Marine Institute

Carlingford Lough Special Protection Area (004078): Appropriate Assessment of Aquaculture

February 2019

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Appropriate Assessment of Aquaculture

January 2019

Notice

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Executive Summary

Introduction

This document contains the Appropriate Assessment Report for aquaculture in Carlingford Lough SPA (site code IE004078). A portion of the northern shore is also designated in the UK as a SPA (UK9020161). Carlingford Lough is a 15km long, narrow sea inlet into which the Newry River flows. The lough is flanked by glacial mountains and moraines, with the Mourne Mountains to the north and Carlingford Mountain to the south-west. The lough extends across the border between Northern Ireland (County Down) and the Republic of Ireland (County Louth). In the Republic, Carlingford Lough SPA comprises two portions of the lough extending from Carlingford Harbour to Ballagan Point, with Greenore in between. The predominant habitats within the SPA are intertidal sand and mud flats.

Methodology

Information on the development and current practices of mussel and intertidal oyster cultivation activities in Carlingford Lough SPA was obtained from the aquaculture profile document compiled by Bord Iascaigh Mhara. Consultation was also undertaken with the Marine Institute.

The analyses of the likely impacts of activities covered in this assessment are based on consideration of spatial overlap between the SCI species distribution and the spatial extent of the activities. 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, although we have included assessment of potential impacts on roosting birds, where relevant.

Carlingford Lough was not counted as part of the National Parks and Wildlife Service Waterbird Survey Program (as described in NPWS, 2011). As the lough straddles the Border between the Republic of Ireland and Northern Ireland, it is covered by both the Irish Wetland Bird Survey co-ordinated by BirdWatch Ireland and the Wetland Bird Survey co-ordinated by the British Trust for Ornithology (BTO). Count zones for each are illustrated on Figure 2.1 and 2.2, respectively. Information on bird usage of Carlingford Lough was also extracted from NPWS (2013) *Carlingford Lough SPA (004078). Conservation Objectives Supporting Document* (Version 1.0) as well as from AFBI (2015) *Cumulative Impact Assessment: Aquaculture activities within and adjacent to Natura 2000 designated sites in Carlingford Lough*. The former drew heavily on work undertaken by Martin (2011); as Martin (2011) was not available to the author, we instead commissioned Breffni Martin to prepare a summary document detailing his knowledge of the use of Carlingford Lough by Light-bellied brent geese (*Branta bernicla hrota*); this was based on Breffni Martin's years of experience of surveying in Carlingford Lough and in undertaking specific survey work on Light-bellied brent geese.

The assessment was further informed by research carried out for a previous Marine Institute project: *The effects of intertidal oyster culture on the spatial distribution of waterbirds* (Gittings and O'Donoghue, 2016) as well as general observations thereafter. Additional sources of data included intertidal and subtidal biotope mapping; NPWS information on marine communities; Admiralty Charts; tidal information etc.

The methodology used to identify potentially significant impacts is focussed on the Conservation Objectives, and their attributes, that have been defined and described for the Carlingford Lough SPA. Impacts that will cause displacement of 5% or more of the total Carlingford Lough SPA population of a non-breeding SCI species are assessed as potentially having a significant negative impact.

Conservation objectives & Screening

The Special Conservation Interest (SCI) of Carlingford Lough SPA (004078) is the non-breeding population of Light-bellied Brent Goose (*Branta bernicla hrota*). In addition, wetland habitats within Carlingford Lough SPA are identified to be of conservation importance for non-breeding (wintering) migratory waterbirds.

Therefore, the wetland habitats are considered to be an additional Special Conservation Interest. The Special Conservation Interests (SCIs) of Carlingford Lough SPA (UK9020161) are the breeding populations of Sandwich Tern (*Thalasseus sandvicensis*) and Common Tern (*Sterna hirundo*), and the wintering population of Light-bellied Brent Goose.

There are also several other SPAs in the vicinity: e.g. Dundalk Bay SPA (IE004026), Killough Bay SPA (UK9020221), Stabbannan-Braganstown SPA (IE004091) and Strangford Lough SPA (UK9020111). These SPAs are also considered.

Status of species in Carlingford Lough SPA

NPWS in the *Conservation Objective Supporting Document* indicate a Long term population trend (up to 25 years) of -1% or Intermediate (Unfavourable) status for Light-bellied brent geese in Carlingford Lough SPA; due to incomplete IWeBS data this is based on the UK Wetland Bird Survey 'Alerts System' (after Cook *et al*., 2013) which considers the entire lough. However, in contrast, more recent targeted Light-bellied brent geese counts from Martin (2011) are significantly higher; they show a large increase in numbers of Light-bellied brent geese in Carlingford Lough from the baseline population of 253 (1995/96-1999/00). The maximum recorded was 687 birds in December 2010 (a count of international importance). This is more in-line with the observed national trend for Light-bellied brent geese which is positive.

Sandwich Tern is listed on Annex I of the EU Birds Directive. As a breeding species it is listed as a qualifying interest of Carlingford Lough SPA in Northern Ireland. They nest on Green Island at the mouth of the Lough; to the southeast of Greenore. The site qualifies for designation under Article 4.1 of the Birds Directive by supporting populations of European importance of a number of species listed on Annex I of the directive during the breeding season: including Sandwich Tern. The SPA supported a five year mean number of breeding pairs (1993 – 1997) of 575 pairs. This represented 1.2% of the international population and 13.1% of the Irish population of Sandwich Tern. However, breeding numbers collapsed to just 7 apparently occupied nests (AONs) in 2016 after there having been 250 AONs in 2015. Numbers increased in 2017 to 71. Despite improved breeding success at Carlingford Lough between 2011 – 2015 (due to a programme of monitoring and conservation), no checks fledged in 2017 (from Booth Jones and Wolsey, 2017).

Breeding Common Tern is also listed as a qualifying interest of Carlingford Lough SPA in Northern Ireland. They also nest on Green Island. As above, the site qualifies for designation under Article 4.1 of the Birds Directive by supporting populations of European importance of a number of species listed on Annex I of the directive during the breeding season: including Common Tern. The SPA supported a five year mean number of breeding pairs (1993 – 1997) of 339 pairs. This represented 12.6% of the Irish population of Common Tern. No chicks fledged on Green Island, Carlingford Lough in 2016, but in 2017 nine chicks were produced from 147 AONs (from Booth Jones and Wolsey, 2017).

Light-bellied brent Geese

Mussels

The area of current mussel aquaculture licences is 591.6ha; while there are applications for a further 322.96ha. This gives a total of 914.56ha of current applications. Subtidal mussel cultivation is located entirely outside of Carlingford Lough SPA. Subtidal waters deeper than 0.5m are beyond the feeding range for Light-bellied brent geese and would not be used by geese for foraging. As noted, while birds may occasionally roost on such waters during daylight hours, Light-bellied brent geese using Carlingford Lough roost overnight in Dundalk Bay. Patterns of boat activity outlined in Chapter 3.0 of this document, and presented in more detail in AFBI (2015), should not therefore negatively impact on brent geese use of the SPA.

Mussels are laid on the seabed; there are no physical structures on the shoreline or subtidally. Geese will continue to have access to the shore to feed on intertidal algae. Negative impacts on Light-bellied brent geese are not anticipated from the licencing of existing and new applications. Indeed the reef system

produced by subtidal laying of mussels can provide more robust attachment sites (than underlying muds) and in this way may provide additional feeding resources for Light-bellied brent geese during shallow water phases of the tidal cycle (i.e. <0.5m). See Plate 5.1 which shows brent geese foraging in shallow subtidal waters by upending; one bird can be seen with green algae (probably *Ulva* sp.) hanging from its bill.

In conclusion, it is not anticipated that Light-bellied brent geese would be negatively impacted by the licencing of mussel cultivation in Carlingford Lough. This includes renewal of existing licences and new applications.

Oysters

With respect to oyster cultivation there are 112.7ha previously licenced and 117.47ha of new applications (230.13ha). These are largely located within the SPA. Carlingford Lough SPA is comprised of 304ha of subtidal habitat; 285ha of intertidal habitat and 9ha of supratidal habitat (NPWS, 2013a) (i.e. 598ha). In total the Lough is ca. 51km^2 in area (5,100ha). However, based on admiralty charts and NPWS mapping of annexed habitat 1160 *large shallow inlets and bays* the amount of available intertidal / shallow subtidal waters (across the tidal range) can extend to as much as 475ha within the SPA (ca. 80% of available habitat within the SPA; see Figure 5.1). With respect to oyster cultivation the applications could result in trestle coverage of ca. 23.7% of available habitat for existing licences and ca. 24.7% for new applications; or 48.4% of available habitat within the SPA; this figure will increase on neap tides, but could decrease somewhat on spring tides.

As outlined in the methods the approach taken in the past has been to look at the relationship between area proposed for aquaculture and areas of suitable habitat within the SPA / bay. However, in the case of Carlingford Lough only a small portion of the bay is designated as an SPA, while Light-bellied brent geese are known to use extensive areas outside the SPA; along the north shore in Northern Ireland and within the SPA in UK waters. Therefore to take the above percentages as representative of the level of displacement within Carlingford Lough as a whole would be misleading as there are extensive areas of shoreline and intertidal habitat used by Light-bellied brent geese throughout the lough. Use of the wider lough was therefore also considered. Also the loss of foraging habitat due to placement of trestles may also be offset in part by these structures acting as stable sites upon which green algae can grow; though it should be noted that maintenance of oyster bags will seek to remove excess algae growth to prevent negative impacts on oysters being cultivated.

Martin (2011) recorded peak counts of 438 birds in Zone 1 (Ballagan to Greenore; March 2011) and 412 in Zone 2 (Greenore to Carlingford; Dec 2010); both sites clearly can support large numbers of brent geese even with present levels of aquaculture. It is, therefore, not anticipated that Light-bellied brent geese would be negatively impacted by the renewal of existing licencing for oyster cultivation in Carlingford Lough.

With respect to south of Greenore the existing trestles on the lower shore do appear to have moved up the shore to follow the shoreline and avoid the deeper subtidal channel. Behind the trestles is an area of shore that can be utilised by Light-bellied brent geese. However, there are also new applications south of Greenore which propose to extend further up the shore as well as extend the area of trestle cover southwards towards Ballagan. While brent geese seem to have acclimated to present patterns of aquaculture activity it is not clear whether they could continue to use the site if the area between the existing trestles and the shoreline were infilled; or if loss of foraging opportunities would be adequately offset by growth of green algae on the trestles. During the Loughs Agency 2012 survey this area south of Greenore (S2) accounted for 23% of goose observations; displacement of birds to this extent would result in a significant level of displacement if geese were displaced by proposed activities.

Terns

Tern numbers have been declining in recent years at Carlingford Lough. This pattern is at odds with the general trends for terns in Northern Ireland. The decline was attributed to wet weather, high tides, predation

by Black-headed gulls as well as disturbance, food availability, winter mortality and shifts in breeding populations outside of Carlingford Lough. Active conservation measures are currently in place at these sites.

There is no spatial overlap between the proposed aquaculture sites and the nesting sites on islands at the mouth of Carlingford Lough. Access by boat and tractor will also not result in disturbance of birds nesting on these islands. The minimum distance between aquaculture sites and nesting terns would be from sites south of Greenore and Green Island; ca. 1.3km. This increases to ca. 1.8km to Block House Island. This is well outside the buffer distance of 500m used by AFBI (2015) in their impact assessment. Published buffer distance quoted by AFBI (2015) included 100 m (Rodgers and Smith, 1997), 180 m (Rodgers and Smith, 1995) and 200 m (Erwin 1989) (see also Burger, 1998). These were used to infer that activities at an intertidal aquaculture site over 500 m from Tern nest sites are unlikely to cause significant negative impacts on this feature of the SPA (AFBI, 2015). The proposed aquaculture activities at sites south of Greenore are therefore well outside this distance.

Furthermore, both Common Tern and Sandwich Tern routinely forage close to areas of human activity; and in the case of Common Tern regularly nest on man-made structures, such as in Dublin Port; rafts on the Lagan in Belfast etc.

Disturbance to nesting terns from current proposals to cultivate oysters is not anticipated. It is not anticipated that licencing of the mussel or oyster cultivation licences would negatively impact upon tern species for which Carlingford Lough SPA (UK9020161) has been designated.

Recommendations

With respect to licencing of new applications, there are a number of areas of uncertainty. For example, the potential for increased levels of activity and infilling to negatively impact on early season use of eelgrass beds north of Greenore is unclear. In particular the risk of increased usage of access tracks could result in displacement of birds and loss of foraging time. The importance of eelgrass to birds early in the season and potential for use by birds using Carlingford Lough as a stopover before continuing to migrate to site further south is of note. Furthermore, as noted the risk that infilling with trestles towards the shoreline might displace foraging in utilising the eelgrass and / or foraging more generally cannot be fully discounted.

It is therefore recommended that a programme of monitoring of numbers and spatial distribution of Light-bellied brent geese be implemented in Carlingford Lough to consider the potential impact of new applications. As part of this the use of trestles for foraging should be investigated; looking at frequency of use; numbers feeding; timing during the tidal cycle and seasonality. The objective would be to provide a more quantitative understanding of the degree that trestles provide foraging opportunities for Light-bellied brent geese and to what degree this can compensate for habitat loss.

Incidents of disturbance should also be recorded. This should consider issues such as response to tractors using the access lanes and response to workers, as it was noted that geese at Carlingford seem to have acclimated to such activities. When workers are on site how close do brent geese forage to trestles. This would help to inform the decision on new applications and the degree to which infilling and extension towards the shore might negatively impact upon geese.

Monitoring should also look at patterns of use of eelgrass within the lough. There is an ongoing programme of colour ringing Light-bellied brent geese which would allow for the identification of individual birds. This can also assist with looking for patterns of turnover of individuals early in the season, which will in turn give a greater understanding of the numbers of birds using Carlingford Lough during autumn migration; over-winter and during spring migration.

Any such programme should be implemented in co-operation with the Loughs Agency.

