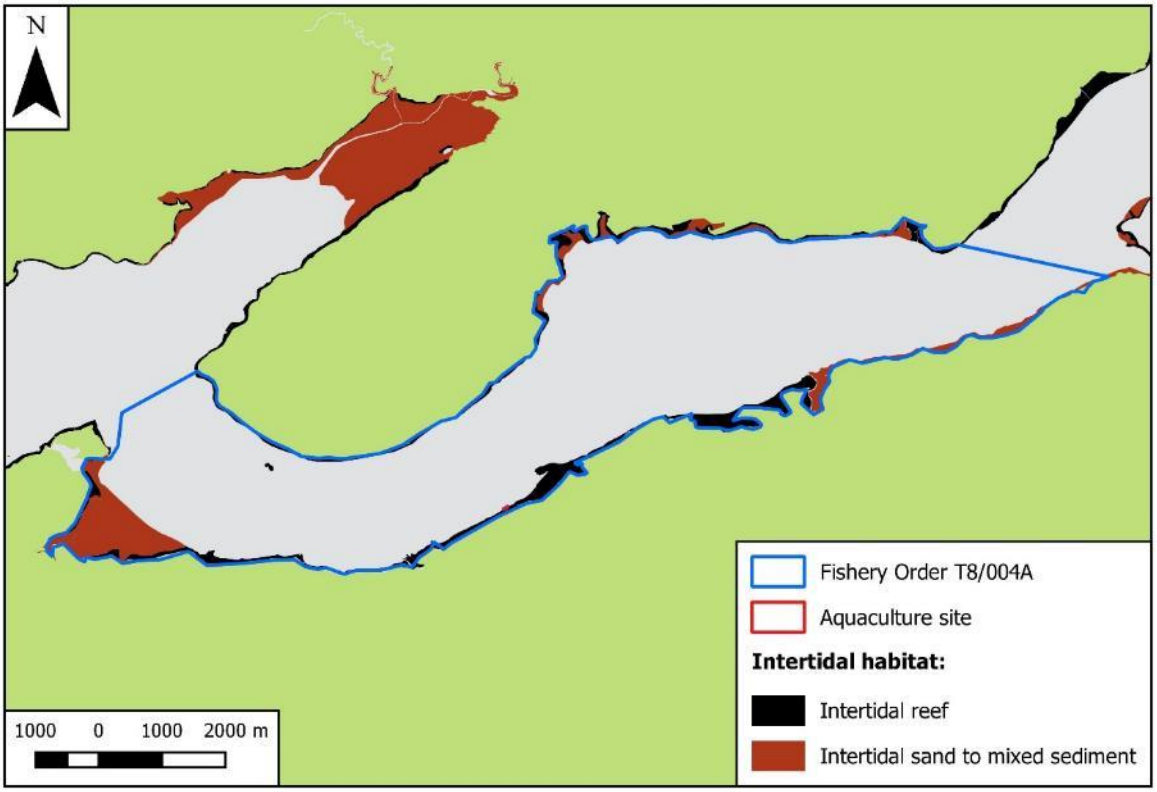

Figure 9.2 Fishery Order T08/004A.

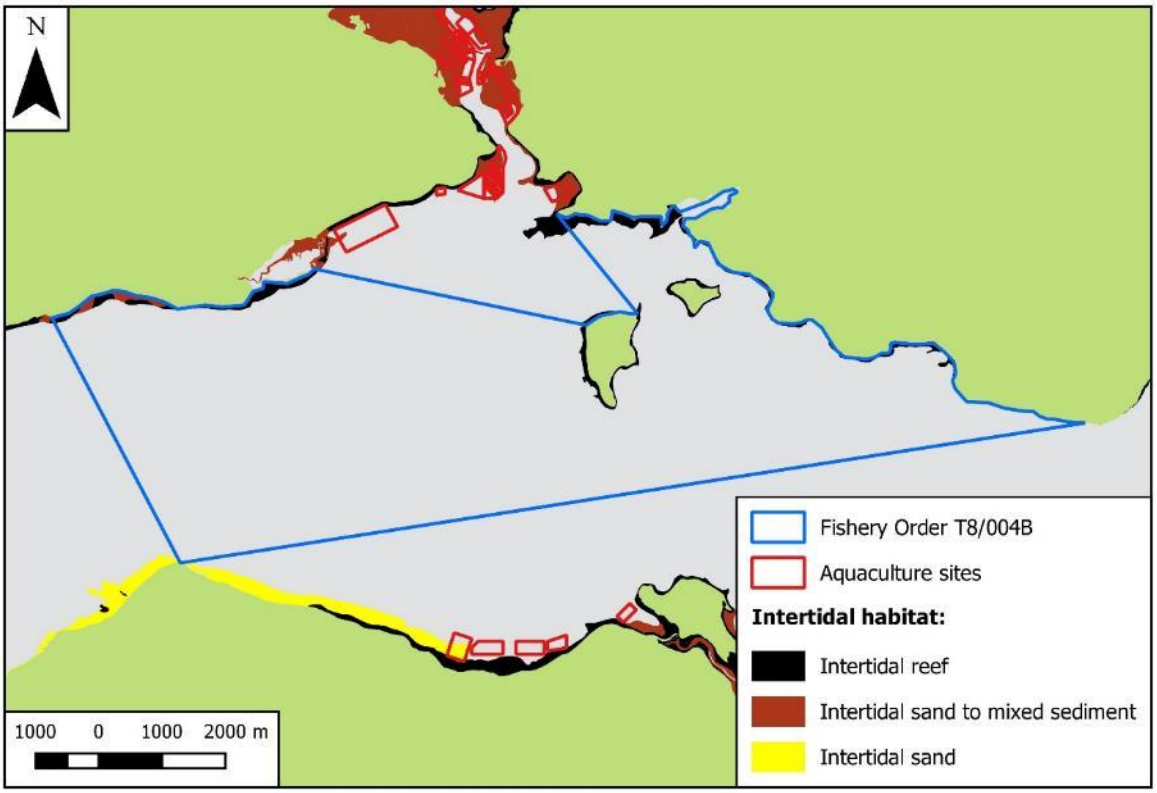

Figure 9.3 Fishery Order T08/004B.

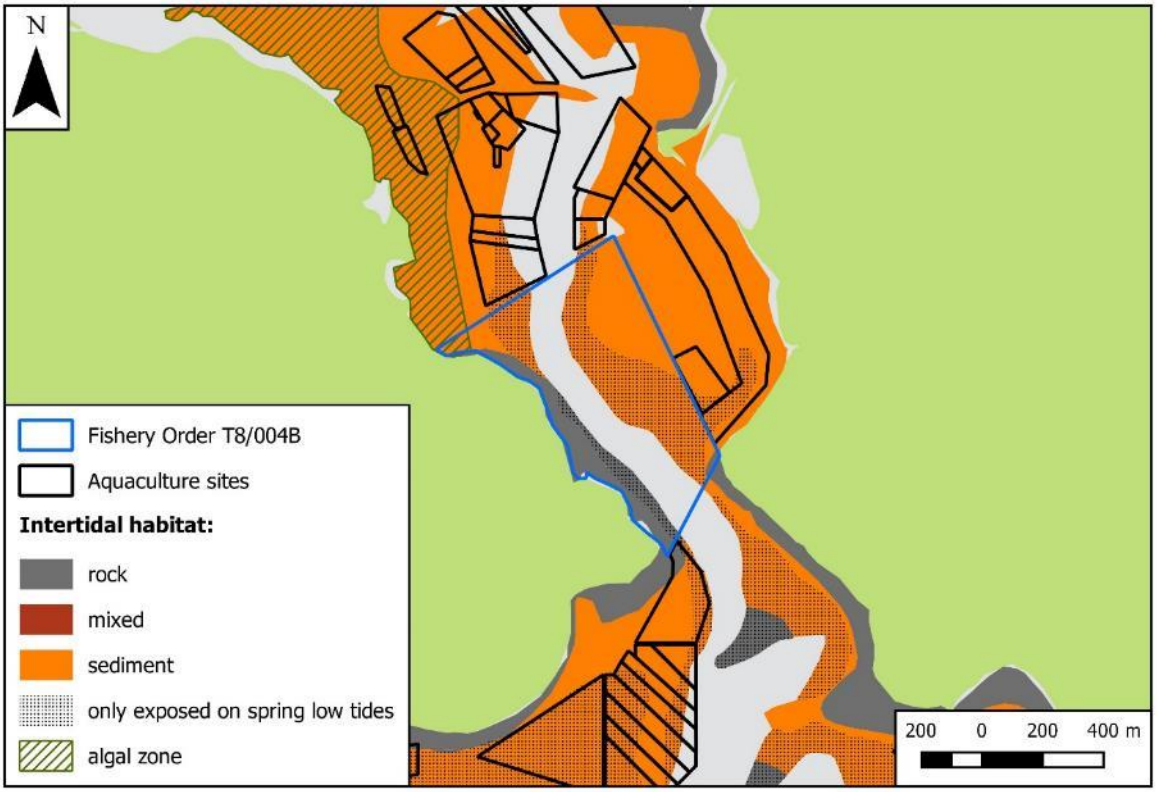

Figure 9.4 Fishery Order T08/008.

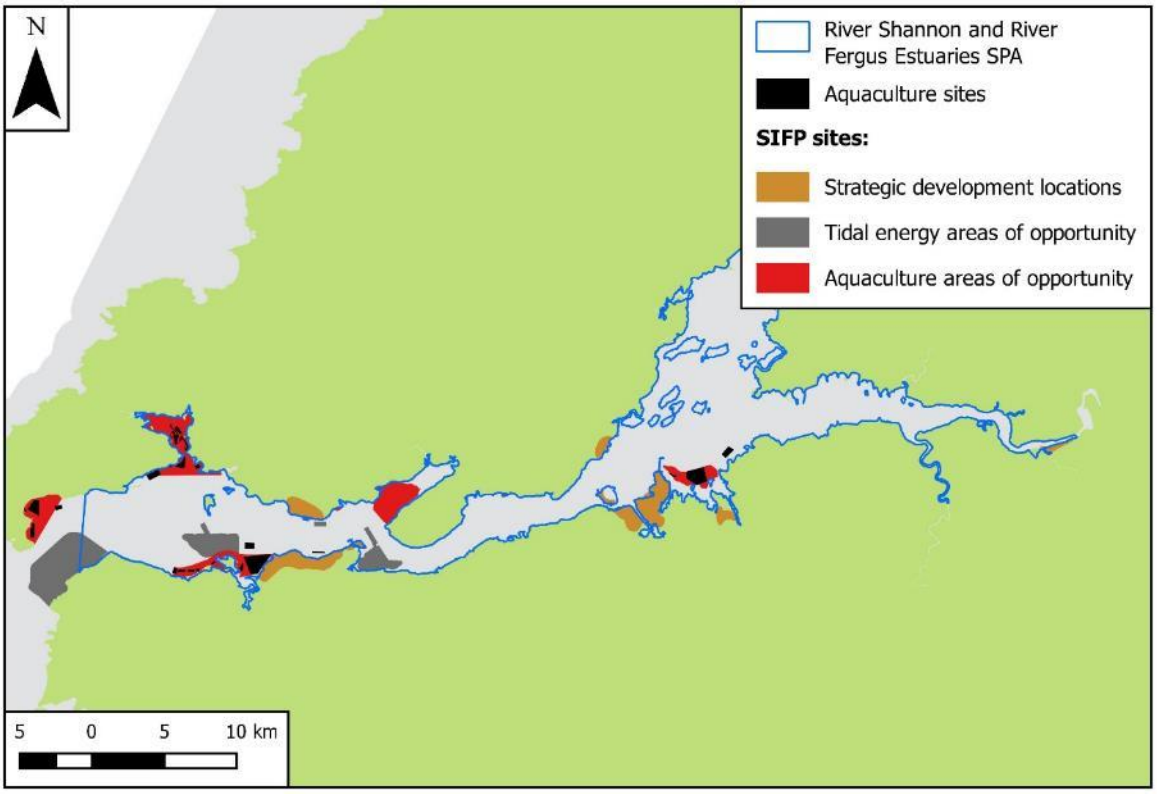

Figure 9.5 Strategic development locations and areas of opportunity identified in the Strategic Integrated Framework Plan for the Shannon Estuary.