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 document contains the Appropriate Assessment Report for aquaculture in Carlingford Lough SPA (site code IE004078). The aquaculture sites are within Carlingford Lough SPA and this SPA is the primary focus of this assessment. A portion of the northern shore is also designated in the UK as a SPA (UK9020161). There are also several other SPAs in the vicinity: e.g. Dundalk Bay SPA (IE004026), Killough Bay SPA (UK9020221), Stabbannan-Braganstown SPA (IE004091) and Strangford Lough SPA (UK9020111). These SPAs are also considered. The boundaries of the SPAs are shown in Figure 1.1a, 1.1b and 1.2.

1.3 Carlingford Lough is a 15km long, narrow sea inlet into which the Newry River flows. The lough is flanked by glacial mountains and moraines, with the Mourne Mountains to the north and Carlingford Mountain to the south-west. The lough extends across the border between Northern Ireland (County Down) and the Republic of Ireland (County Louth). Carlingford Lough SPA comprises two portions of the lough extending from Carlingford Harbour to Ballagan Point, with Greenore in between (Figure 1.1a). The predominant habitats within the SPA are intertidal sand and mud flats. As noted, a portion of the northern shore is designated in the UK as a SPA (UK9020161; see Figure 1.1b); this will be discussed further in Section 3.

1.4 Currently there are 34 aquaculture sites operating off the southern shore of Carlingford Lough. The inner bay is used to produce mussels, while the outer bay is used to produce oysters and mussels. Oyster production is carried out within and throughout the majority of the SPA. No fisheries are currently operational within the lough. There is a Fisheries Natura Declaration (under Regulation 9 of the European Union (Birds and Natural Habitats) (Sea-fisheries) Regulations 2013) in place overlapping with the SPA, prohibiting the production of mussels or harvest of seed stock from this area.

1.5 Carlingford Lough was not counted as part of the National Parks and Wildlife Service Waterbird Survey Program (as described in NPWS, 2011[1]). The NPWS Conservation Objective supporting document relied heavily in work undertaken by B. Martin in 2010 / 2011 (Martin, 2011). This included data from a detailed survey of Light-bellied brent geese (*Branta bernicla hrota*) numbers, distribution, and behaviour in Carlingford Lough. In order to update this assessment Atkins commissioned B. Martin to prepare a summary of his understanding of Light-bellied brent geese in Carlingford Lough.

1.6 As the lough straddles the Border between the Republic of Ireland and Northern Ireland, it is covered by both the Irish Wetland Bird Survey[2] co-ordinated by BirdWatch Ireland and the Wetland Bird Survey[3] co-ordinated by the British Trust for Ornithology (BTO). This assessment is based on consultation, a desktop review of existing information, combined with an examination of the results of the aforementioned surveys. Further counts were also undertaken by the Loughs Agency in 2012 (extracted from AFBI, 2015).

[1] NPWS (2011) *Waterbird surveys within Irish coastal Special Protection Areas. Survey methods and guidance notes.* Unpublished Report. National Parks & Wildlife Service June 2011.
[2] https://www.birdwatchireland.ie/?tabid=111
[3] https://www.bto.org/volunteer-surveys/webs

1.7 In the case of trestle cultivation of Pacific oyster it was also informed by data collected as part of a wider study of the effects of intertidal oyster cultivation on the spatial distribution of waterbirds (Gittings and O'Donoghue, 2012; Gittings and O'Donoghue, 2016a). Interpretation of licences and proposed activities was assisted by consultation with Bord Iascaigh Mhara (BIM); the Marine Institute and the Department of Agriculture, Food and the Marine.

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

1.9 The data analysis and report writing was done by Paul O'Donoghue.

1.10 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

1.11 The structure of the report is as follows: -

- Chapter 2.0 of the report describes the methodology used for the assessment.
- Chapter 3.0 reproduces the detailed Aquaculture Profile prepared by Bord Iascaigh Mhara (BIM).
- Chapter 4.0 of the report lists the Special Conservation Interests (SCIs) of the Carlingford Lough SPA and adjoining SPAs, and describes the Conservation Objectives, and their attributes and targets, that have been defined for these SCIs. This also contains a preliminary screening assessment that screens out SCIs and / or SPAs that do not show any significant spatial overlap or likely interactions with the activities being assessed.
- Chapter 5.0 of the report contains a summary of the status and distribution of the SCI species, and their habitats, in the Carlingford Lough SPA. This section only contains a summary of distribution patterns; detailed analyses of distribution patterns of individual, species are carried out, as appropriate, in the impact assessment sections of relevant activities later in the document.
- Chapter 6.0 discusses the potential impact from a) mussel cultivation and b) oyster cultivation. In each case a description of the proposed activity is presented in the Aquaculture Profile presented in Chapter 2.0. The SCI species relevant to these sites / activities are discussed, as is their association with the activity on question. Finally, an assessment of potential cumulative impacts is presented in Chapter 7.0.

Constraints to this assessment

1.12 The spatial extents of the aquaculture plots have been derived from shapefiles supplied by the Marine Institute. Detailed information on the aquaculture activities proposed was compiled by BIM through an aquaculture profiling exercise; this is reproduced in full in Chapter 2.0. Details of site specific activities were further clarified through follow-up consultation with BIM, the Marine Institute and the Department of Agriculture, Food and the Marine as appropriate.

1.13 As noted, Carlingford Lough was not counted as part of the National Parks and Wildlife Service Waterbird Survey Program (as described in NPWS, 2011).

1.14 The assessment of cumulative impacts provides a general assessment of issues such as recreational impacts, but without detailed information on other activities it is not possible to precisely quantify these potential impacts. General comments are, however, included as appropriate.

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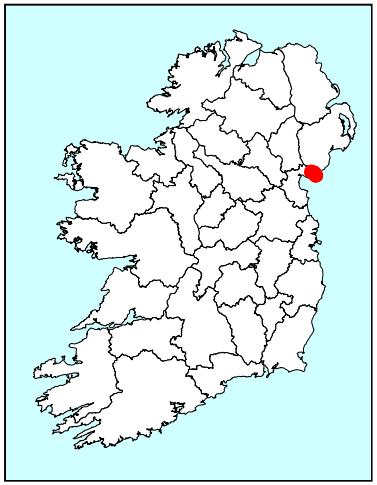
Legend

Special Protection Area (IE)

Carlingford Lough SPA



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Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018	
Drawing No: 1.1a		Rev: 0	

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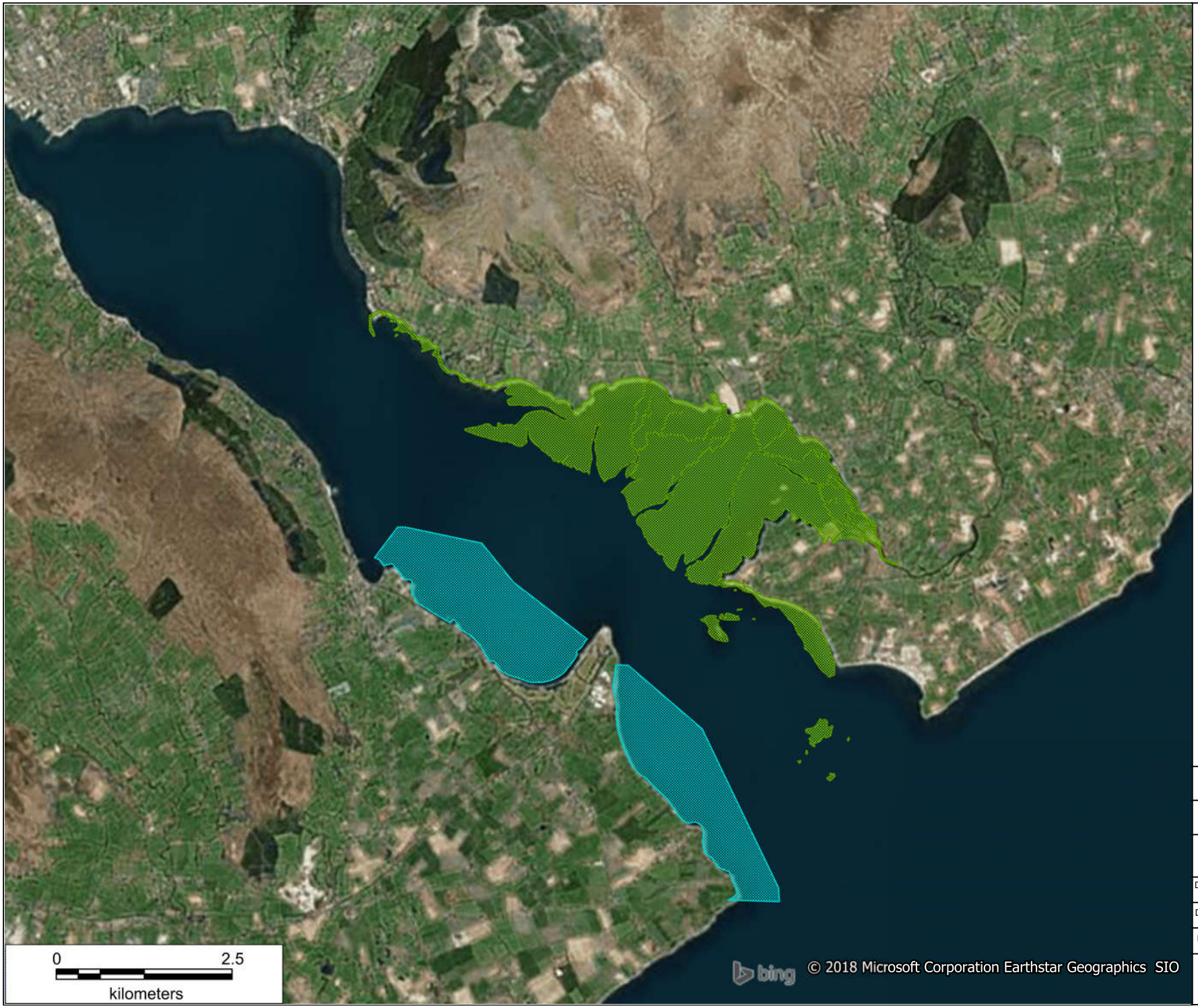

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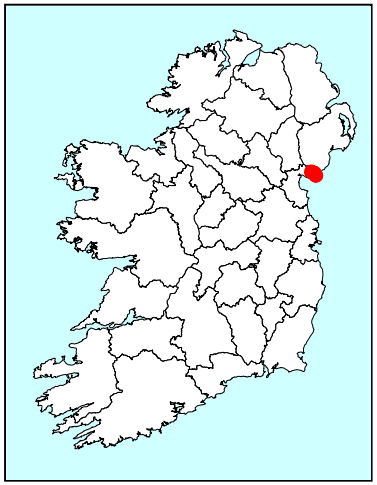
Special Protection Areas

Carlingford Lough SPA (IE004078)

Carlingford Lough SPA (UK9020161)



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Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018
Drawing No: 1.1b		Rev: 0

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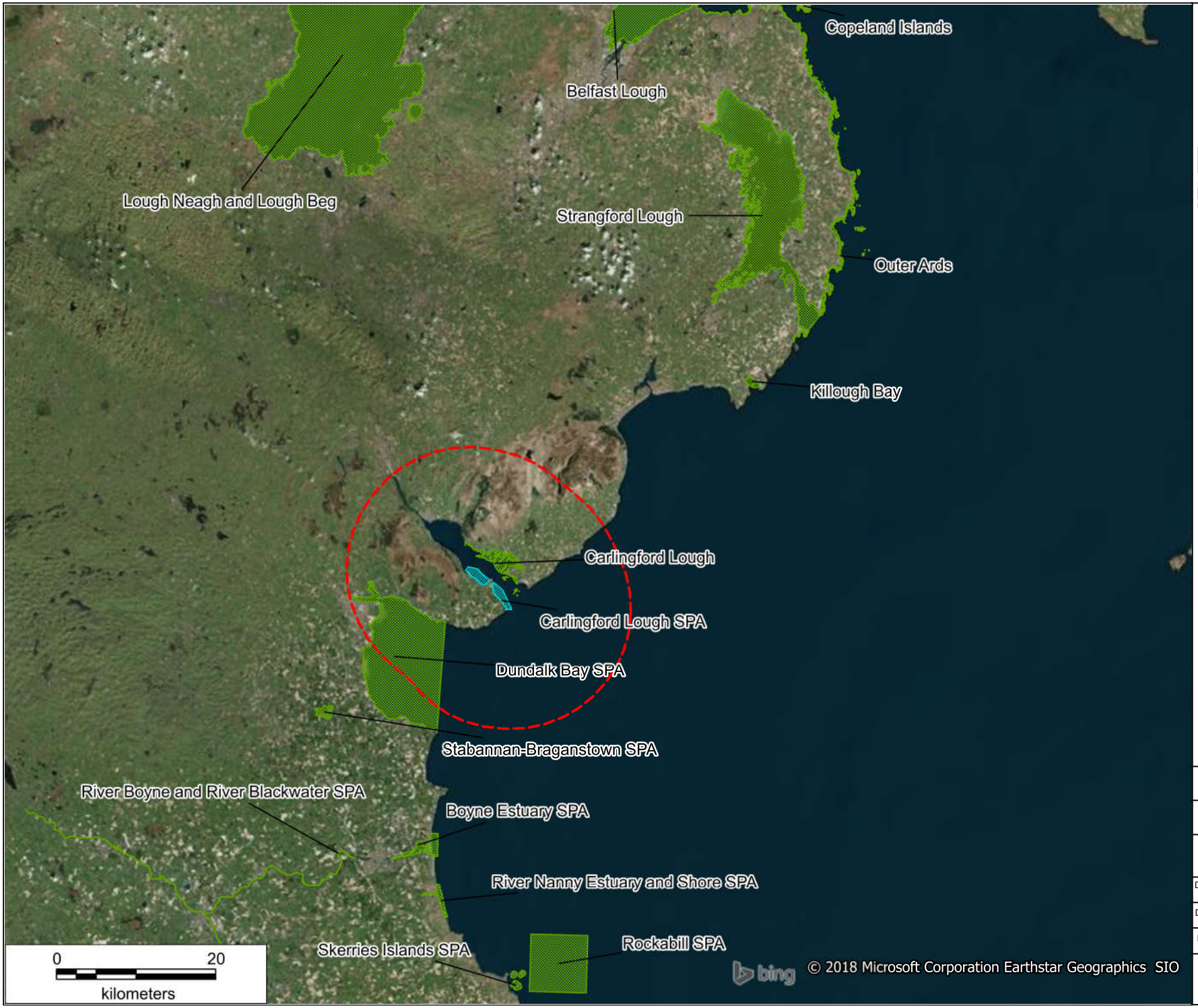

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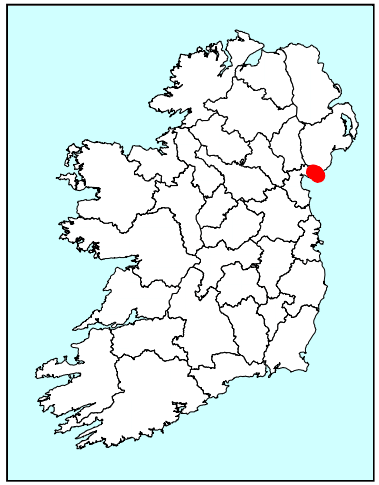
- Carlingford Lough SPA (ROI)
- 15km buffer
- Nearby Special Protection Areas



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2. Methods

Data sources

2.1 Carlingford Lough was not counted as part of the National Parks and Wildlife Service Waterbird Survey Program (as described in NPWS, 2011[4]). As the lough straddles the Border between the Republic of Ireland and Northern Ireland, it is covered by both the Irish Wetland Bird Survey[5] co-ordinated by BirdWatch Ireland and the Wetland Bird Survey[6] co-ordinated by the British Trust for Ornithology (BTO). Count zones for each are illustrated on Figure 2.1 and 2.2, respectively.

2.2 Carlingford Lough is divided into two no. IWeBS subsites; 0Z483 from Carlingford to west of Greenore and 0Z480 from east of Greenore to Ballagan Point at the southern side of the mouth of the Lough (see Figure 2.1). These do not overlap with count sites in Northern Ireland.

2.3 Carlingford Lough is divided into 10 no. WeBS subsites; these include count subsites along the southern shore of the Lough; in the Republic (see Figure 2.2). Of these count subsite 01419 overlaps with IWeBS sector 0Z483; while 01918 overlaps with IWeBS sector 0Z480.

2.4 Information on bird usage of Carlingford Lough was also extracted from NPWS (2013) *Carlingford Lough SPA (004078). Conservation Objectives Supporting Document (Version 1.0)* as well as from AFBI (2015) *Cumulative Impact Assessment: Aquaculture activities within and adjacent to Natura 2000 designated sites in Carlingford Lough* (see Figure 2.3). The former drew heavily on work undertaken by Martin (2011). As noted, the Waterbird Survey Program, undertaken by BirdWatch Ireland on behalf of NPWS, did not include Carlingford Lough. Unlike IWeBS, which focuses on high tide survey work, the Waterbird Survey Program undertook a series of low tide surveys. In the absence of such survey data, and as Martin (2011) was not available to the author, we instead commissioned Breffni Martin to prepare a summary document detailing his knowledge of the use of Carlingford Lough by Light-bellied brent geese (*Branta bernicla hrota*); this was based on Breffni Martin's years of experience of surveying in Carlingford Lough and in undertaking specific survey work on Light-bellied brent geese.

2.5 In the case of trestle cultivation of Pacific oyster the assessment was also informed by data collected as part of a wider study of the effects of intertidal oyster cultivation on the spatial distribution of waterbirds (Gittings and O'Donoghue, 2012; Gittings and O'Donoghue, 2016a). Interpretation of licences and proposed activities was assisted by consultation with Bord Iascaigh Mhara (BIM); the Marine Institute and the Department of Agriculture, Food and the Marine.

2.6 The SPA boundaries are derived from NPWS[7] and NIEA[8] shapefiles. The spatial extents of the aquaculture plots have been derived from shapefiles supplied by the Marine Institute. Licence plots for Northern Ireland were extracted from AFBI, 2015.

2.7 Information on the development and current practices of aquaculture in Carlingford Lough was obtained from the aquaculture profile document compiled by Bord Iascaigh Mhara (BIM, 2018) as well as consultation with BIM, the Marine Institute and the Department of Agriculture, Food and

[4] NPWS (2011) *Waterbird surveys within Irish coastal Special Protection Areas. Survey methods and guidance notes.* Unpublished Report. National Parks & Wildlife Service June 2011.
[5] https://www.birdwatchireland.ie/?tabid=111
[6] https://www.bto.org/volunteer-surveys/webs
[7] http://www.npws.ie/maps-and-data/designated-site-data/download-boundary-data
[8] https://www.daera-ni.gov.uk/articles/download-digital-datasets

the Marine. The aquaculture profile is included in full in Chapter 2.0 and was used to inform this Appropriate Assessment.

2.8 Carlingford Lough does not currently have a CLAMS plan (i.e. Co-ordinated Local Aquaculture Management Systems. CLAMS is a "*is a nationwide initiative to manage the development of aquaculture in bays and inshore waters throughout Ireland at a local level. In each case, the plan fully integrates aquaculture interests with relevant national policies*" (BIM, n.a.).

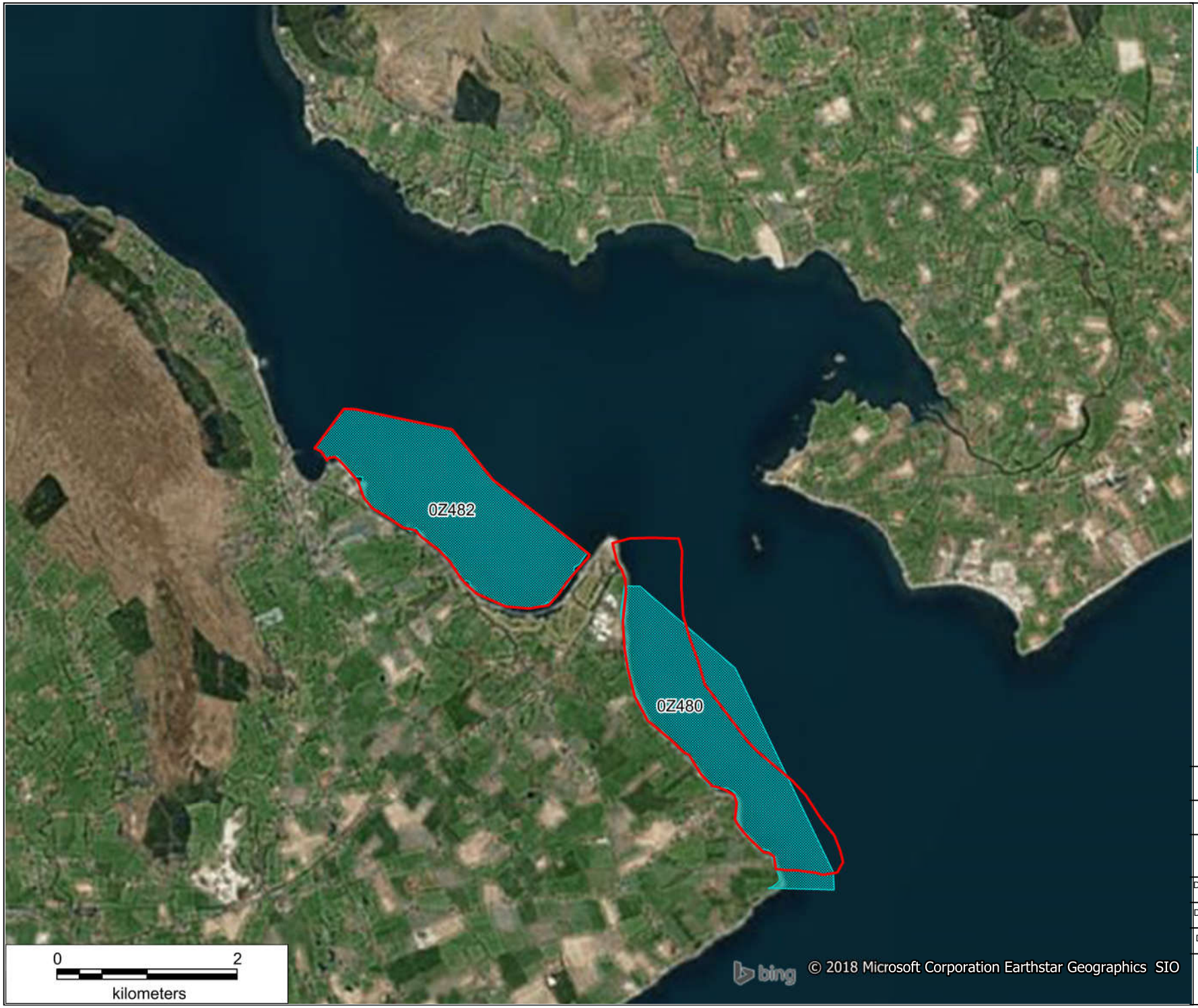
2.9 No information was available from the Marine Institute on the distribution of biotopes in Carlingford Lough SPA. Biotope GIS / mapping was downloaded from NPWS online Habitats and Species data portal (http://www.npws.ie/maps-and-data/habitat-and-species-data) and also viewed on EMODnet – The European Marine Observation and Data Network[9].

2.10 The extent of intertidal and subtidal habitats in key bays are based on Admiralty Chart data (see Figure 5.1), and represent the depth below the lowest astronomical tide; supplemented by available aerial imagery. Descriptions of habitats from within survey zones used by Martin (2011), which largely coincide with the SPA are included below.

2.11 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/).

2.12 Information on other activities (such as recreational use and shellfish gathering) was obtained primarily from the data on potentially disturbing activities recorded during the NPWS low tide counts; from AFBI, 2015; supplemented by desktop research and consultation.

[9] https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/



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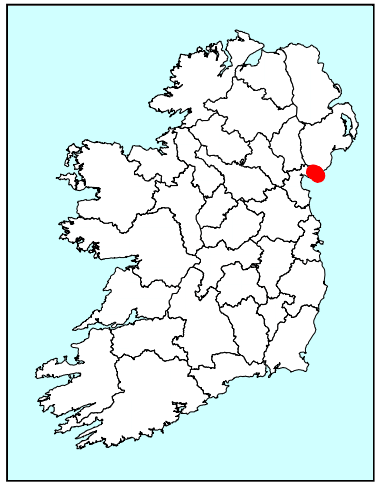
Carlingford Lough SPA (ROI)

IWeBS Subsites



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Project: Carlingford Lough SPA AA of Aquaculture			
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Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018	
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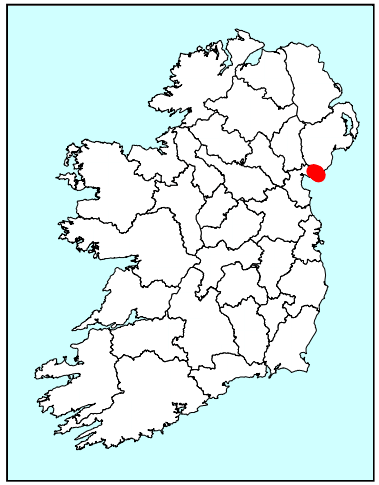
WeBS subsites



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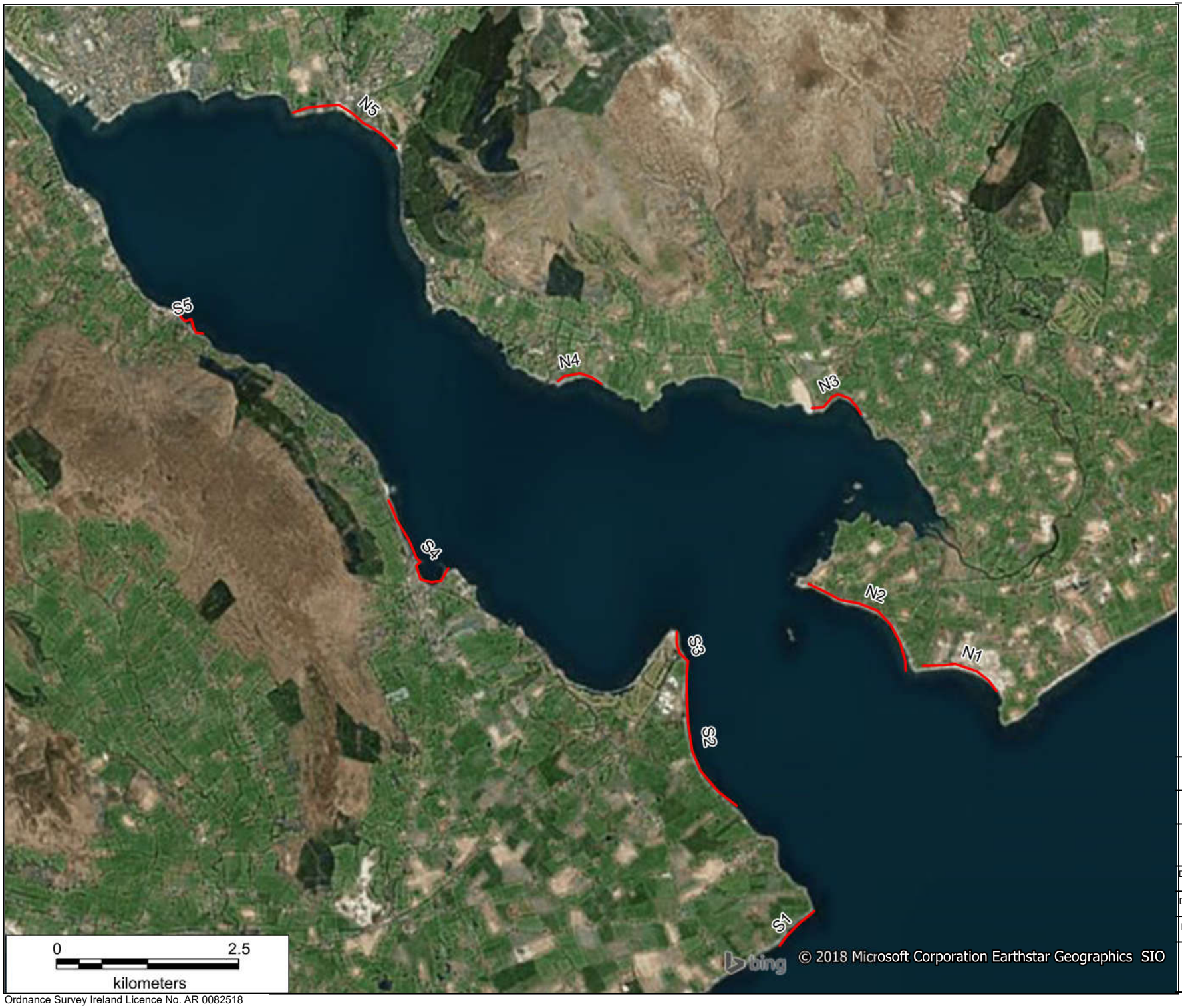