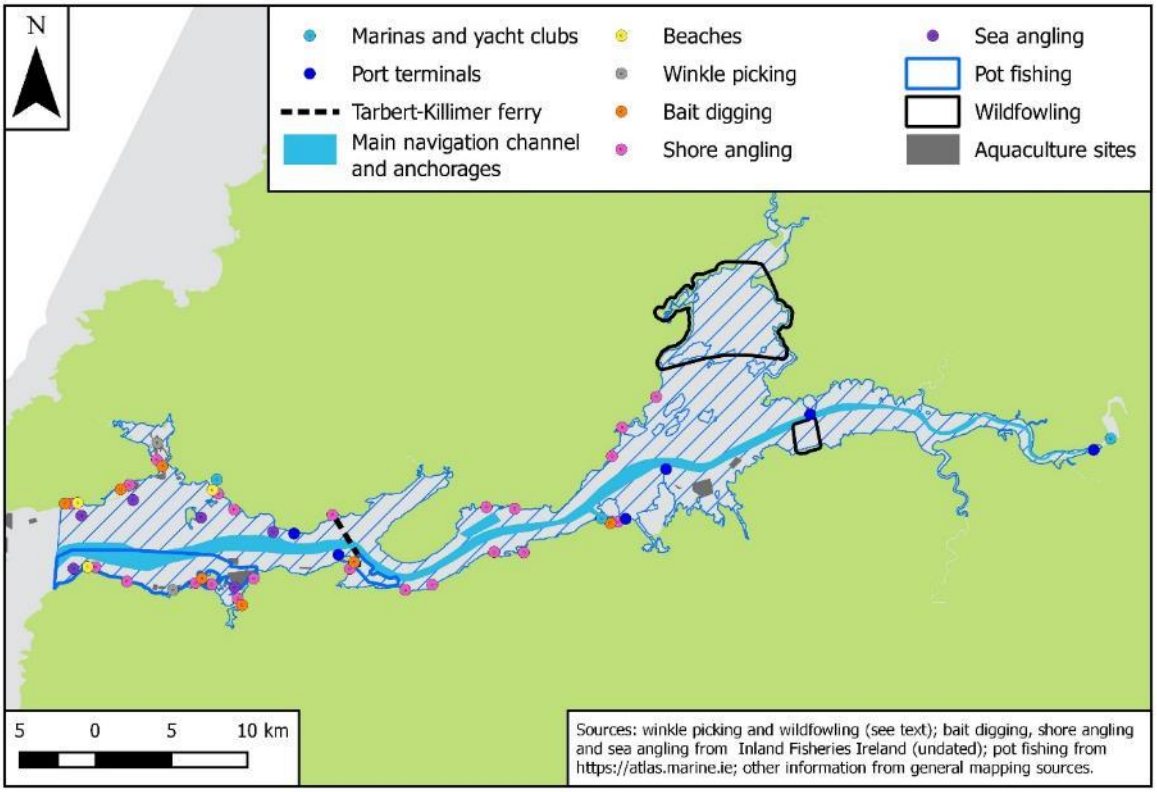

Figure 9.6 Disturbance pressures.

10. Assessment of impacts on conservation objectives

Introduction

10.1 Potential impacts on the screened-in SCIs are summarised below.

River Shannon and River Fergus Estuaries SPA

Whooper Swan

10.2 The possibility of intertidal or subtidal aquaculture development affecting nocturnal roost sites used by Whooper Swan cannot be discounted as we have no information on the location of these roost sites.

Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Knot and Dunlin

10.3 There is a high potential for significant displacement impacts to Grey Plover and Bar-tailed Godwit, while significant displacement impacts to Light-bellied Brent Goose and Ringed Plover are also possible. These potential impacts would arise from intertidal aquaculture sites in the Ballylongford/Bunaclugga, Poulnasherry/Kilrush and Aughinish/Foynes AQUAs. There is potential for further significant cumulative impacts on some of these species from the development of the above sites in combination with oyster trestle cultivation in Fishery Order T08/008, development of the area of opportunity for tidal energy in Tarbert Bay, and/or development of the area of opportunity for aquaculture in Clonderlaw Bay.

10.4 Significant displacement impacts to Shelduck, Wigeon, Teal, Pintail, Shoveler, Golden Plover, Lapwing, Curlew, Black-tailed Godwit, Knot and Dunlin are considered to be unlikely.

10.5 The possibility of significant disturbance impacts to high tide roosts used by these species from vessel activity associated with the development of sites T06/233, T06/394A, T06/394B, T07/007, T07/012A and T07/014A cannot be discounted due to a lack of information about the usage of high tide roost sites in these areas. The potential for cumulative impacts from this vessel activity in combination with other vessel activity in these areas also needs to be considered.

10.6 It is not possible to assess the potential cumulative impacts of disturbance from wildfowling activity on these species in-combination with aquaculture activity in the River Shannon and River Fergus Estuaries SPA due to the lack of detailed information on the distribution and intensity of wildfowling activity within the SPA.

Scaup

10.7 The potential for intertidal oyster cultivation in the aquaculture sites in the Poulnasherry/Kilrush AQUA to cause significant impacts to the availability of suitable foraging habitat for Scaup cannot be excluded due to lack of knowledge about the effects of oyster trestles on Scaup foraging behaviour. The potential for cumulative impacts from the development of the above sites in combination with oyster trestle cultivation in Fishery Order T08/008 and/or bottom oyster cultivation in Fishery Orders T08/004A and T08/004B also needs to be considered.

Cormorant

10.8 None of the aquaculture activities covered by this assessment are likely to cause significant impacts to availability of suitable foraging habitat for Cormorant, or to cause significant disturbance impacts to Cormorant.

Black-headed Gull

10.9 The potential impact of intertidal aquaculture on Black-headed Gull cannot be assessed at this stage, due to lack of data on Black-headed Gull distribution within the River Shannon and River Fergus Estuaries SPA at the time of its likely peak usage of the area. However, it should be noted that for Black-headed Gull the likelihood of any negative impact occurring is uncertain.

10.10 None of the aquaculture activities covered by this assessment are likely to cause significant impacts to availability of suitable subtidal foraging habitat for Black-headed Gull, or to cause significant disturbance impacts to Black-headed Gull roosting in subtidal habitat.

Other SPAs

Fulmar SCI of the Kerry Head SPA

10.11 None of the aquaculture activities covered by this assessment are likely to cause significant impacts to the breeding Fulmar population of the Kerry Head SPA.

Kittiwake and Guillemot SCIs of the Loop Head SPA

10.12 None of the aquaculture activities covered by this assessment are likely to cause significant impacts to the breeding Kittiwake and Guillemot populations of the Loop Head SPA.

Wigeon, Teal, Mallard, Shoveler and Black-tailed Godwit SCIs of the Ballyallia Lough SPA

10.13 This assessment for the River Shannon and River Fergus Estuaries SPA concluded that the possibility of significant disturbance impacts to high tide roosts of these species within the River Shannon and River Fergus Estuaries SPA could not be discounted. If such impacts do occur, the effects of any such impacts on the conservation objectives for the Ballyallia Lough SPA would depend upon the connectivity between the two sites. If there connectivity is high, the two sites would effectively support a single population and it is possible that major displacement impacts within the River Shannon and River Fergus Estuaries SPA would affect attribute 1 (population trend) of the conservation objectives for the Ballyallia Lough SPA.

10.14 Any such impacts would not affect attribute 2 (distribution) of the conservation objectives for the Ballyallia Lough SPA as this attribute refers to distribution within Ballyallia Lough.

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Appendix A

Scientific names

Common name	Scientific names	BTO code
Barnacle Goose	*Branta leucopsis*	BY
Bar-tailed Godwit	*Limosa lapponica*	BA
Black Turnstone	*Arenaria melanocephala*	n.a.
Black-headed Gull	*Chroicocephalus ridibundus*	BH
Black-tailed Godwit	*Limosa limosa*	BW
Chough	*Pyrrhocorax pyrrhocorax*	CF
Coot	*Fulica atra*	CO
Cormorant	*Phalacrocorax carbo*	CA
Curlew	*Numenius arquata*	CU
Dunlin	*Calidris alpina*	DN
Gadwall	*Anas strepera*	GA
Golden Plover	*Pluvialis apricaria*	GP
Great Black-backed Gull	*Larus marinus*	GB
Great Blue Heron	*Ardea herodias*	n.a.
Great Egret	*Ardea alba*	HW
Greenshank	*Tringa nebularia*	GK
Grey Plover	*Pluvialis squatarola*	GV
Hen Harrier	*Circus cyaneus*	HH
Knot	*Calidris canutus*	KN
Light-bellied Brent Goose	*Branta bernicla hrota*	PB
Long-billed Curlew	*Numenius americanus*	n.a.
Mallard	*Anas platyrhynchos*	MA
Marbled Godwit	*Limosa fedoa*	n.a.
Night Heron	*Nycticorax nycticorax*	n.a.
Oystercatcher	*Haematopus ostralegus*	OC
Pintail	*Anas acuta*	PT
Purple Sandpiper	*Calidris maritima*	PS
Red-breasted Merganser	*Mergus serrator*	RM
Redshank	*Tringa totanus*	RK
Ringed Plover	*Charadrius hiaticula*	RP
Sanderling	*Calidris alba*	SS
Scaup	*Aythya marila*	SP
Shelduck	*Tadorna tadorna*	SU
Shoveler	*Anas clypeata*	SV
Snowy Egret	*Egretta thula*	n.a.
Teal	*Anas crecca*	T.
Turnstone	*Arenaria interpres*	TT
Whooper Swan	*Cygnus cygnus*	WS
Wigeon	*Anas penelope*	WN
Willet	*Catoptrophorus semipalmatus*	n.a.

Appendix B

Ballylongford/Bunaclugga AQUA flock maps

B.1 Introduction

B.1.1 This appendix shows maps of the distribution in the Ballylongford/Bunaclugga AQUA of the SCI species covered in this assessment, as recorded in the WSP flock maps.