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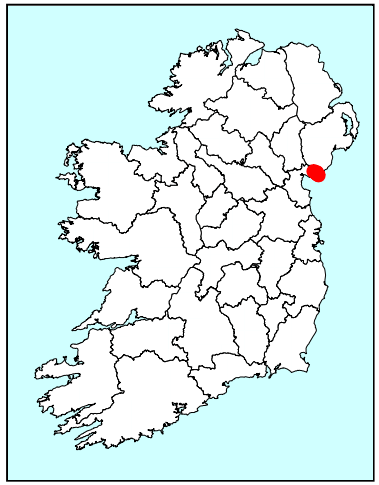
Loughs Agency survey sites 2012



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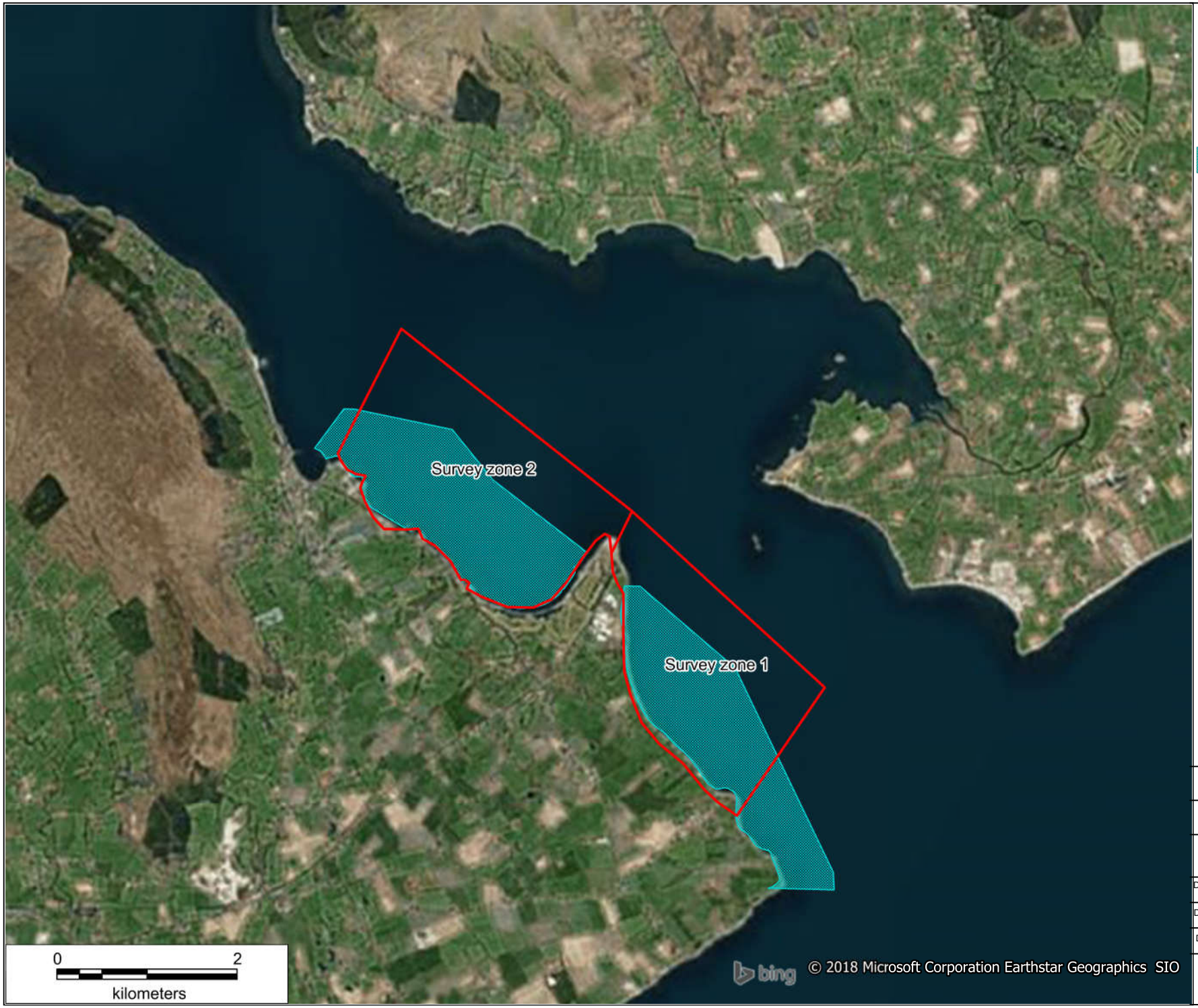

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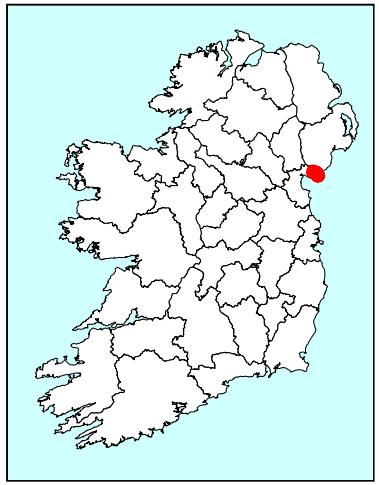
- Carlingford Lough SPA (ROI)
- NPWS Waterbird Survey 2010/11 Count Sites



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Project: Carlingford Lough SPA AA of Aquaculture		
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Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018
Drawing No: 2.4		Rev: 0

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Galway - Tel: 353 - 91 786050

Assessment Methodology

Identification of potential impacts

2.13 A literature review was carried out to assess the likely main food resources of the SCI species in the Carlingford Lough SPA. Information on the impact of the proposed aquaculture activities on intertidal and subtidal biotopes from the SAC Appropriate Assessment, and previous published research, has been used to identify potential impacts to prey resources used by the SCI species. Where available, previous research (Caldow *et al*., 2003; Gittings and O'Donoghue, 2012 / 2016a; Roycroft *et al*., 2004, 2007; Scheiffarth *et al*., 2007; van der Kam *et al*., 1999; Wehrmann, 2009) has also been used to identify the likely response (positive, neutral or negative) of the SCI species to the activities being assessed.

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

2.15 With respect to cultivation of oysters on trestles, the primary source of information used for the identification of potential impacts is the oyster trestle study (Gittings and O'Donoghue, 2012; 2016a). The results of this study were used to identify consistent patterns of positive or negative association with oyster trestles across the sites studied and categorised species into the following groups: neutral/positive association, negative association, exclusion response, and variable response (response may vary between sites). The trestle study was carried out during periods with typical levels of husbandry activity. Therefore, the effects of disturbance due to husbandry activity associated with intertidal oyster cultivation are included in the categorisation of species responses and such disturbance impacts are not analysed separately in this assessment. The trestle study focused on species associated with the intertidal and/or shallow subtidal habitats including Light-bellied Brent Goose.

Assessment of impact magnitude

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

Assessment of impact significance

2.17 The methodology used for this Appropriate Assessment is focussed on the Conservation Objectives, and their attributes, that have been defined and described for the Carlingford Lough SPA (NPWS, 2013a).

2.18 Conservation Objective 1 defines two types of attributes to assess conservation condition: long term population trends and numbers or range (distribution) of areas used. This assessment focuses on assessing potential impacts on the spatial distribution of Light-bellied Brent Goose within Carlingford Lough SPA and, in particular, whether the activities will cause displacement of a significant proportion of the Carlingford Lough SPA population from the affected area(s). If the

activities are not predicted to cause significant displacement, then the activities are not likely to affect the long term population trends. If the activities are predicted to cause significant displacement, then the activities could affect the long term population trends (but see below). In the cases where the activities are predicted to cause significant displacement, the impacts on distribution and population size are assessed separately.

2.19 The basis for the assessments are datasets that indicate the distribution of waterbird species between different broad sectors of Carlingford Bay SPA (e.g. IWeBS, WEBS, Loughs Agency data (2012) and data collected by B. Martin on 2010/11 (Martin, 2011) as well Seabird Monitoring Reports for terns). In general the approach adopted to examine the potential for negative impacts is to use datasets in order to allow calculation of the proportion of the Carlingford Lough SPA population that would be affected if aquaculture or fisheries activities cause displacement of birds from areas occupied by the activities. This approach can be considered as a very simple form of habitat association model and represents a conservative form of assessment (see Stillman and Goss-Custard, 2010): the population-level consequences of displacement will depend upon the extent to which the remaining habitat is available (i.e., whether the site is at carrying capacity). In general, this assessment method "*will be pessimistic because some of the displaced birds will be able to settle elsewhere and survive in good condition*" (Stillman and Goss-Custard, 2010).

2.20 However, as there is no spatial overlap with tern nesting sites and areas of subtidal mussel cultivation a more qualitative approach to impact assessment has been undertaken in this instance.

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

Assessment of significance

2.22 The significance of any potential impacts identified has been assessed with reference to the attributes and targets specified by NPWS (2013a) for this conservation objective. Potential negative impacts are either assessed as significant (if the assessment indicates that they will have a detectable effect on the attributes and targets) or not significant. The significance levels of potential positive impacts have not been assessed.

Attribute 1 – Long term population trends

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

2.24 If the impact is predicted to cause spatial displacement of >25% of the total Carlingford Lough SPA population of a SCI species, then the impact could, pessimistically, cause the long term population trend to show a decrease of 25% or more. Therefore, the impact would be potentially significant with reference to attribute 1 of the conservation objective.

2.25 If the long-term population trend of the species is a decrease of 25% or more, and the impact is predicted to cause spatial displacement of 5% or more (see criteria under Attribute 2), then the

impact could prevent the potential recovery of the population. Therefore, the impact would be potentially significant with reference to Attribute 1 of the conservation objective.

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

Table 2.1 – Criteria for assessing significance with reference to attribute 1 of the conservation objectives.

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

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

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

2.28 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). The minimum error level in large-scale waterbird monitoring is considered to be around 5% (Hale, 1974; Prater, 1979; Rappoldt, 1985). Therefore, any population decrease of less than 5% is unlikely to be detectable and, for the purposes of this assessment, 5% has been taken to be the threshold value below which displacement effects are not considered to be significant. This is a conservative threshold, as error levels combined with natural variation are likely to, in many cases; prevent detectability of higher levels of change. This threshold is also likely to be very conservative in relation to levels that would cause reduced survivorship (see above).

Summary

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

- Displacement of 25% or more of the Carlingford Lough SPA total; or
- Significant displacement levels (i.e., 5% or greater; see below) that combined with current long-term population trends, could result in a long-term population decline of 25%; or

- Significant displacement levels (i.e., 5% or greater; see below) where the current long-term population trends is already equal to or greater than 25%.

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

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

3. Aquaculture Profile

3.1 The following profile was prepared by Bord Iascaigh Mhara (BIM[10]) and is reproduced (with minor changes) in full here in order to inform the Appropriate Assessment.

3.2 Aquaculture sites in the Republic are illustrated in Figure 3.1; all aquaculture sites within Carlingford Lough are shown in Figure 3.2.

3.3 Figure 3.3 illustrates the location of previously licenced and new application for mussel cultivation; all areas are outside of the Carlingford Lough SPA. Figure 3.4 illustrates the location of previously licenced and new application for oyster cultivation; nearly all areas are inside of the Carlingford Lough SPA. In a number of cases an oyster licence application also highlights a secondary species which may be cultivated; these are illustrated in Figure 3.5.

Carlingford Lough Overview

General description

3.4 Carlingford Lough is a sea lough at the mouth of the Newry (or Clanrye) River on the east coast of Ireland with a total area of approximately 51 km^2. The lough borders both the Irish Republic (Co. Louth) and Northern Ireland (Co.'s Down and Armagh) and has a catchment of approximately 474 km^2. Carlingford Lough is generally shallow with depths between 2 and 5 meters, but depths within the narrow navigable channel can extend to 25 meters with a deepest point in the lough of 36 meters.

3.5 The upper reaches of the lough are shallow and dominated by fine muddy sand beds and intertidal (>14 km^2) mud-flats, while the seaward entrance to the lough is a mixture of boulder, cobble and bedrock forming numerous small islands and reefs. The tidal cycle ranges from a mean high water of 5.1m to a mean low water of 0.4m during spring tides. Maximum current speeds at the mouth of the Lough regularly exceed 0.87 ms^{-1}, with speeds in the Lough regularly exceeding 0.35m s^{-1} in the vicinity of the Rostrevor Narrows. Although tidal flow is generally weak outside the entrance, strong currents prevail within the Lough with speeds of 2.5m/s^{-1} recorded off Greenore point.

Protected Sites and Species

3.6 Both the Republic (IE) and Northern Ireland (NI) have designated multiple sites in the Lough for nature conservation and landscape amenity purposes. The Lough currently contains two SPA's (IE004078 and UK9020161), one SAC (IE002306), one Area of Special Scientific Interest (ASSI 103), one Area of Outstanding Natural Beauty (AONB) (NI), one Natural Heritage Area (NHA) (IE), one Marine Conservation Zone (MCZ) (NI) and qualifies as a RAMSAR site (NI).

3.7 With the exception of the tern nesting sites which are located in Northern Ireland, bird species in the Lough exploit waters / habitats in both the Republic and Northern Ireland. Both of the Carlingford Lough SPA's contain mud and sand dominated intertidal sedimentary flats and are designated. The SPA in Northern Ireland was initially exclusively comprised of terrestrial habitat consisting principally of inter-tidal mudflats and saltmarsh on Carlingford Lough's northern shore (Principally Mill Bay) and includes the offshore islands of Green Island and Blockhouse and

[10] BIM (2018). Aquaculture Profile. Carlingford Lough, County Louth.

associated islets in the area – this terrestrial habitat extends to some 827.12 ha[11]. The SPA in Northern Ireland was extended in 2015 to include adjacent coastal waters and in total now extends to some 11,143.10 ha. (Figure 1.1b).

3.8 The qualifying interests of Carlingford Lough SAC are Annual vegetation of drift lines [1210] Perennial vegetation of stony banks [1220]. Areas of saltmarsh along the southern shore (IE) are small and fragmented.

Aquaculture Overview

3.9 Carlingford Lough is an important area for the production of mussels (*Mytilus edulis*), cultured on the seabed and Pacific oysters (*Crassostrea gigas*), grown on bags and trestles. These are produced for both processing and fresh markets.

3.10 Due to the location of the navigational channel roughly in the middle of Carlingford Lough, an agreement has allowed for aquaculture licensing by DAERA[12] on the Northern Ireland side of the channel and by DAFM[13] on the Republic side. While there are a large number of aquaculture licences held by different individuals in the Lough, recent times have seen a natural rationalisation of the sector. In the Republic today the sector consists largely of four bottom mussel groupings (all of whom also work in Northern Ireland) and three larger oyster farmers. A number of smaller operators also farm both species.

3.11 Bottom mussel culture sites towards the mouth of the Lough (southeast of Carlingford Village) are less intensively utilised. Producers report that all oyster sites are currently utilised, however, this is subject to validation.

3.12 Production and employment stats for the Lough are presented in Table 3.1 and 3.2 below.

[11] http://jncc.defra.gov.uk/page-2076-theme=default.
[12] Department of Agriculture, Environment and Rural Affairs.
[13] Department of Agriculture, Food and Marine.

Table 3.1 – Bottom Grown Mussel production statistics (Republic).

Year	Jobs	Tonnage	Value
2017	35	2505	€3,443,700.00
2016	31	1855	€1,819,400.00
2015	35	1453	€1,781,500.00
2014	37	313	€722,850.00
2013	46	2155	€5,400,000.00
2012	39	2320	€2,157,000.00
2011	39	1784	€1,411,400.00
2010	32	3300	€1,897,000.00
2009	45	4796	€3,819,300.00
2008	38	4004.5	€7,840,600.00

Table 3.2 –Oyster production statistics (Republic).

Year	Jobs	Tonnage	Value
2017	52	482	€1,865,000.00
2016	49	455	€1,763,000.00
2015	35	378	€957,000.00
2014	27	420	€1,209,000.00
2013	32	438	€1,348,400.00
2012	28	360	€1,077,000.00
2011	19	358	€1,013,000.00
2010	20	420	€1,084,024.00
2009	22	405	€909,024.00
2008	20	290	€591,000.00

Mussel Farming

Overview

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

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

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

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

Husbandry activity

Overview

3.17 Seed mussel is fished from the sub-tidal seed areas in Republic, Northern Ireland and United Kingdom waters (the latter only to Northern Ireland sites) and transferred to licensed sub-tidal sites in Carlingford for ongrowing until harvest. Ongrowing duration generally varies between 12-36 months depending on the growth rates and the size of the initial seed input. During ongrowing there are a range of husbandry activities undertaken in the Lough such as predator control and transfer of mussel stocks between licensed sites, these practices are necessary to maximise the ultimate return ratio.

Seed fishing

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

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

3.20 The SMAC assessed all applications by applying the criteria outlined below: -

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

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

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

3.22 The capacity of the relay area in the allocation system (30-40T rule) effectively caps the stocking density which is a measure of the quantity of mussels occupying a known area of ground (both the size and number of mussels are important). Correct stocking densities are critical to the eventual production of a quality product. Too high a stocking density will result in a variable sized crop with poor meat condition particularly from the centre of the farm. Too low a stocking density and the full potential of the area is not realized causing an increase in the cost of production. Higher stocking densities are generally preferred for bottom culture of mussels, with local variations between sites. The capping of the stocking density at 30-40T hectare is precautionary in the context of international standards[14].

3.23 Total seed allocations for Carlingford Lough – Republic and Northern Ireland is approximately 6,000t however this is subject to seed availability and this level has not been reached in the last number of years, the average seed input to the lough from 2010-2016 is approximately 2,200t with a maximum of 4,468t in 2010 (Please note that all figures are net tonnages).

[14] http://www.thefishsite.com/articles/894/#sthash.A51IFQDI.dpuf

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

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

3.26 In Carlingford relaying is generally at a density of 20-40t per hectare depending on seed size. Return rates of 1:1 are expected and the final product is harvested to order by vessels, from the licensed sites. Seed size generally varies from 1,000-2,000 pieces per kilo.

Grow out

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

3.28 Predator control mainly focuses on the control of starfish and green crab. Stars are generally fished with the standard dredge or via "*mops*" (see Plate 2.1 below) and pots are deployed by operators to control green crab.

Plate 2.1 Starfish mop.

Harvesting

3.29 All harvesting and sales activity is monitored by a variety of mechanisms; registration documents, VMS plotting, and annual returns.

3.30 No waste is generated as the harvested product is placed directly into one tonne bags for export, via refrigerated truck from Warrenpoint Harbour.

3.31 Seasonal, daily and tidal profile of activities undertaken by a standard mussel vessel in Carlingford Lough is summarised in Table 2.3.

Bycatch

3.32 As part of the Marine Stewardship Council certification BIM and industry members have adopted a bycatch monitoring scheme in Carlingford Lough. Surveys in 2016 and 2017 detected no bycatch species exceeding 5% of the catch. Species detected are associated with shell fouling and those that predate on mussels – green crab and starfish.

3.33 No '*Endangered, Threatened or Protected*' (ETP) species were detected in the samples collected on the harvest beds in Carlingford Lough.

IAS Species

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

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

Access

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

Activity levels

Overview

3.37 The activity levels for a standard vessel is provided in Table 3.3 below.

- The activity level for a standard mussel vessel is approximately 220 days per year.
- Days of activity are not all within Carlingford Lough as vessels are typically involved in about 40 days seed fishing, transiting, maintenance and surveying per year.
- Subtracting activity outside the Lough provides 180 days activity per vessel per year.
- Maximum time vessels would spend on site is 6 hours per day.
- Maximum activity per vessel is 1,080 hrs per year
- Note that as the operators in Carlingford are on a broadly similar production cycle, it is inappropriate to multiply 1,080hrs per year by 5 vessels as there will be significant overlap in times of activity.

3.38 Figure 2.13 of the Cumulative Impact Assessment: Carlingford Lough (AFBI, 2015) presents a series of maps illustrating annual vessel activity within licenced subtidal aquaculture areas in Carlingford Lough in each year between 2010 – 2014 (produced from black box data supplied to the authors by DARD). We understand that the activity level has been similar since; and is confined to the sites west of where the oyster culture is located (Marine Institute pers comm.).

Activity monitoring

3.39 The following data sources are available to track the activity of the Bottom Mussel Operators; custodians of the data are also listed.

Seed Fishing

- Log Books — Sea Fisheries Protection Authority (SFPA)
- VMS — SFPA (larger vessels only)
- Black Box — SFPA, BIM, the Loughs Agency[15] and DAERA subject to data protection requirements.
- Load Inspections — SFPA
- Health Certs — Marine Institute

Husbandry practices

- Farm Diaries — Farm Operators
- VMS — SFPA (larger vessels only)
- Black Box — SFPA, BIM, the Loughs Agency and DAERA subject to data protection requirements

Dispatch

- Health Certs (if stock is to be relayed or going for further processing) — Marine Institute
- Gatherers Documents (If stock is going to directly to market) — SFPA
- Annual Returns - — BIM

[15] http://www.loughs-agency.org/

Table 3.3 - Seasonal, daily and tidal profile of activities undertaken by a standard mussel vessel in Carlingford Lough.

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

X = Activity, H = High Activity, L = Low activity.

Oyster Farming

Overview

3.40 Oyster farming within Carlingford Lough is a form of intensive culture which has been taking place since the early 1970's. Cultivation of the Pacific oyster (*Crassostrea gigas*) is carried out by growing oysters in bags placed on a variety of trestle designs. The trestle type used in the Lough varies depending on location. The most common trestle type typically measure 3m x 1m and stand 0.4 – 1.2m in height, holding 6 bags each. Bags are made of a plastic (HDPE) mesh and are fastened to trestles using rubber straps and hooks. Bags vary in mesh size depending on oyster stock grade (6mm, 9mm, and 14mm).

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

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

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

Husbandry Activities

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

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

3.46 Mixed stocks of Diploid and Triploid oysters are grown in Carlingford Lough and no settlement and recruitment of these oysters to the wild has ever been reported from the Lough. The operators are happy with the success of growing mixed stocks and wish to continue with this practice into the future. This is particularly important given the consumer perception of genetic manipulation, which may become an issue for Triploid sales in the future.

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

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

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

Activity Levels

3.50 The intertidal area is typically accessed during mean and spring tides. Preparatory work is always conducted in the packing areas (outside the protected areas) in the intervening periods, including grading and packing, depuration, preparation of bags and trestles and general maintenance. Sites are accessed by tractor and trailer. Each operator observes one or 2 dedicated access routes to the sites (see Figure 2.1 & 2.2).

3.51 Oysters are thinned out and graded as the oysters grow. Through the ongrowing period, they are taken to the handling / sorting facility twice per year for grading and re-packing, and subsequently returned to the trestles. In the final stage they will be 'hardened' and stored in the upper intertidal area, before being removed, graded, depurated (if required), packed and shipped for distribution.

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

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

3.54 Maintenance activities on-site include shaking and turning of bags, removal of fouling and seaweed by hand, and movement of stocks as necessary. Between all the operators a maximum of 10 tractors (2 at Ballagan, 8 in inner Carlingford) are used to access the sites from four main access points (see Figure 2.1 & 2.2). Three operators have land based facilities directly on the shore at the access point. A fourth currently uses a nearby land base approximately 200m from the shore. As mentioned previously, some of the growers employ the use of a dedicated holding area on the upper shore close to the land base for finishing stock and to allow for ready access for grading or final harvesting during slack tides. Oysters are kept in the holding area for periods of up to 6 weeks. This system minimised the amount of time spent on the remaining sites.

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

Access Routes

3.56 Access Routes have been established over many years and occur in areas where the ground is suitable to support the weight of a tractor and trailer (see Figure 2.1 & 2.2).

Winter Harvesting sites

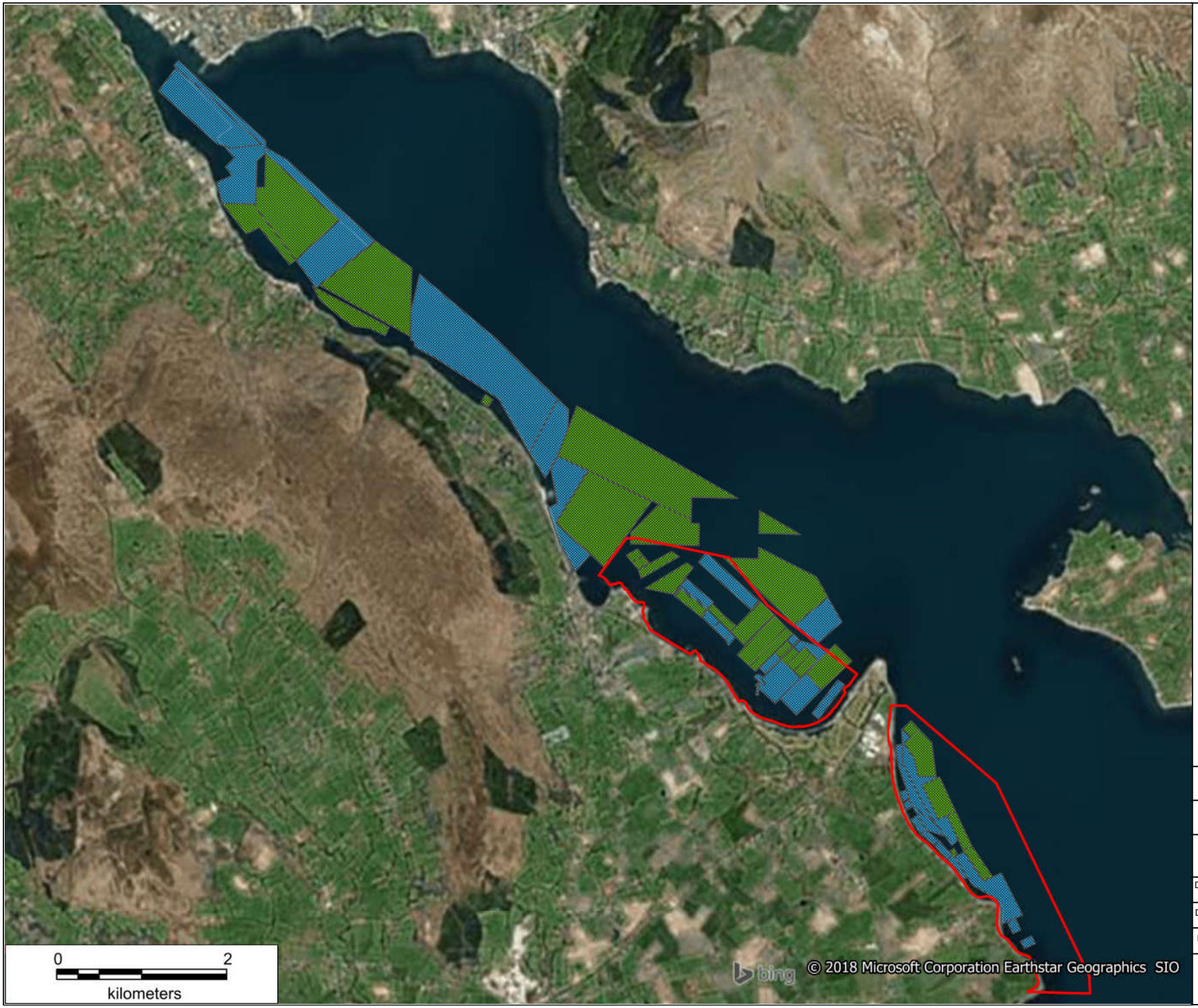
3.57 A number of applications have been submitted for winter harvesting sites - T1/102, T1/100, T01/104A, T01/101, T01/96A, T01/96B and T01/124 (see Figure 3.6). These sites are key to the production units in inner Carlingford due to the presence of norovirus in inner Carlingford over the winter months. Without access to winter harvesting sites the producers in inner Carlingford would be unable to provide product to their customers over the winter months which would make all their businesses unviable.