B.2 Figures

B.2.1 Figure B.1 shows the total numbers of SCI dabbling duck and geese species (Light-bellied Brent Goose, Shelduck, Wigeon, Teal and Shoveler) in each mapped flock across all the low tide counts.

B.2.2 Figure B.2 shows the total numbers of SCI wader species (Golden Plover, Lapwing, Ringed Plover, Curlew, Black-tailed Godwit, Bar-tailed Godwit, Dunlin, and Redshank) in each mapped flock across all the low tide counts.

B.3 Interpretation of the figures

B.3.1 The positions mapped in the figures are the centroids of the positions shown on the count maps.

B.3.2 The figures were prepared in QuantumGIS 2.18.3 and use the point displacement function to handle overlapping points. This uses concentric rings to displace overlapping points. These rings are shown on the figures and indicate the degree of displacement applied.

B.3.3 The caveats discussed in Chapter 2 about the interpretation of the WSP flock map data need to be taken into account in interpreting these maps. It is because of these caveats that we have presented maps showing species groups, rather than maps for individual species.

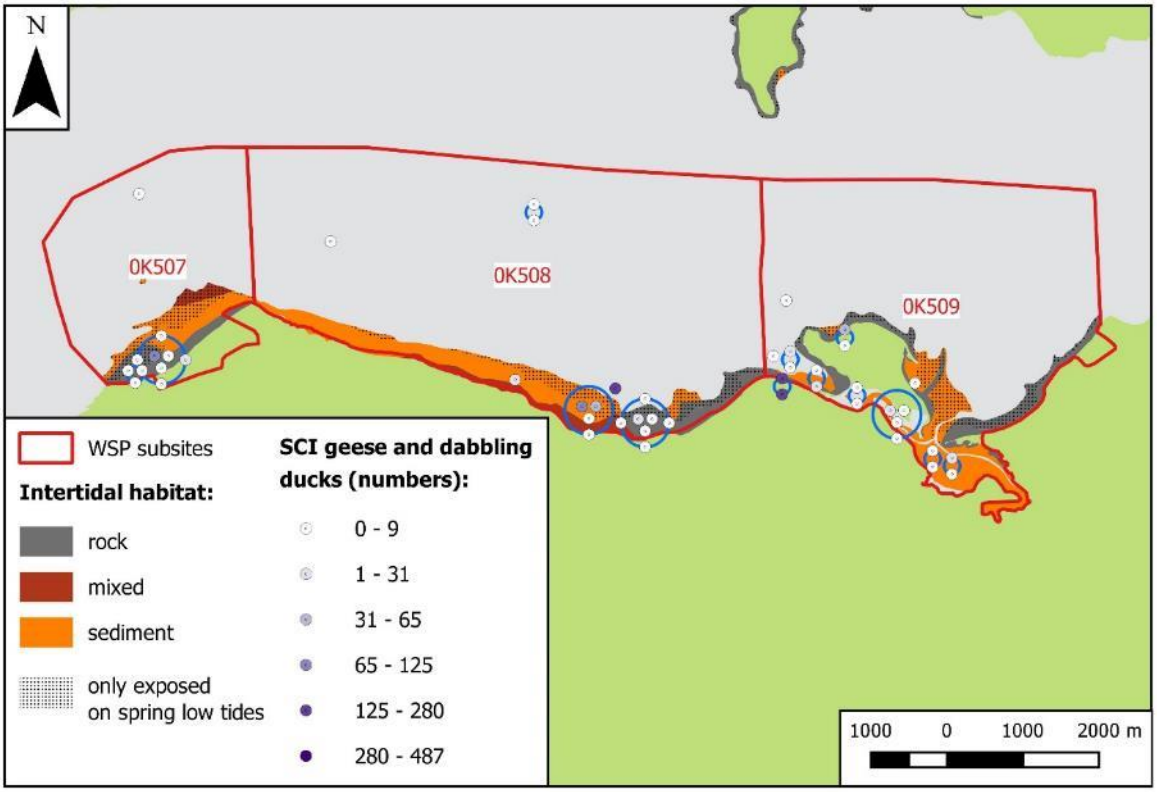


Figure B.1 SCI dabbling duck and geese species.

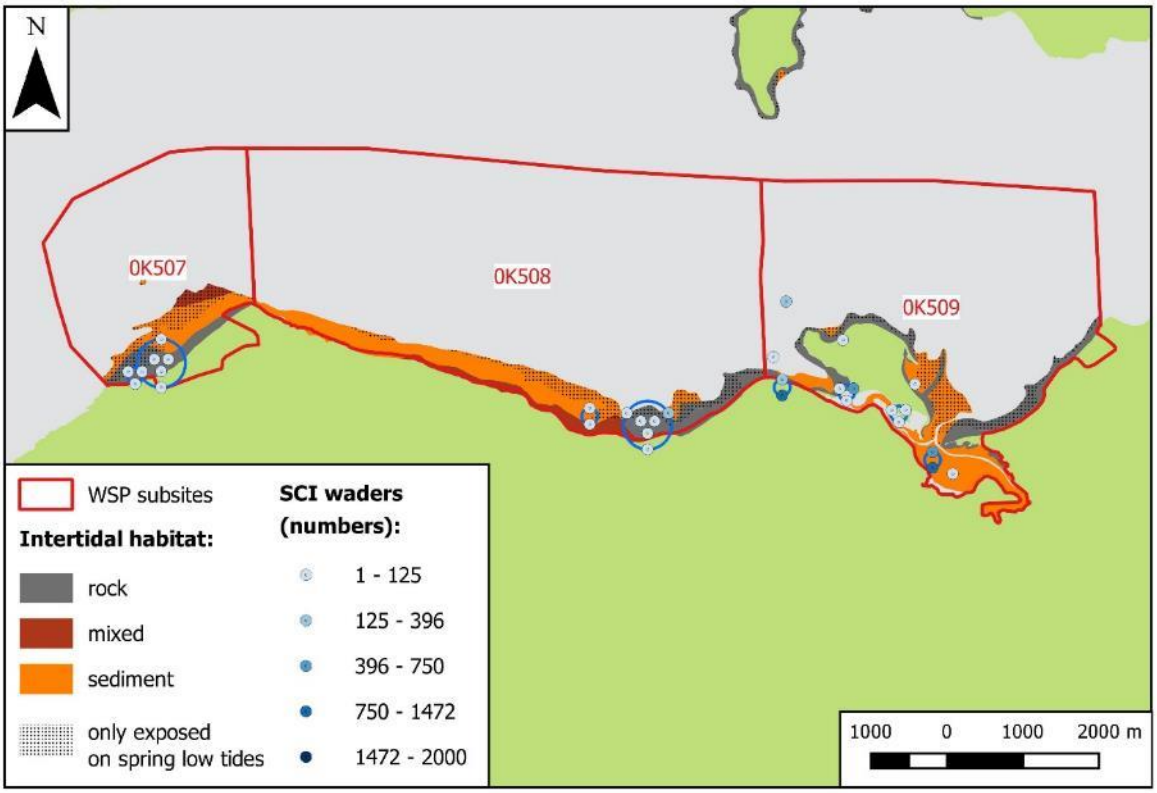


Figure B.2 SCI wader species.

Appendix C

Poulnasherry Bay flock maps

C.1 Introduction

C.1.1 This appendix shows maps of the distribution in Poulnasherry Bay in 2000-2002 of the SCI species covered in this assessment, as recorded in the NPWS bird usage counts.

C.2 Figures

C.2.1 Figure C.1-Figure C.1 show the distribution of Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Cormorant, Golden Plover, Grey Plover, Lapwing, Ringed Plover, Curlew, Bar-tailed Godwit, Knot, Dunlin, Redshank and Black-headed Gull in Poulnasherry Bay during the NPWS bird usage counts.

C.3 Interpretation of the figures

C.3.1 For each bird usage count, maps were drawn up showing the positions of the birds recorded (see example in Figure 2.3). Comparison of the totals on the maps with the count totals indicate that most, or all, of the birds counted were mapped. For each species shown in Figure C.1-Figure C.1, the relevant figure shows all mapped positions recorded on these maps across all the counts.

C.3.2 The positions mapped in the figures are the centroids of the positions shown on the count maps. The exact positions mapped should be interpreted with caution, as birds will have been dispersed to varying degrees (depending upon the species and their behaviour on the day) around the mapped position, and there was also likely to be a degree of mapping error.

C.3.3 The figures were prepared in QuantumGIS 2.18.3 and use the point displacement function to handle overlapping points. This uses concentric rings to displace overlapping points. These rings are shown on the figures and indicate the degree of displacement applied.

C.3.4 The figures also the mapped position of trestles in March 2000, and the intertidal mapping used in this assessment.

C.3.5 The mapped position of trestles is taken from the count sector map supplied by NPWS with the bird usage count data. We do not have details of how the trestles were mapped, but presume that the mapping was done by eye (sketch mapping), so a degree of caution is required in the interpretation of the exact position of the trestles.

C.3.6 The details of the methods used for the intertidal mapping are given in Chapter 2. It should be noted that the mapping is based on recent aerial imagery, supplemented by observations from our site visits in 2010 and 2017. Therefore, the position of flocks in relation to this mapping should be interpreted with caution as there may have been changes in the distribution of the habitats, particularly in the extent of the algal zone.

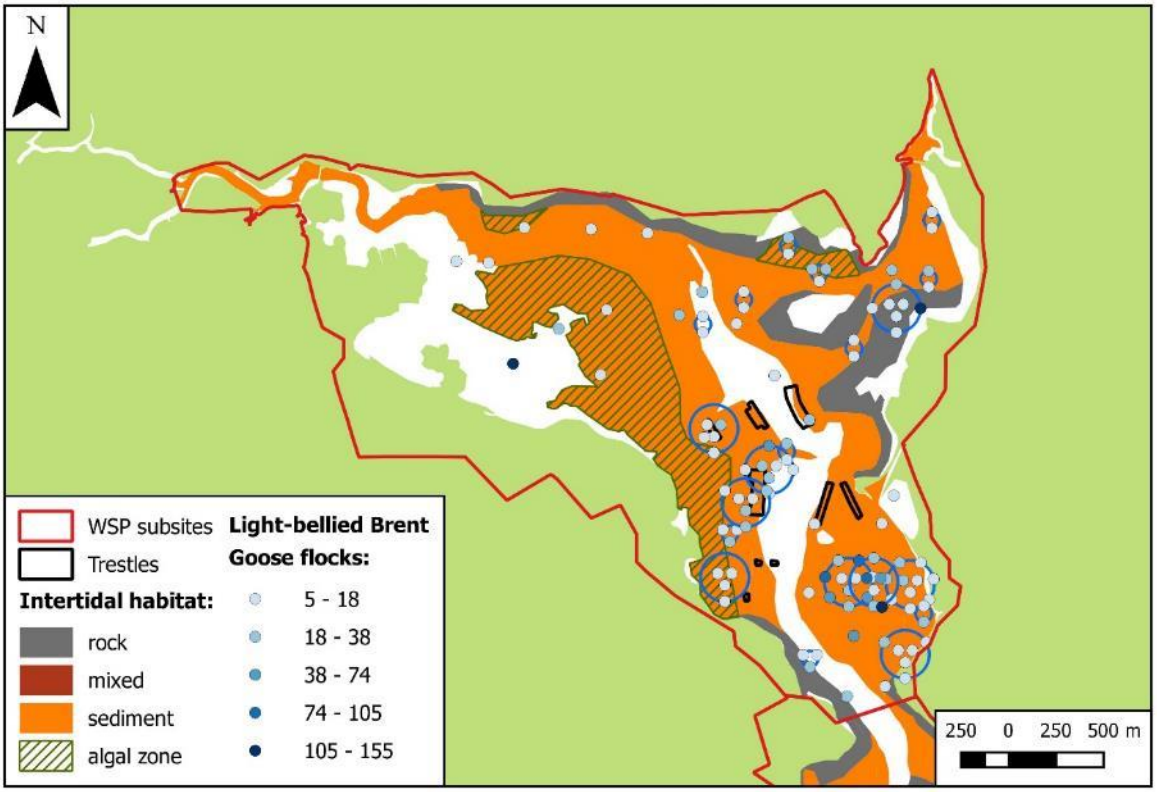


Figure C.1.1 Light-bellied Brent Goose.