Legacy Issues

3.58 Licences were initially applied for and granted based on sight lines and old OSI maps in the 1970's, since then these coordinates have been transformed through a number of coordinate systems and renewals.

3.59 When the farms were subsequently subject to modern GPS surveys certain licences were identified as effectively being in the wrong place. In the case of the mussel licences anomalies were identified in the main co-op site at the time of last renewal (2004). In the case of the oyster sites at Ballagan a serious anomaly was identified in 2007 and realignment was agreed with MED and submitted for approval.

3.60 There remains a clear issue with the Ballagan Licences in that the majority of licences as mapped, are currently subtidal, indeed less than 5 Ha of the farm are in depth of water that can be farmed. Addressing this issue is not an attempt by the operator to gain additional production areas but rather to align the maps with the historic location of his farm. However, the scope of this assessment is to assess the licences as provided by DAFM to the Marine Institute.



N

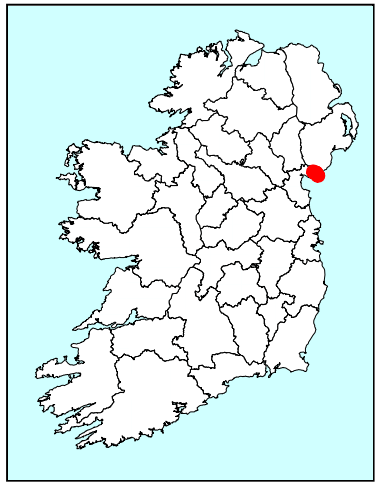
Legend

Carlingford Lough SPA

Aquaculture plot status

Previously licensed

New Application



Client:	Marine Institute
Project:	Carlingford Lough SPA AA of Aquaculture
Title:	Aquaculture sites (existing and applications) within Carlingford Lough

Drawn: EN	Checked: PO'D	Authorised: PO'D
Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018
Drawing No: 3.1		Rev: 0

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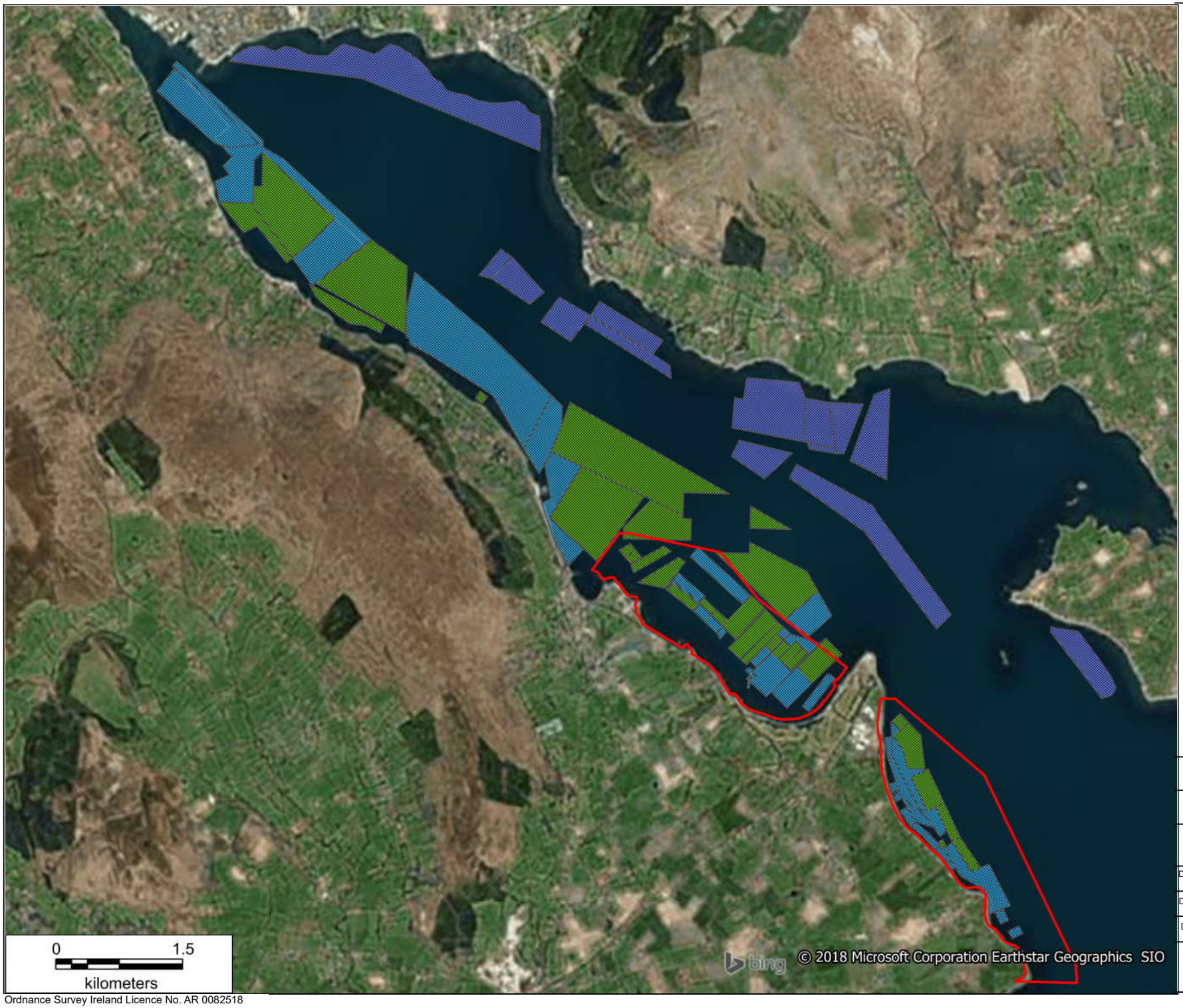
Cork - Tel: 353 - 21 - 429 0300
Galway - Tel: 353 - 91 786050



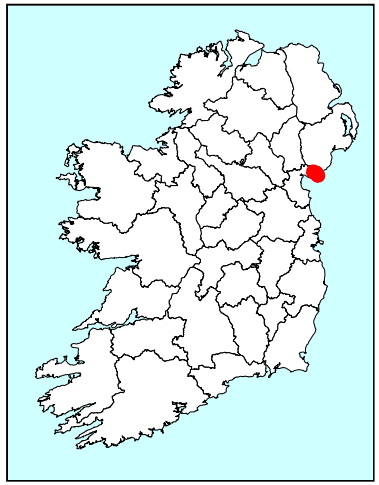
N

Legend

- Carlingford Lough SPA
- Indicative NI aquaculture plots

ROI aquaculture plot status

- Previously Licensed
- New Application



Client: Marine Institute

Project: Carlingford Lough SPA AA of Aquaculture

Title: All aquaculture activity within Carlingford Lough.

Drawn: EN	Checked: PO'D	Authorised: PO'D
Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018
Drawing No: 3.2		Rev: 0

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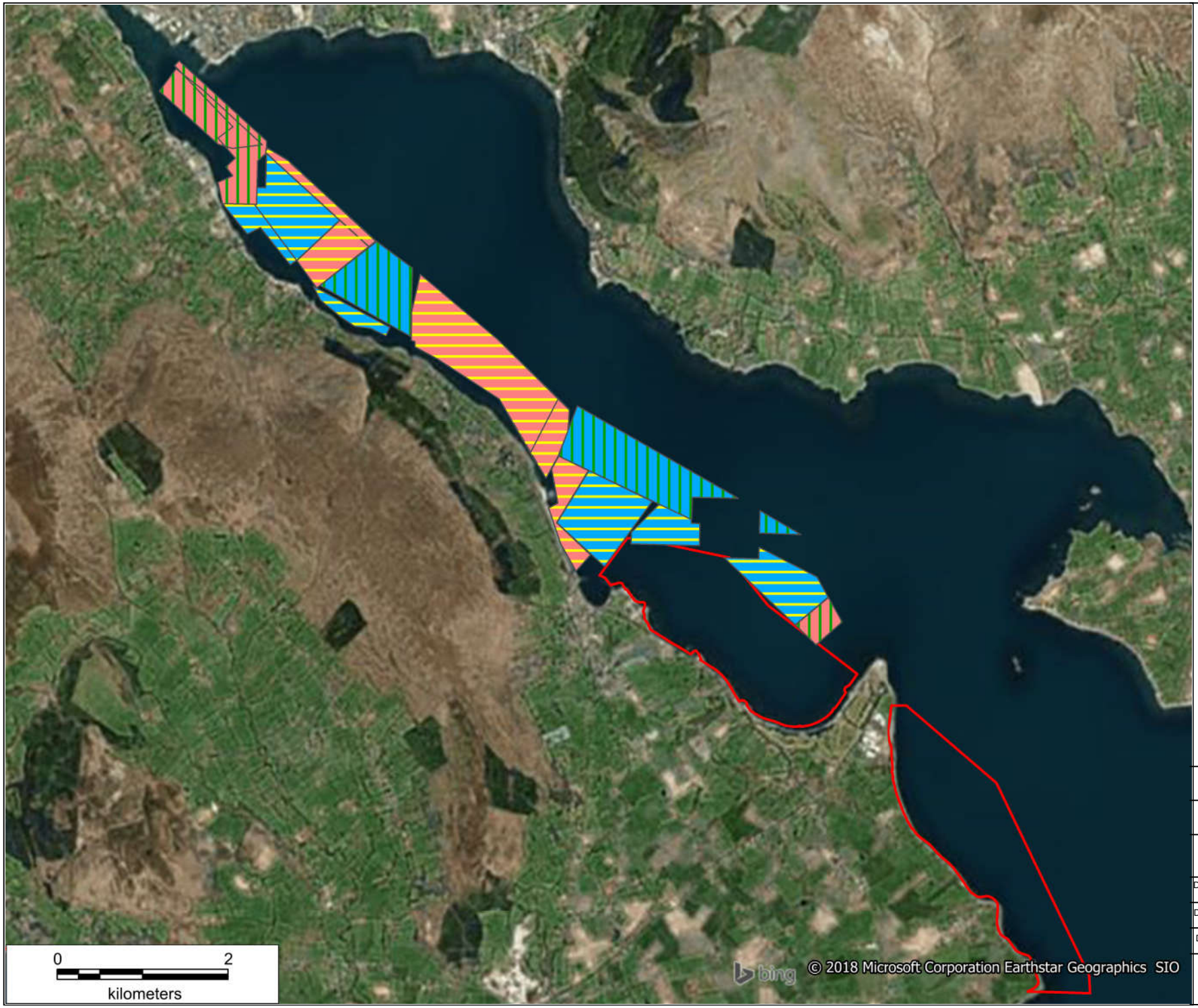


N

Legend

Carlingford Lough SPA

Mussel Production

Licence Type

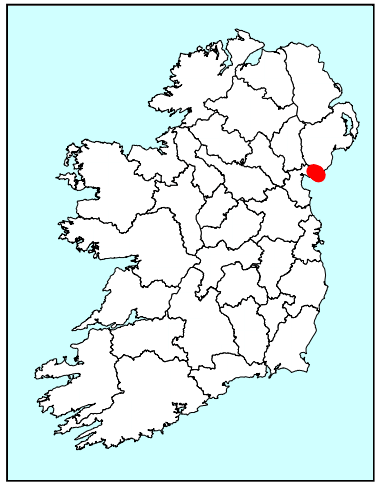
New Application

Previously Licensed

Culture Type

Extensive

Intensive



Client: Marine Institute		
Project: Carlingford Lough SPA AA of Aquaculture		
Title: Mussel production areas within Carlingford Lough.		
Drawn: EN	Checked: PO'D	Authorised: PO'D
Date: 18/12/2018	Date: 18/12/2018	Date: 18/12/2018
Drawing No: 3.3		Rev: 0

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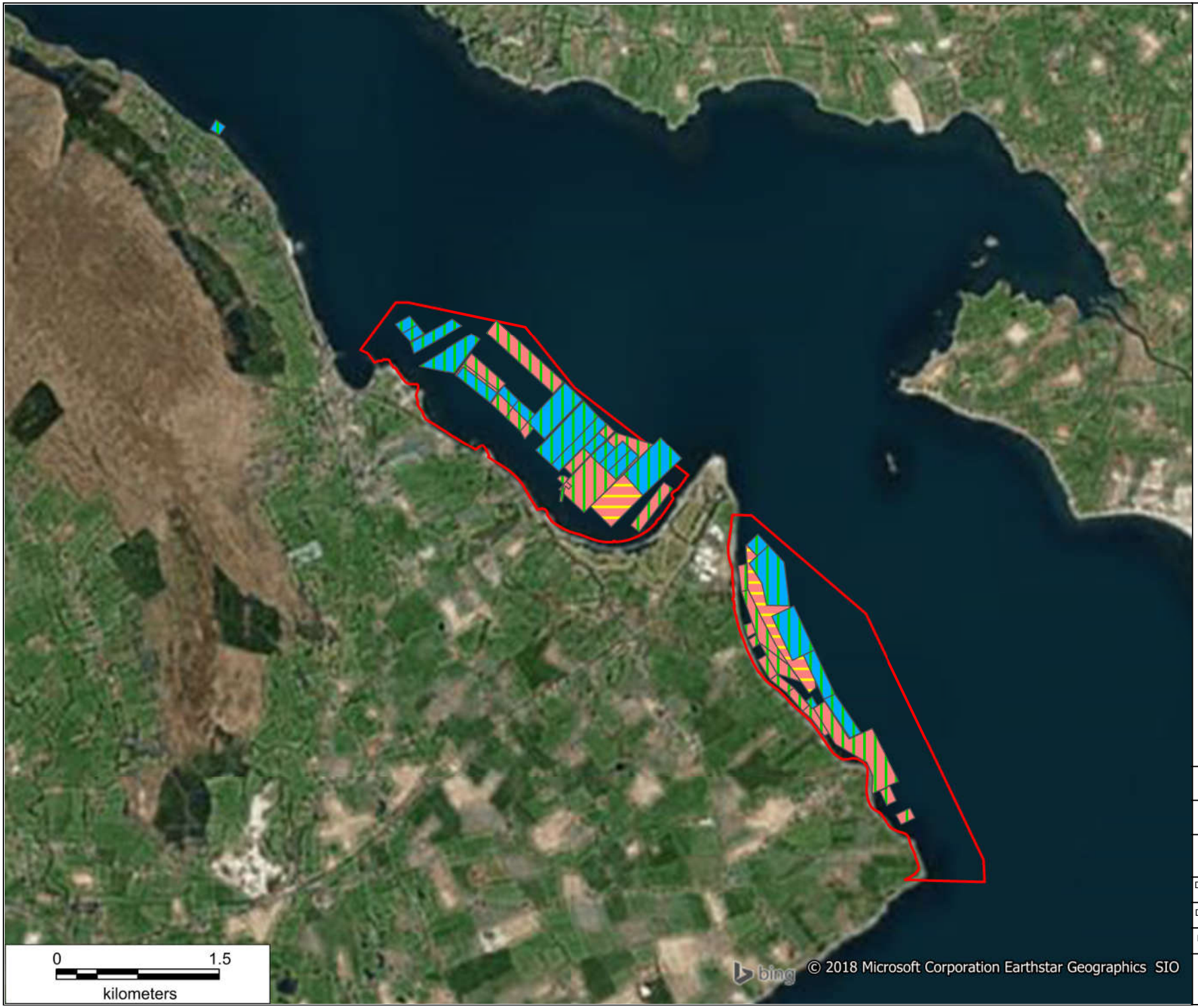


N

Legend

Carlingford Lough SPA

Oyster Produciton

Licence Type

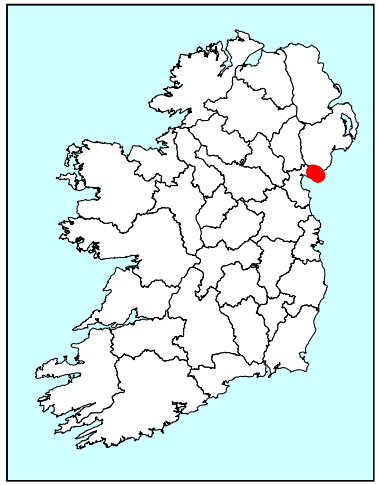
New Application

Previously Licensed

Culture Type

Extensive

Intensive



Client: Marine Institute		
Project: Carlingford Lough SPA AA of Aquaculture		
Title: Oyster production licences within Carlingford Lough		
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Date: 18/12/2018	Date: 18/12/2018	Date: 18/12/2018
Drawing No: 3.4		Rev: 0

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Cork - Tel: 353 - 21 - 429 0300
Galway - Tel: 353 - 91 786050

N

Legend

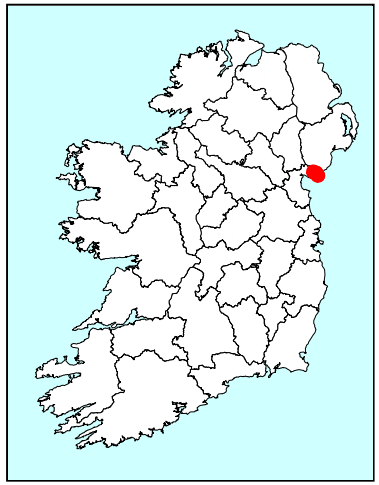
Carlingford Lough SPA

Oyster Production
Species Composition

Oysters

Oysters with Clams

Oysters with Mussels



Client:	Marine Institute
Project:	Carlingford Lough SPA AA of Aquaculture
Title:	Oyster production (species composition) within Carlingford Lough

Drawn: EN	Checked: PO'D	Authorised: PO'D
Date: 18/12/2018	Date: 18/12/2018	Date: 18/12/2018
Drawing No: 3.5		Rev: 0

ATKINS
Dublin - Tel: 353 - 1 - 890 9000
Cork - Tel: 353 - 21 - 429 0300
Galway - Tel: 353 - 91 786050

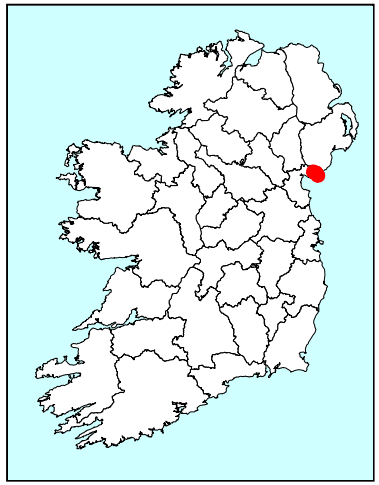
N

Legend

- Carlingford Lough SPA
- *Zostera noltii*
- Intertidal zone

Proposed Winter Harvesting Activity
Species composition

- Oysters
- Oysters with Mussels



Client:	Marine Institute
Project:	Carlingford Lough SPA AA of Aquaculture
Title:	Proposed winter harvesting activity within Carlingford Lough

Drawn:	Checked:	Authorised:
EN	PO'D	PO'D
Date: 18/12/2018	Date: 18/12/2018	Date: 18/12/2018

Drawing No: 3.6 Rev: 0

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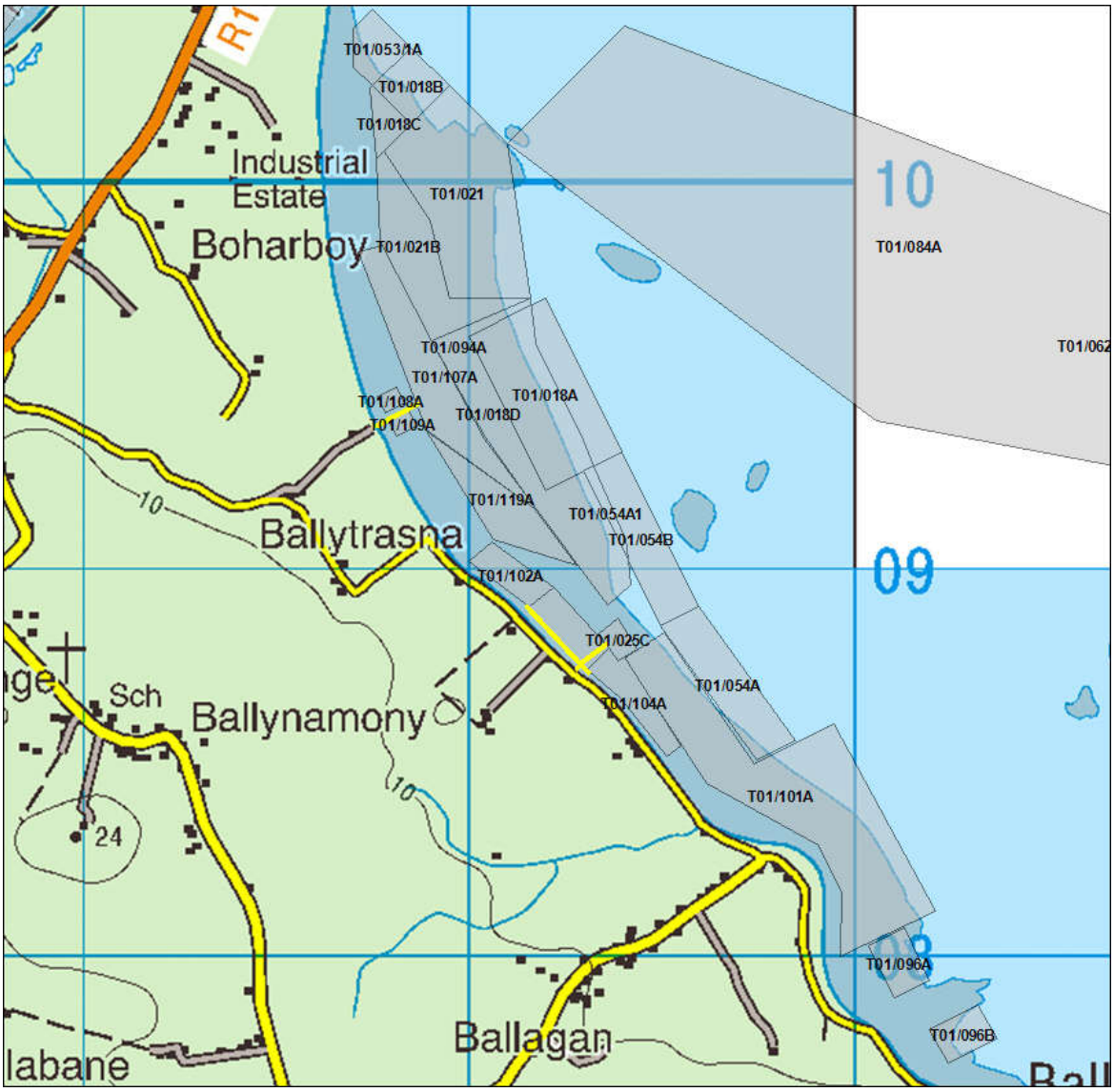


Figure 3.7 Access Routes Ballagan (in yellow) (from BIM Aquaculture Profile).

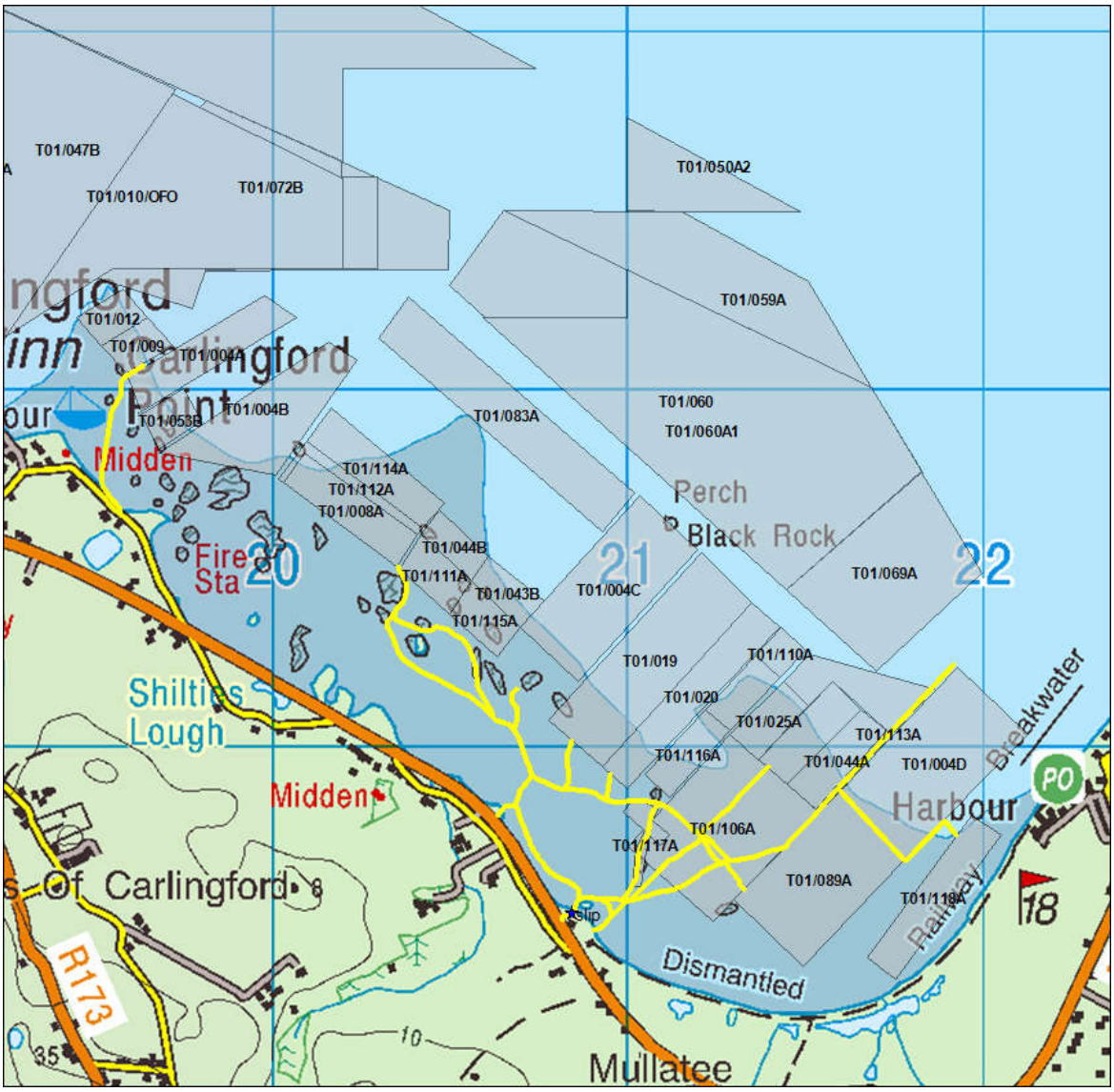


Figure 3.8 Access Routes Inner Carlingford (in yellow) (from BIM Aquaculture Profile).

4. Conservation objectives

Carlingford Lough SPA (004078)

Qualifying features

4.1 The Special Conservation Interest (SCI) of Carlingford Lough SPA (004078) is the non-breeding population of Light-bellied Brent Goose.

4.2 In addition, wetland habitats within Carlingford Lough SPA are identified to be of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore, the wetland habitats are considered to be an additional Special Conservation Interest (NPWS, 2013a, b).

Conservation objectives

SCI species

4.3 The conservation objectives for the non-breeding population of Light-bellied Brent Goose at Carlingford Lough SPA are to maintain its favourable conservation status (NPWS, 2013a, b).

4.4 The favourable conservation conditions of this species at Carlingford Lough 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 Light-bellied Brent Goose at Carlingford Lough SPA.