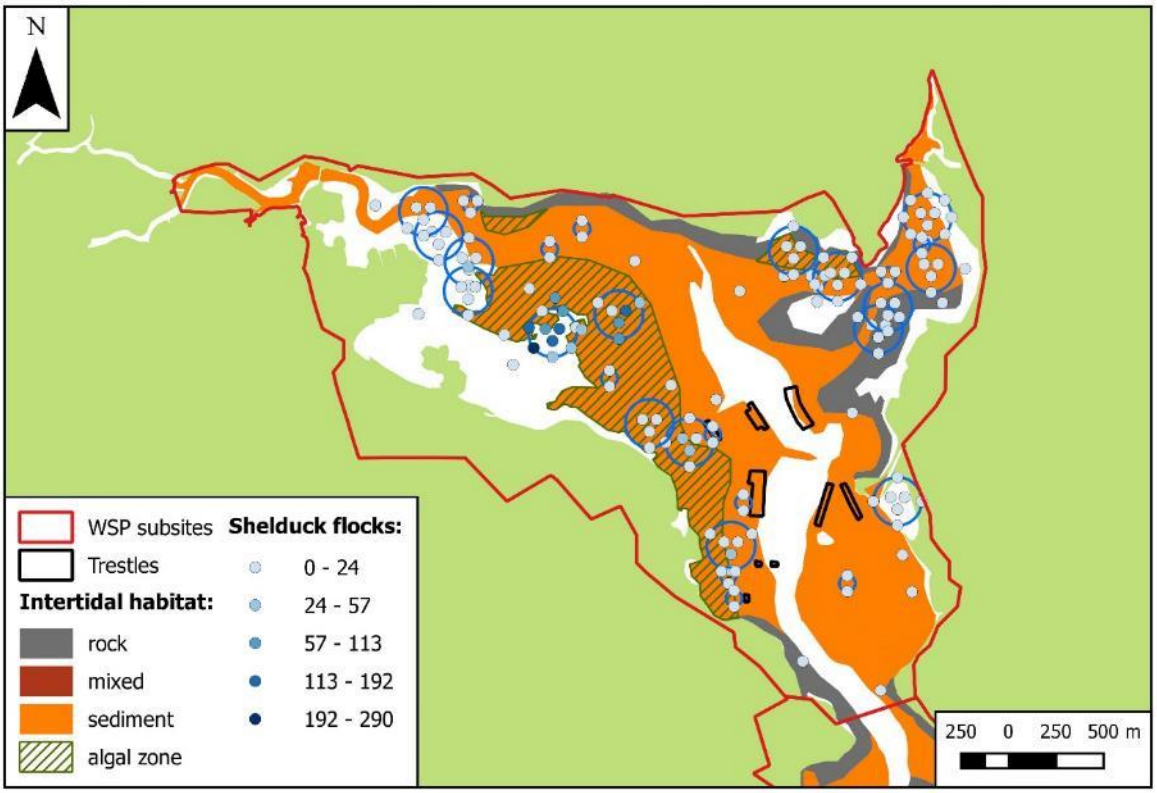


Figure C.1.2 Shelduck.

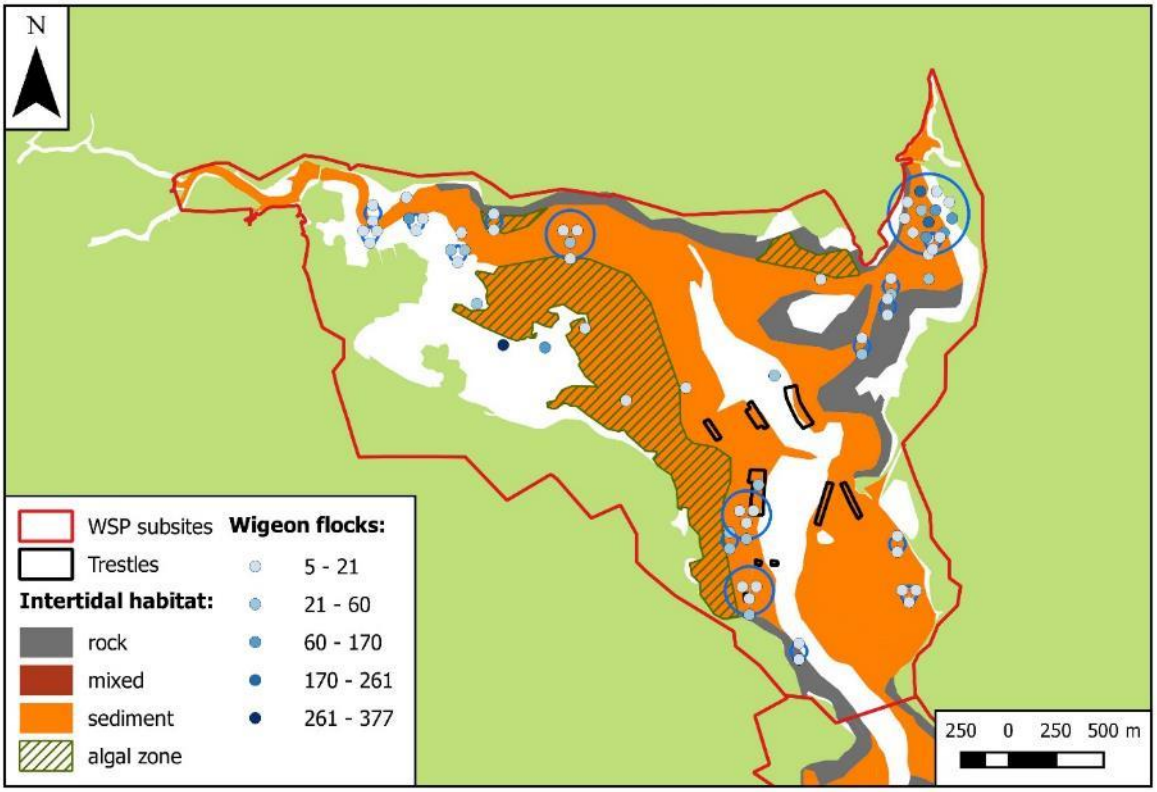


Figure C.1.3 Wigeon.

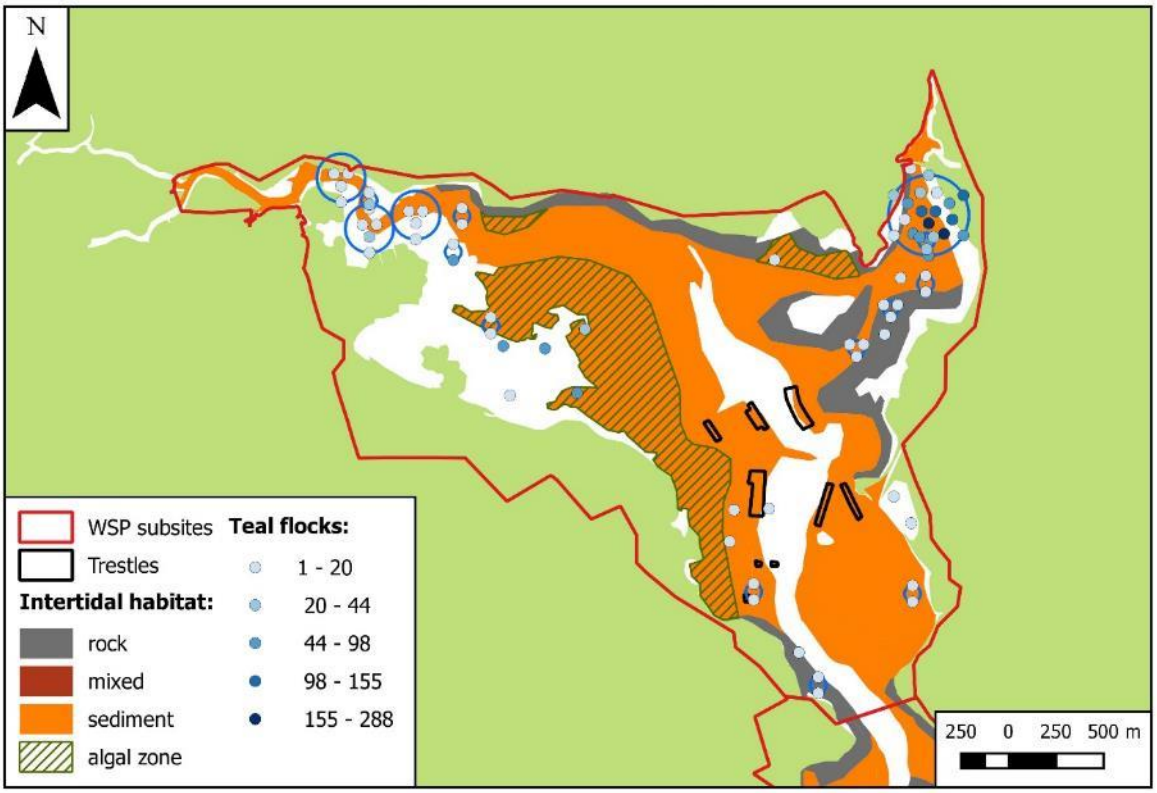


Figure C.1.4 Teal.

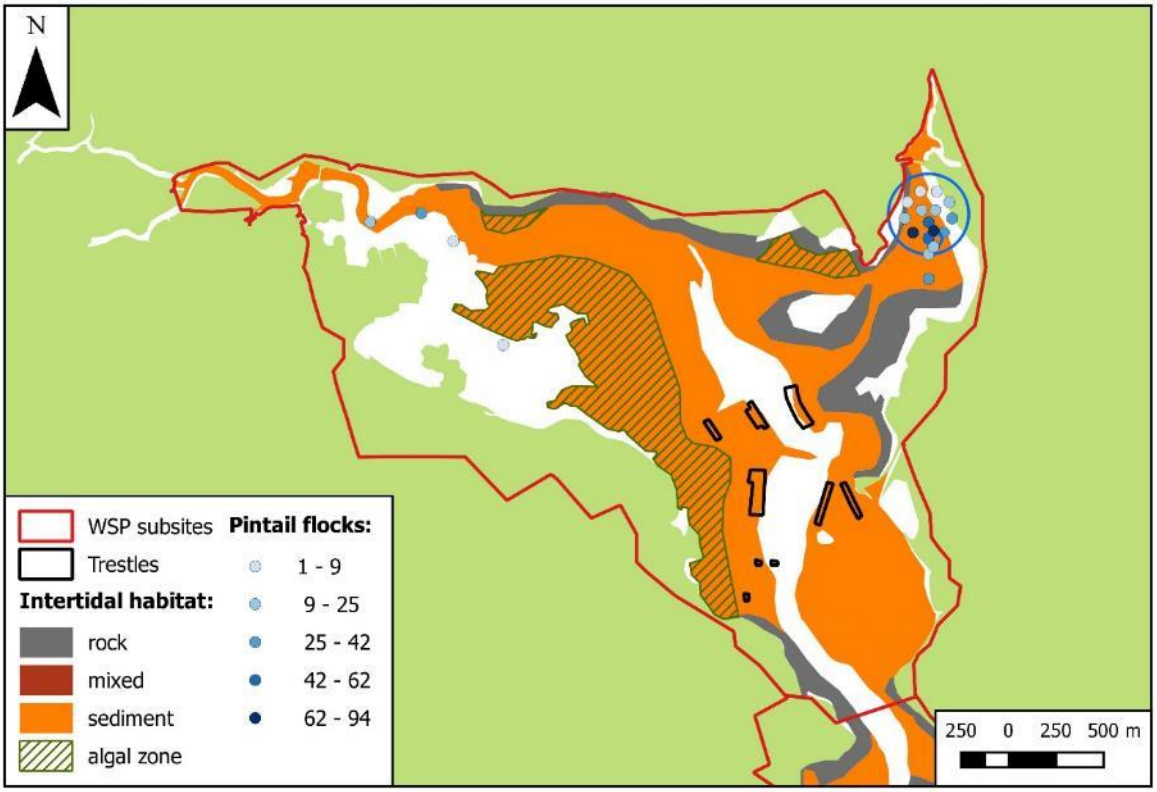


Figure C.1.5 Pintail.

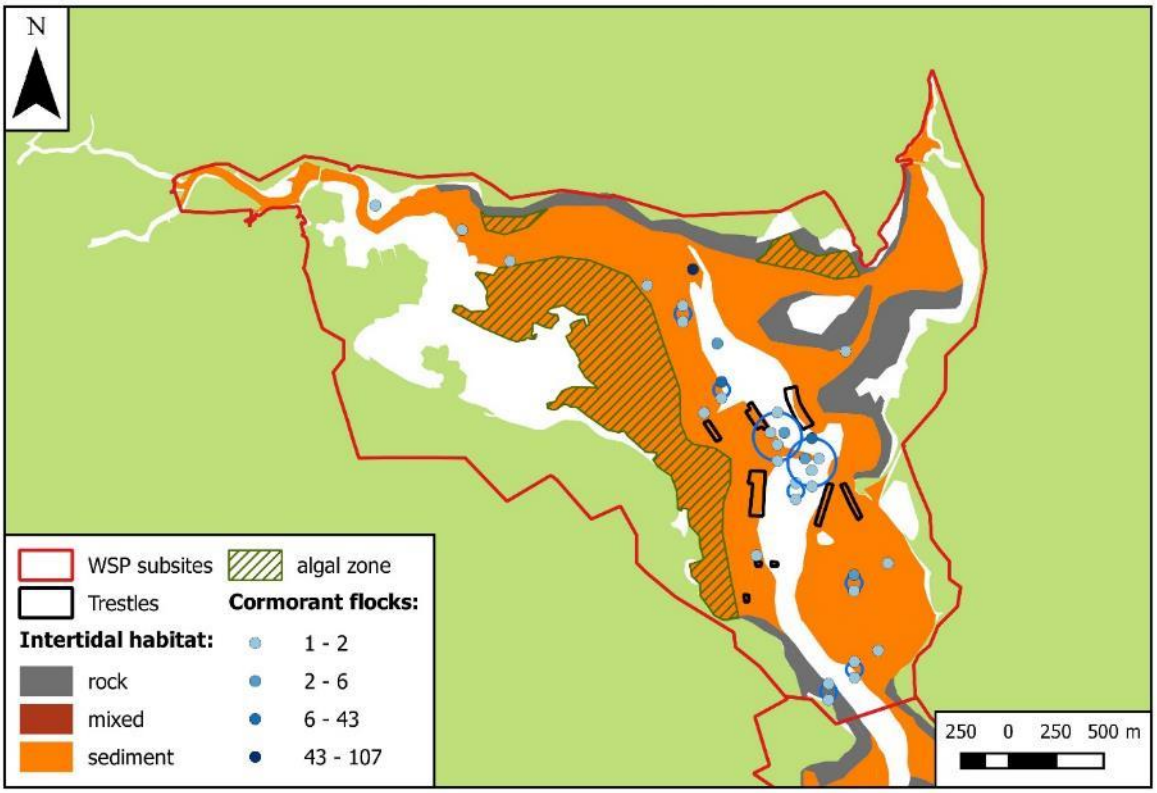


Figure C.1.6 Cormorant.

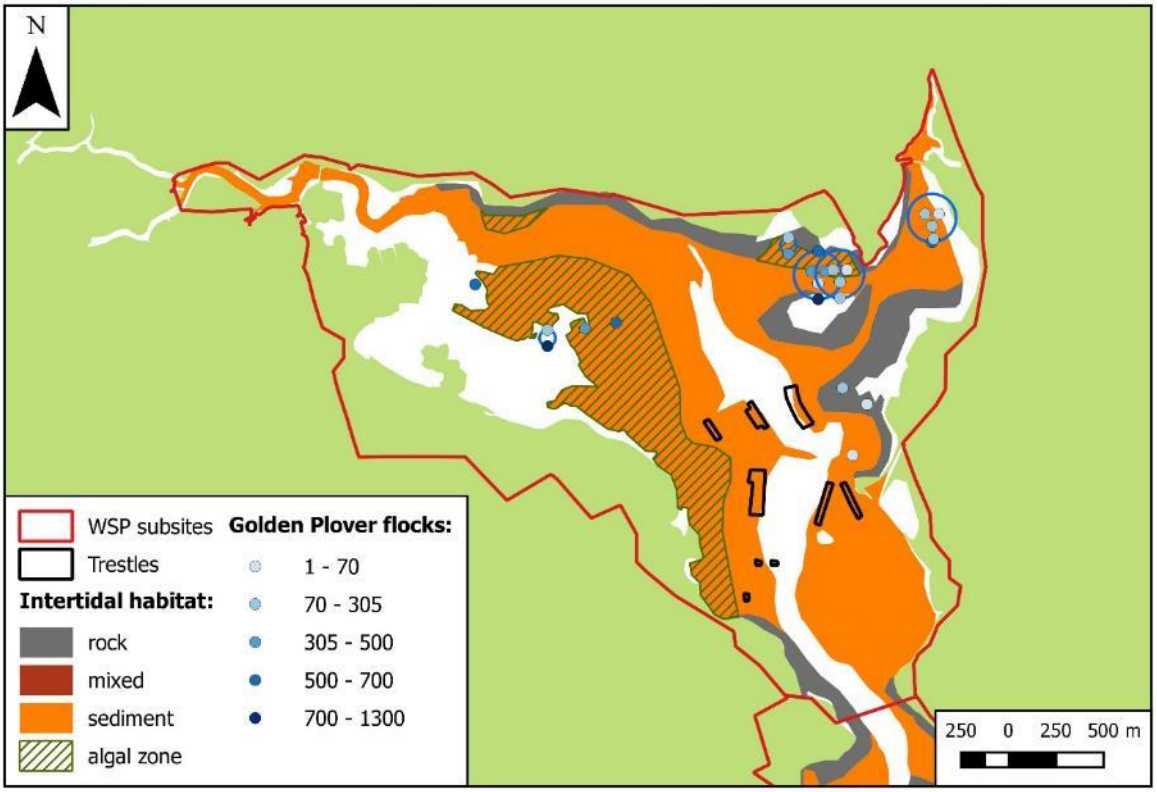


Figure C.1.7 Golden Plover.

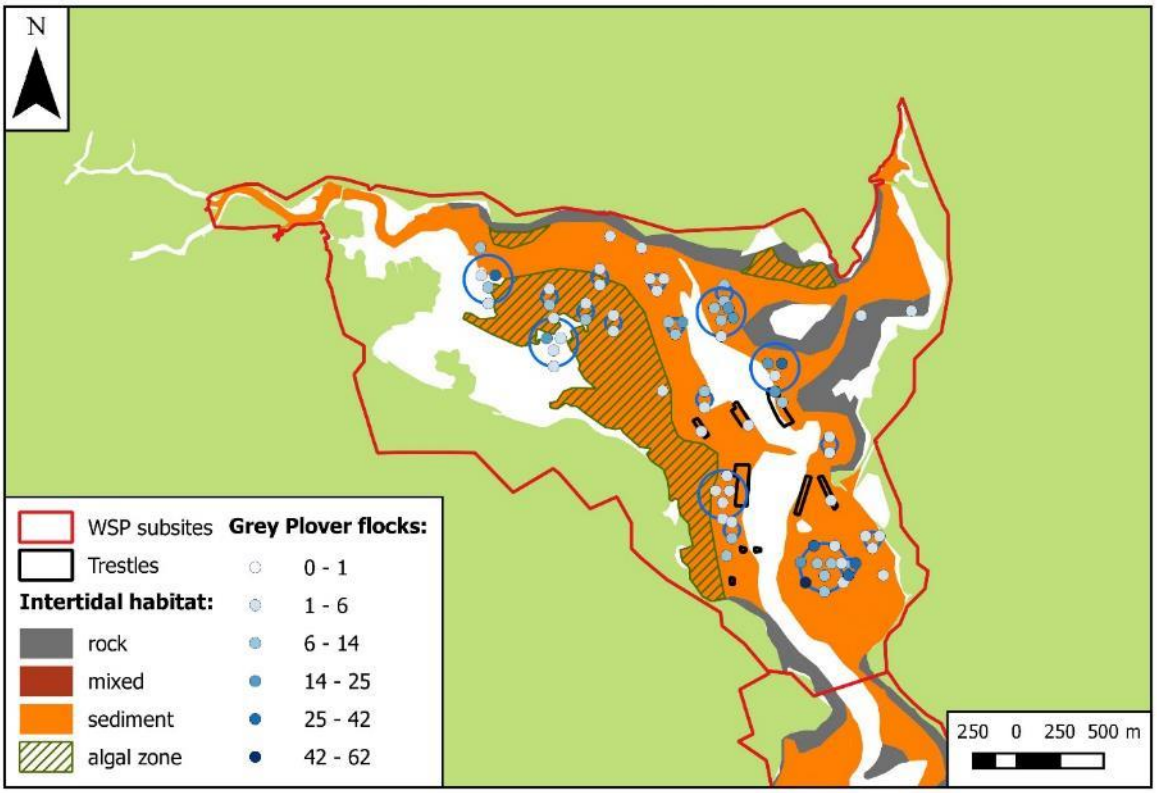


Figure C.1.8 Grey Plover.

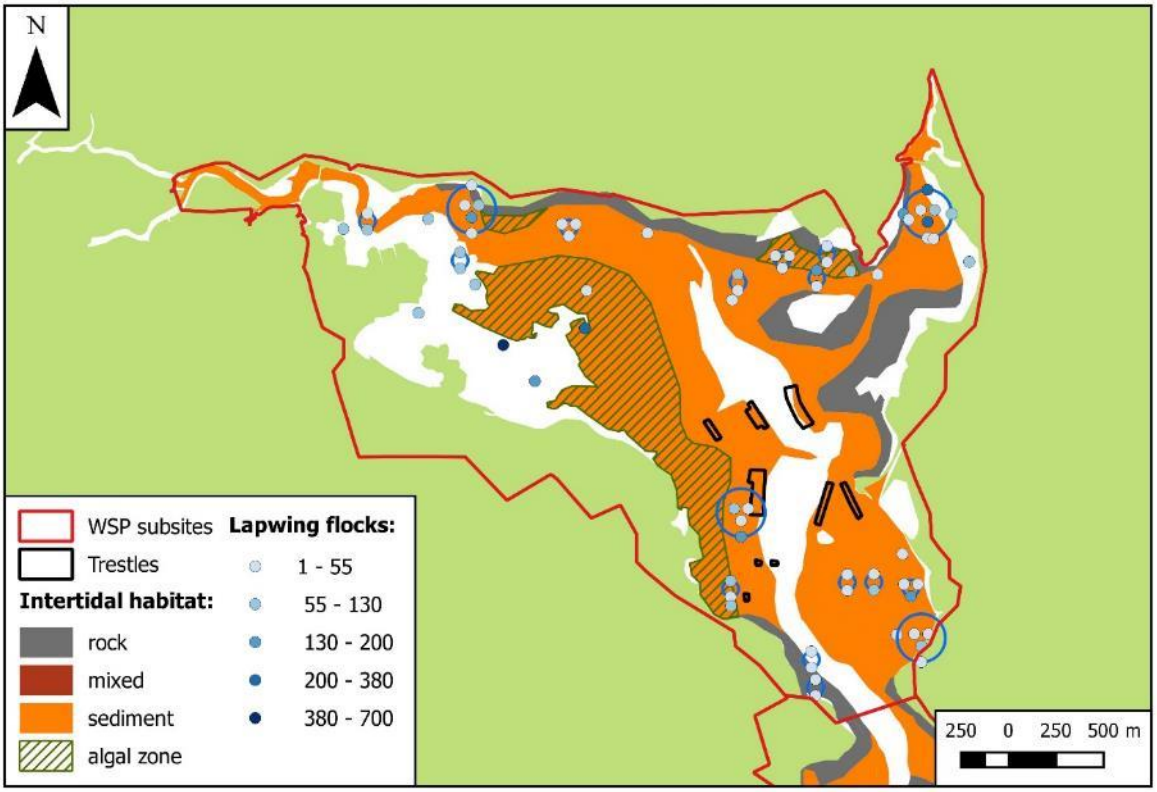


Figure C.1.9 Lapwing.

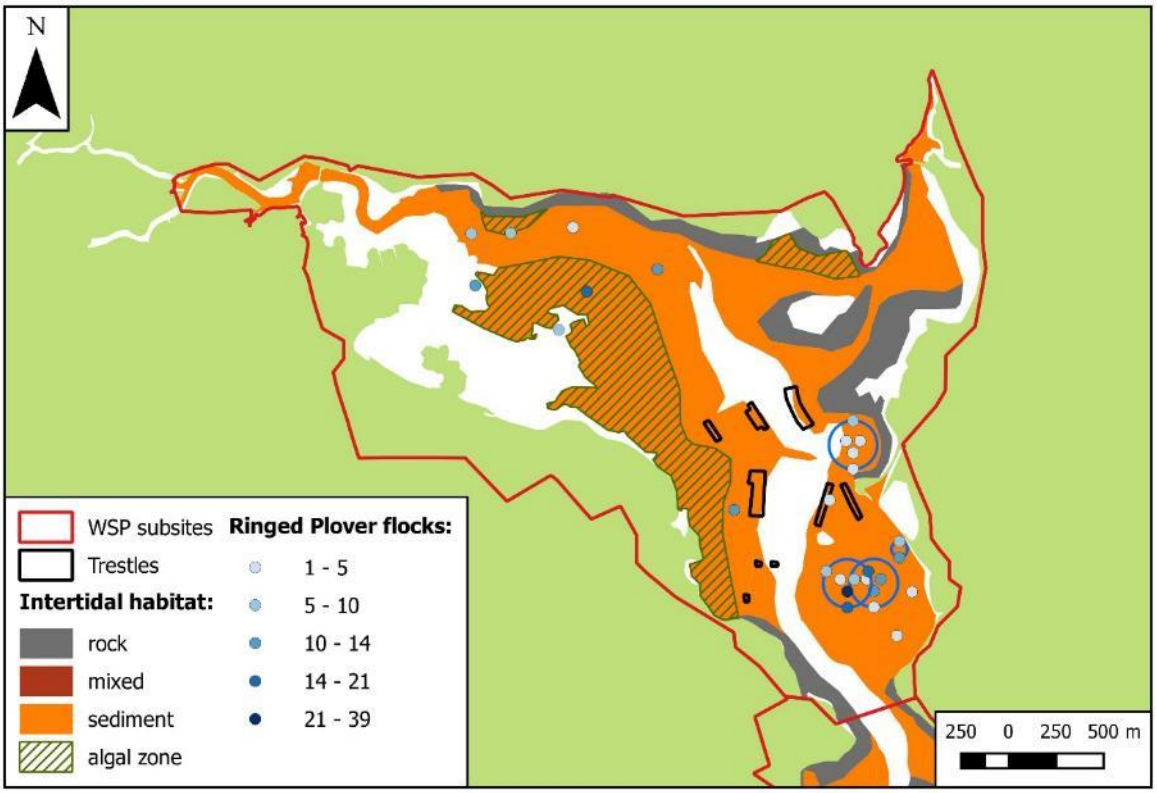


Figure C.1.10 Ringed Plover.

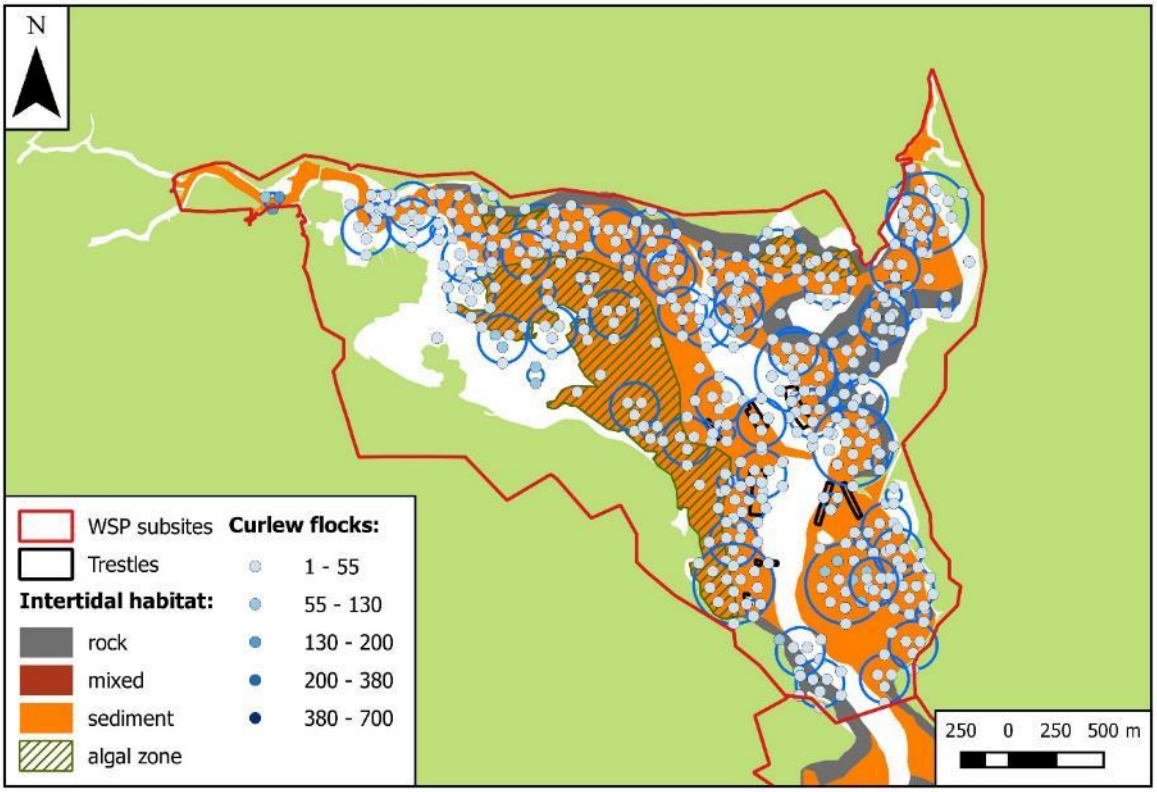


Figure C.1.11 Curlew.

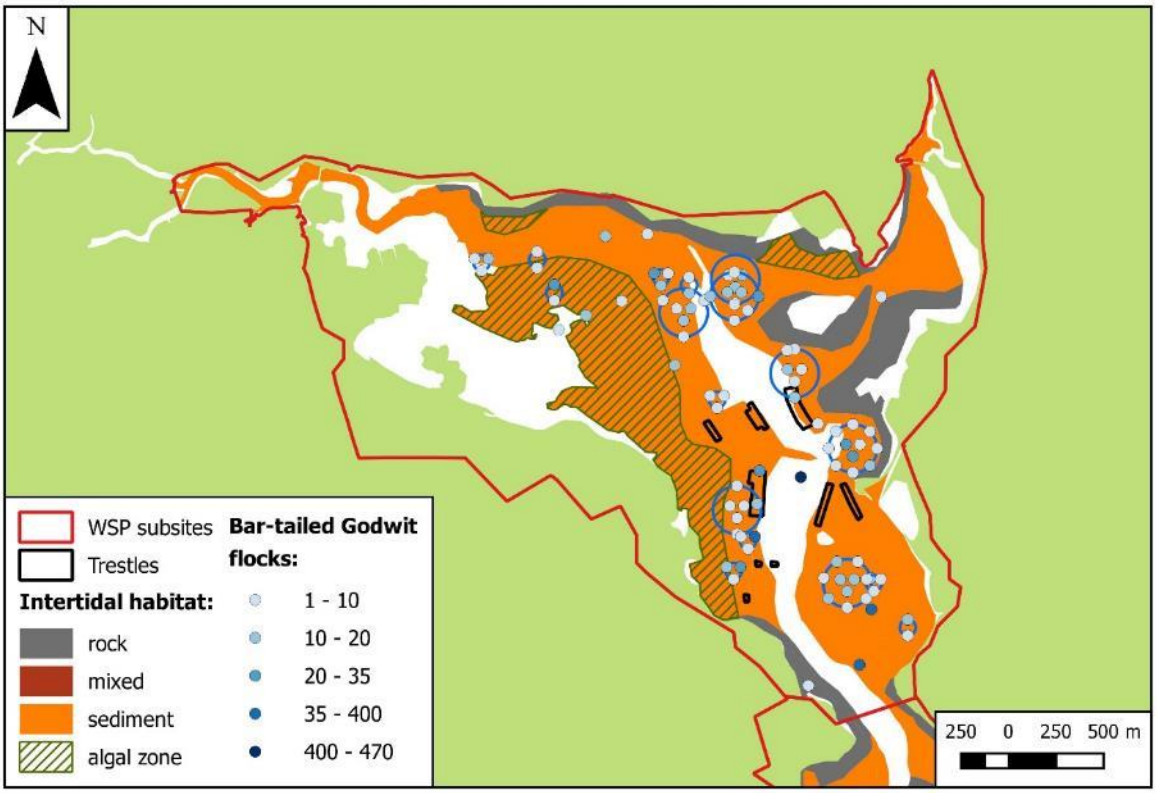


Figure C.1.12 Bar-tailed Godwit.

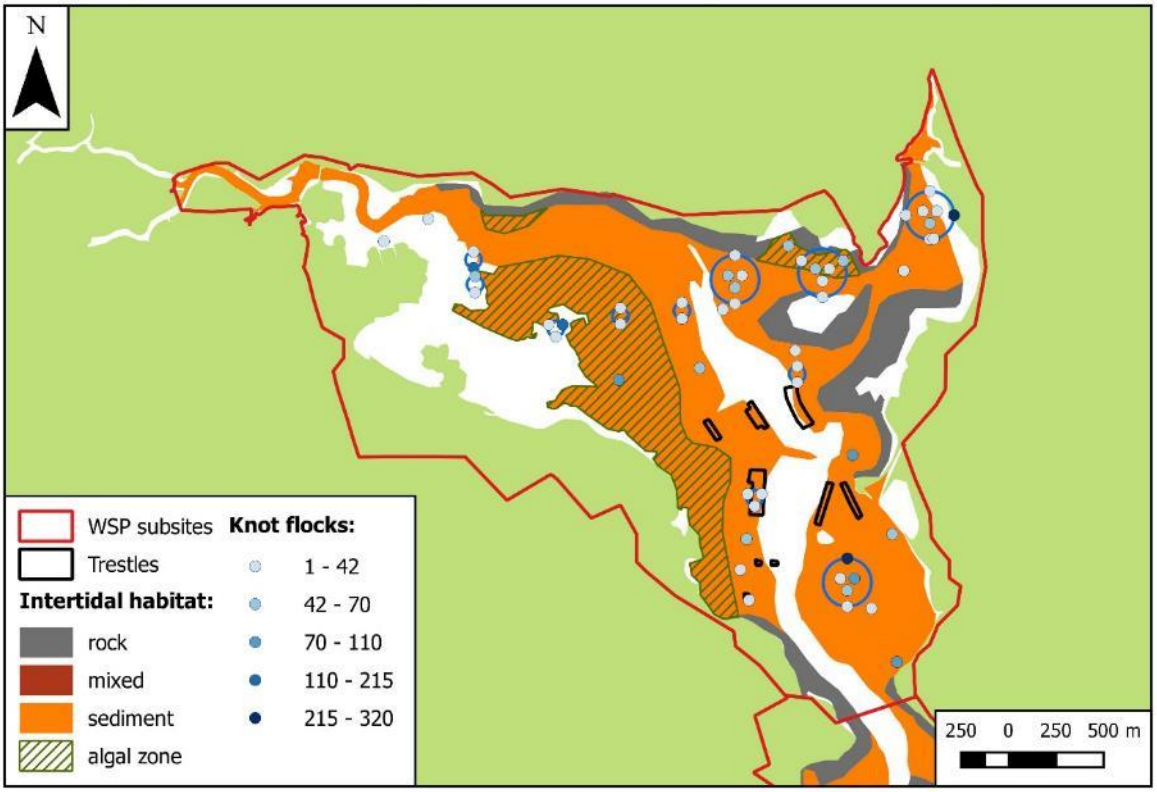


Figure C.1.13 Knot.

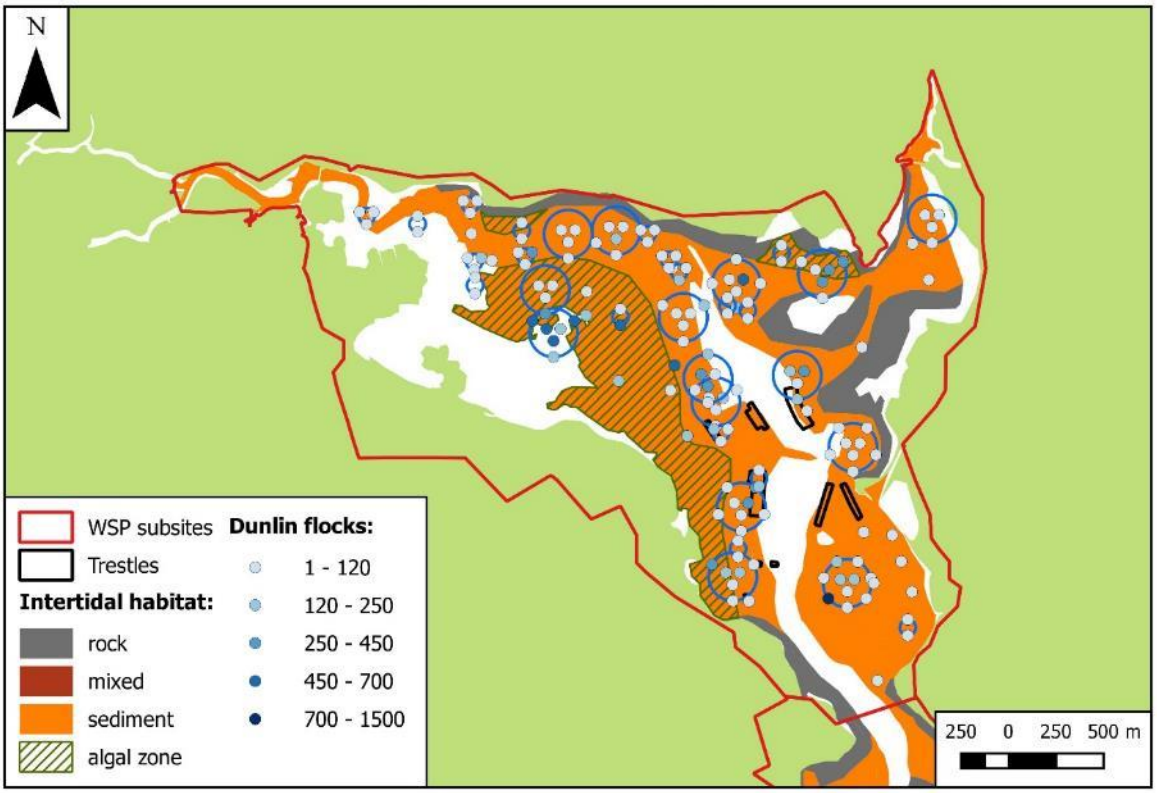
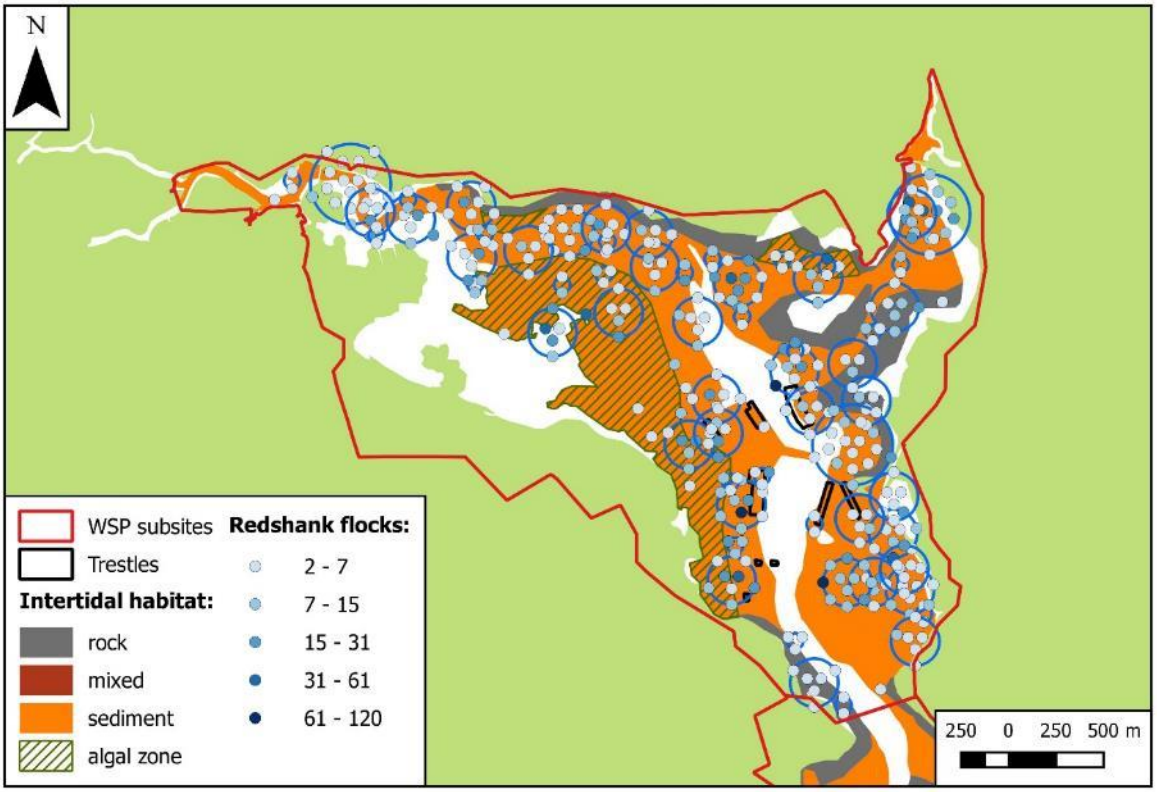


Figure C.1.14 Dunlin.



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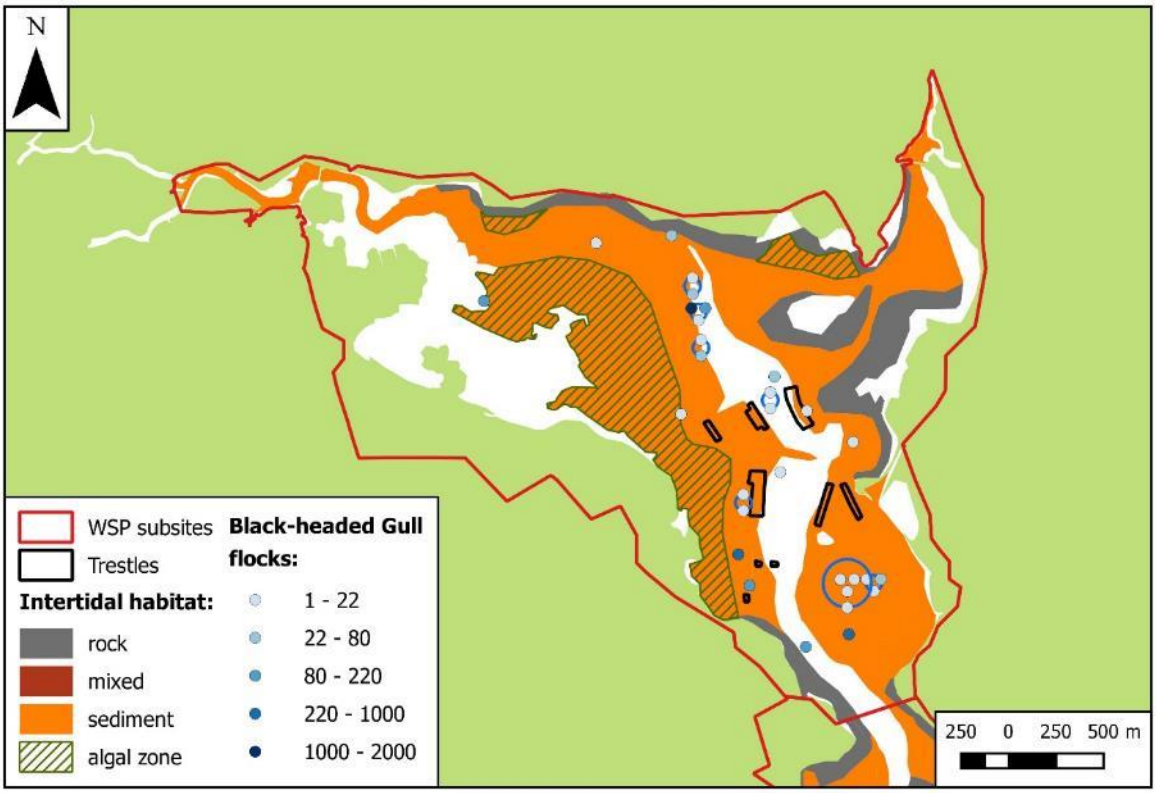

Figure C.1.15 Black-headed Gull.

Appendix D

Literature review - Impacts of bottom mussel culture on benthic fauna

D.1 Review

D.1.1 Bottom culture accounts for about half of all mussels produced in Ireland (Heffernan, 1999). In 1995, 5,570 tonnes were produced. Bottom cultivation involves the location, collection and transplantation of wild mussel spat into richer, shallower waters using a dredger. Successful on-growing of re-laid spat requires sandy shallow beds. When the mussels reach commercial size (9-18 months later), they are harvested by dredger (Joyce, 1992 cited in Heffernan, 1999). This method is practised successfully on a large scale in Wexford Harbour and also in Carlingford Lough (Heffernan, 1999).

D.1.2 Heffernan (1999) could not find any literature on the impact of bottom culture on benthic fauna and it was presumed that the culture beds were analogous to natural mussel beds. In the intervening years, a number of studies have been undertaken to assess the impacts of bottom mussel culture on benthic fauna.

D.1.3 Smith and Shackley (2004) investigated the development of bottom mussel culture in inner Swansea Bay, Wales. The area was a shallow, sublittoral and high tidal energy environment. The results of this study found that the establishment of bottom mussel culture led to a reduction in the number and abundance of species due to habitat change and regular harvesting. There was an increase in abundance in carnivorous and deposit feeding species. In addition, the study found that the mussels reduced the chance of other filter feeding benthic species from becoming established by filtering their larvae or by physically smothering them. Smith and Shackley (2004) predicted that the establishment of bottom mussel culture at the Swansea site would lead to a change in benthic fauna and as a result, potentially impact the availability of prey species of juvenile flatfish that use the area as a nursery. Furthermore, an increased number of mussels in the area may reduce the potential food source of other filter feeding species in the area.

D.1.4 These finding are in contrast to those of Dolmer (2002) who reported that there is a positive relationship between mussel abundance and the number of associated species due to the increased complexity of the substratum in mussel beds compared to the surrounding sediments. In effect, the mussels become ‘ecosystem engineers’ (Jones *et al*. 1994; 1997). The presence of mussel beds can control the benthic environment directly by providing habitat and indirectly by enhancing larval settlement (Dolmer, 2002), providing shelter from predation, trapping sediment and altering water flow (Gutiérrez *et al*. 2003).

D.1.5 At study sites in western Sweden, Norling *et al*. (2015) examined the effects of blue mussel plots, one containing live mussels and the other with post mortem shells, on the epifaunal and infaunal assemblages. Notably, this study included the effect on fish species which were not considered in some of the other studies. This study supported previous studies which found that the ecosystem engineering effects of plots containing live mussels and dead shells both had an increase in epibenthic species richness, total abundance and biomass compared to the control plot which consisted of bare sand. Notably, small crustaceans were positively affected by the presence of blue mussel plots whereas fish species were positively affected by the presence of oyster plots which were also studied.

D.1.6 Ysebaert *et al*. (2009), made a comparison study between bottom mussel culture at sites in Denmark (a shallow, wind dominated, mixed water environment with microtidal range and low current conditions) and the Netherlands (a deeper, marine dominated environment with greater tidal range and currents). They reported the change in the habitat due the presence of bottom culture

mussels had a positive effect on the benthic community, especially in the Netherlands site where an increase in the number of epibenthic species was seen.

D.1.7 However, it is important to consider the impact of biodeposition on the benthic fauna, in particular the infaunal assemblages. The presence of bottom culture mussel beds means the habitat is dominated by single species on the seabed. This may lead to the transformation of an infaunal dominated community to an epifaunal dominated community and also cause alteration of sediment type and chemistry due to the production of mussel mud (Marine Institute, 2013). Relaid mussels lead to the development of mussel mud (a mix of dead shells, silt and faeces/pseudofaeces) beneath the mussel beds as the filtration and feeding activities of the mussels increase the sedimentation rate (Kaiser *et al*., 1998). The effects of this were observed by Beadman *et al*. (2004) who noted that an increase in the abundance of mussels resulted in a decrease of both infaunal diversity and abundance through provision of a complex habitat, input of organically rich material and larval removal through filter feeding at a study site in Bangor Pier, north Wales. However, these impacts were local in nature (0 to 10 m) and were not detectable at greater distances.

D.1.8 Ysebaert *et al*. (2009) also found that the influence of bottom cultures on the sedimentary environment and on the macrobenthic community was found to be very local. Kaiser *et al*. (1998) argue that although local in extent, these changes may persist in time following the removal of mussel beds as although the fine sediments are reworked, the remaining shell material effectively creates a new benthic habitat that may have more long term effects on the composition of benthic fauna in the area.

D.1.9 In contrast, Van der Zee *et al*. (2012) reported that mixed blue mussel and oyster beds can have large scale effects (>100 m) as the beds have effects on consumer-resource interactions far beyond their own physical spatial boundaries in intertidal soft-sediment systems. This is a result of increasing organic matter in the sediment, increasing the silt fraction in the sediment and decreasing the redox potential all of which can influence the distribution of benthic species (Norling *et al*., 2015).

D.1.10 In relation to the effects on surrounding sediment, Norling *et al*. (2015) again reported that the presence of live blue mussels on the seabed significantly increased the organic content in the surrounding sediment by both excreting organic-rich particles and also by trapping passing organic rich particles due to the heterogeneous structure of the mussel bed compared to the surround sandy seabed. However, no significant effects on infaunal species richness or abundance were found during this study though there was a trend towards reduced infaunal abundance in both oyster and blue mussel plots (both alive and dead). Dittmann (1990) reported that blue mussel beds reduce macroinfauna abundances compared to the surrounding sandflats with a change in the composition of the assemblages from Polychaeta in the sandflats to Oligochaeta in the mussel beds. Kochmann *et al*. (2008) report that the presence of mussel beds on the seabed results in a change in the species composition but not in richness. Species which are more tolerant to the changing organic content in the sediment move into the mussel beds whereas less tolerant species remain in the bare sand. The abundances of infaunal species increased under the mussel beds, possibly due to the cover provided by the mussels from predators.

D.1.11 With respect to fish species, Norling *et al*. (2015) found that live blue mussel beds had a positive effect on the fish assemblages with an increase in species richness, abundance and total biomass particularly for oyster beds but also to a lesser degree for live blue mussel beds. Similar positive relationships between blue mussel beds and fish in the Baltic Sea (Jansson *et al*., 1985). However, the other studies cited in Norling *et al*. (2015) of observations of an increases in fish diversity and abundance over bivalve beds made by Norling *et al*. (2015) were all based on oyster beds (Breitburg, 1999; Posey *et al*., 1999; Trolley and Volety, 2005) and in the United States by Peterson *et al*., (2003). In particular the differences in physical structure of oyster beds compared to blue mussel beds to attract different suites of species, the ability of oyster beds to form reefs and so persist for much longer and the lack of information relating to use of fish on dead blue mussel beds are all factors that need to be considered when evaluating the impact of bivalve plots on benthic fauna.

D.1.12 The use of dredges to harvest the mussel beds had an impact on the non-target infaunal benthic fauna at a site in Denmark with polychaetes associated with mussel beds having a reduced density after dredging. In addition, gastropods and bivalves were also reduced in number after dredging. These impacts are reported to be short term in nature (Dolmer *et al*. 2002). The invasion of scavenging brown shrimps into the dredged area accelerates the transport of energy to higher trophic levels, and thereby changes the trophic structure of the ecosystem. (Dolmer *et al*. 2002).

D.1.13 Hoffmann and Dolmer (2000) found that the use of dredges had no long-term effects on the epifauna composition, however further studies suggest that taxa such as sponges, echinoderms, anthozoans, molluscs, crustaceans and ascideans occurred at reduced density or were not observed at all 4 months after an area had been fished, indicating that the fishery has a short-term effect on the epifauna (P. Dolmer, unpublished results). In contrast, harvesting, as well as habitat change, was proposed as an explanation for a decrease in the number of species and in the total number of individuals in their study site (Smith and Shakley, 2004).

D.1.14 In summary, it appears that mussel culture beds can increase the diversity and abundance of epibenthic fauna by providing an additional food resource for species that predate on the mussels themselves or other species that may be attracted to the mussel bed to predate on the species that are attracted to the mussel beds for refuge. This change in epibenthic fauna is contrasted with a change of infaunal species as increased organic rich sediments deposited by the mussels changes the characteristics of the sediments beneath the culture plot. There is disagreement as to the effectiveness of mussel beds to increase or decrease the abundance of other filter feeding benthic species positively by providing an additional habitat for larvae to establish or negatively by consuming the larvae of other species that may otherwise occupy the area. Local site specific factors may play an important role in determining the impact of bottom mussel plots on benthic fauna.

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