Attribute	Measure	Target	Notes
1 Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the Conservation Objectives Supporting Document
2 Distribution	Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing and intensity of use of areas used by the '*SCI species*', other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/11 waterbird survey programme is discussed in Part Five of the conservation objectives supporting document

Source: NPWS (2013a). Attributes are not numbered in NPWS (2013a), but are numbered here for convenience

Wetlands and waterbirds

4.5 The conservation objective for wetlands and waterbirds at Carlingford Lough SPA is to "*maintain the favourable conservation condition of the wetland habitat in Carlingford Lough SPA as a resource for the regularly occurring migratory waterbirds that utilise it"* (NPWS, 2013a).

4.6 The favourable conservation condition of the wetland habitat at Carlingford Lough SPA is defined by a single attribute and target, which is shown in Table 4.2.

Table 4.2 – Attribute and target for the conservation objective for wetlands and waterbirds at Carlingford Lough SPA.

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 595 hectares, other than that occurring from natural patterns of variation	The wetland habitat area was estimated as 595ha using OSi data and relevant orthophotographs. For further information see part three of the conservation objectives supporting document

Source: NPWS (2013a)

4.7 Carlingford Lough is also designated as an Important Bird Area in Ireland - Carlingford Lough IBA (Site Code: IE122); listed for Light-bellied brent geese and Scaup (*Aytha marila*). In 1996, 640 Scaup were recorded at Carlingford Lough. This is not a qualifying interest of the SPA. From 1996-2000 the average count of Scaup at Carlingford Lough was 635 making it the third most important site for this species. Scaup is not recorded from Carlingford Lough in NPWS, 2013a. Carlingford Lough is not a Ramsar site in the Republic.

Screening Decision

4.8 The potential for negative impacts on Light-bellied Brent Goose cannot be discounted at this time. Light-bellied Brent Goose is not screened out and is considered further below.

Other sites

Carlingford Lough SPA (UK9020161)

Qualifying features

4.9 The Special Conservation Interests (SCIs) of Carlingford Lough SPA (UK9020161) are the breeding populations of Sandwich Tern and Common Tern, and the wintering population of Light-bellied Brent Goose (DAERA, 2015a[16]).

Conservation objectives

SCI species

4.10 The conservation objective for the site is to maintain favourable conservation status of all features (DAERA, 2015a).

4.11 The favourable conservation conditions of this species at Carlingford Lough SPA are defined by various attributes and targets, which are shown in Table 4.3.

[16] https://www.daera-ni.gov.uk/sites/default/files/publications/doe/carlingford-lough-SPA-conservation-objectives-2015.pdf

Table 4.3 – Attributes and targets for the conservation objectives for Sandwich Tern, Common Tern and Light-bellied Brent Goose at Carlingford Lough SPA.

SCI	Target
Sandwich Tern	To maintain or enhance the population of the qualifying species
Sandwich Tern	Fledging success sufficient to maintain or enhance population
Common Tern	To maintain or enhance the population of the qualifying species
Common Tern	Fledging success sufficient to maintain or enhance population
Light-bellied Brent Goose	To maintain or enhance the population of the qualifying species
Habitat Extent	To maintain or enhance the area of natural and semi-natural habitats used or potentially usable by SCI bird species (780 ha intertidal area), (breeding area 0.62ha) subject to natural processes
Habitat Extent	Maintain the extent of main habitat components subject to natural processes
Roost Sites	Maintain or enhance sites utilised as roosts

Source: DAERA (2015a).

4.12 Carlingford Lough Ramsar Site (Site Code: UK12004). The Carlingford Lough Ramsar Site qualifies for designation under Criterion 2 and 6 of the Ramsar Convention:

- Criterion 2 - By supporting an important assemblage of vulnerable and endangered Irish Red Data Book bird species. The site supports nationally important breeding populations of common tern. In the recent past the site also supported nationally important numbers of Arctic Tern. Roseate Terns have also previously bred, with 2 breeding pairs recorded in 1997.

- Criterion 6 - By supporting species/populations occurring at levels of international importance including Sandwich Tern during the breeding season [650 apparently occupied nests, representing an average of 0.7% of the breeding population], and Pale-bellied Brent Goose during the winter [300 individuals representing an average of 1.5% of the population, five year peak mean 1998/9-2002/3].

4.13 Carlingford Lough is also designated as an Important Bird Area in Northern Ireland -Carlingford Lough IBA (Site Code: UK274).

Screening Decision

4.14 The potential for negative impacts on Light-bellied Brent Goose and Sandwich Tern cannot be discounted at this time. Light-bellied Brent Goose and Sandwich Tern are not screened out and is considered further below.

Dundalk Bay SPA (004026)

Qualifying features

4.15 The Special Conservation Interests (SCIs) of Dundalk Bay SPA (004026) are the wintering populations of Great Crested Grebe, Greylag Goose, Light-bellied Brent Goose, Shelduck, Teal, Mallard, Pintail, Common Scoter, Red-breasted Merganser, Oystercatcher, Ringed Plover, Golden

Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Black-headed Gull, Common Gull and Herring Gull (NPWS, 2011a[17], 2011b[18]).

Conservation objectives

SCI species

4.16 The conservation objectives for the non-breeding populations of Great Crested Grebe, Greylag Goose, Light-bellied Brent Goose, Shelduck, Teal, Mallard, Pintail, Common Scoter, Red-breasted Merganser, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Black-headed Gull, Common Gull and Herring Gull are to maintain their favourable conservation status (NPWS, 2011a, 2011b).

4.17 The favourable conservation conditions of this species at Dundalk Bay SPA are defined by various attributes and targets, which are shown in Table 3.4.

Table 4.4 – Attributes and targets for the conservation objectives for SCI bird species at Dundalk Bay SPA.

Attribute	Measure	Target	Notes
1 Population trend	Percentage change	Long term population trend stable or increasing	Population trend assessment (Generalised Additive Modelling (GAM)) was undertaken using waterbird count data collected through the Irish Wetland Bird Survey and other surveys. See the SPA conservation objectives supporting document for further details
2 Distribution	Number and range of areas used by waterbirds	There should be no significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2009/2010 waterbird survey programme is discussed in Section 5 of the SPA conservation objectives supporting document

Source: NPWS (2011a). Attributes are not numbered in NPWS (2011a), but are numbered here for convenience

Wetlands and waterbirds

4.18 The conservation objective for wetlands and waterbirds at Dundalk Bay SPA is to "*maintain the favourable conservation condition of the wetland habitat in Dundalk Bay SPA as a resource for the regularly occurring migratory waterbirds that utilise it*" (NPWS, 2011a). The predominant habitats within the SPA are intertidal sand and mudflats. More extensive mudflats occur along the northern shore of the lough, together with large areas of saltmarsh; these are included in the Northern Ireland SPA.

4.19 The favourable conservation condition of the wetland habitat at Dundalk Bay SPA is defined by a single attribute and target, which is shown in Table 4.5.

[17] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004026.pdf
NPWS (2011a) Conservation Objectives: Dundalk Bay SAC 000455 and Dundalk Bay SPA 004026. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

[18] NPWS (2011b). Dundalk Bay SPA (site code 4026). Conservation Objectives Supporting Document. Version 1.0 (March, 2011).

Table 4.5 – Attribute and target for the conservation objective for wetlands and waterbirds at Dundalk Bay SPA.

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the areas of 8136, 4374 and649 hectares respectively for subtidal, intertidal and supratidal habitats, other than that occurring from natural patterns of variation	As defined by SPA boundary to MLWM; MLWM to MHWM; and MHWM to SPA boundary (the latter value is minus the area of Lurgangreen Fields)

Source: NPWS (2011a)

Screening Decision

4.20 Dundalk Bay is located on the southern side of the Cooley Peninsula, travelling around the coast Dundalk Bay SPA is ca. 10km from Ballagan Point at the southern end of Carlingford Lough SPA. The distance between areas of intertidal habitat within each site is considerably longer.

4.21 Table 4.6 presents a review of bird species, which occur within Carlingford Lough, but which are also qualifying interests of Dundalk Bay SPA. Apart from Oystercatcher and Curlew none of the species for which Dundalk Bay SPA is designated occur in notable numbers in Carlingford Lough. Notable subtidal diving species in Dundalk, such as Common scoter, Red-breasted merganser and Great crested grebe do not occur, or occur in small numbers, in Carlingford. The same applies to species which favour sandflats, such as Bar-tailed godwit and Knot.

4.22 While movement of birds between Carlingford Lough and Dundalk Bay cannot be entirely discounted, it is not anticipated the waders or wildfowl using Dundalk Bay would be negatively impacted by proposals at Carlingford. Dundalk Bay is not therefore considered further in this assessment.

Table 4.6 – Occurrence in Carlingford Lough of species which are qualifying interests of Dundalk Bay SPA.

Qualifying Interest of Dundalk Bay SPA	Occurrence in Carlingford Lough			
	Carlingford to Greenore Mean Peak 1995/96 to 1999/00	Greenore to Ballagan Point Mean Peak 1996/97 – 2000/01	Carlingford to Greenore Peak Count 2009/10 – 2010/11	Greenore to Ballagan Point Mean Peak 2006/07 – 2010/11
Great Crested Grebe	12			
Greylag Goose				
Shelduck				
Teal	5		50	
Mallard	20			
Pintail				
Common Scoter				
Red-breasted Merganser	6	7		2
Oystercatcher	188	187	50	211
Ringed Plover	64	7	2	25
Golden Plover	184			
Grey Plover	4	11		2
Lapwing	82	68	45	104
Knot				
Dunlin	211	424	150	186
Black-tailed Godwit				
Bar-tailed Godwit	20	24	15	17
Curlew	100	68	40	49
Redshank	94	49	122	97
Black-headed Gull	162	304	65	85*
Common Gull	147	91	100	60*
Herring Gull	23	98	14	38*

Note: Taken from Table 5.1a and 5.1b of NPWS (2013a).

Killough Bay SPA (UK9020221)

Qualifying features

4.23 The Special Conservation Interest (SCI) of Killough Bay SPA (UK9020221) is the wintering population of Light-bellied Brent Goose (DAERA, 2015b[19]).

Conservation objectives

SCI species

4.24 The conservation objectives for the non-breeding population of Light-bellied Brent Goose is to maintain their favourable conservation status (DAERA, 2015b).

4.25 The favourable conservation conditions of this species at Killough Bay SPA are defined by various attributes and targets, which are shown in Table 3.7.

Table 4.7 – Attributes and targets for the conservation objectives for Light-bellied Brent Goose at Killough Bay SPA.

SCI	Target
Light-bellied Brent Goose	To maintain or enhance the population of the qualifying species
Habitat Extent	To maintain or enhance the area of natural and semi-natural habitats used or potentially usable by SCI bird species (94 ha intertidal area), subject to natural processes
Habitat Extent	Maintain the extent of main habitat components subject to natural processes
Roost Sites	Maintain or enhance sites utilised as roosts

Source: DAERA (2015b).

Screening Decision

4.26 The potential impact of aquaculture proposals on Light-bellied brent geese, including sites in the wider environment, such as Killough Bay are considered further below.

Strangford Lough SPA (UK9020111)

Qualifying features

4.27 The Special Conservation Interests (SCIs) of Strangford Lough SPA (UK9020111) are the breeding populations of Sandwich Tern, Common Tern, Arctic Tern, and the non-breeding populations Golden Plover, Bar-tailed Godwit, Light-bellied Brent Goose, Shelduck, Knot, Redshank, Great Crested Grebe, Cormorant, Greylag Goose, Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler, Goldeneye, Red-breasted Merganser, Coot, Oystercatcher, Ringed Plover, Grey Plover, Lapwing, Dunlin, Curlew and Turnstone (DAERA, 2015c[20]).

[19] https://www.daera-ni.gov.uk/sites/default/files/publications/doe/killough-bay-spa-conservation-objectives-2015.pdf
[20] https://www.daera-ni.gov.uk/sites/default/files/publications/doe/strangford-lough-spa-conservation-objectives-2015.pdf

Conservation objectives

SCI species

4.28 The conservation objectives for breeding populations of Sandwich Tern, Common Tern, Arctic Tern, and the non-breeding populations Golden Plover, Bar-tailed Godwit, Light-bellied Brent Goose, Shelduck, Knot, Redshank, Great Crested Grebe, Cormorant, Greylag Goose, Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler, Goldeneye, Red-breasted Merganser, Coot, Oystercatcher, Ringed Plover, Grey Plover, Lapwing, Dunlin, Curlew and Turnstone is to maintain their favourable conservation status by maintaining or enhancing the populations of the respective species. There is an additional objective for the breeding populations of Sandwich Tern, Common Tern and Arctic Tern, for fledging success to be sufficient to maintain or enhance their populations (DAERA, 2015c).

4.29 There are additional objectives for habitat extent and roost sites, which are shown in Table 4.8.

Table 4.8 Conservation objectives for habitat extent and roost sites at Strangford Lough SPA.

Attribute	Target
Habitat Extent	To maintain or enhance the area of natural and semi-natural habitats used or potentially usable by SCI bird species (3781 ha intertidal area), subject to natural processes
Habitat Extent	Maintain the extent of main habitat components subject to natural processes
Roost Sites	Maintain or enhance sites utilised as roosts

Source: DAERA (2015c).

Screening Decision

4.30 While movement of birds between Carlingford Lough and Strangford Lough cannot be entirely discounted, it is not anticipated the waders or wildfowl using Strangford Lough would be negatively impacted by proposals at Carlingford. Dundalk Bay is not therefore considered further in this assessment.

4.31 The potential for negative impacts to Sandwich Tern, Common Tern and / or Arctic Tern are considered further below.

5. Status, habits and distribution of SCI species

Light-bellied brent geese

5.1 The extent of intertidal habitat (extracted from Admiralty Charts for Carlingford Lough) is illustrated in Figure 5.1. There are also a number of beds of eelgrass (*Zostera noltii*) within the lough; these are an important habitat in their own right, while also being an important food resource for Light-bellied brent geese and wigeon (see Figure 5.2a & b).

IWEBS Data

Table 5.1 – Population data for Light-bellied brent geese, Carlingford Lough SPA (Table 4.1 of NPWS, 2013a).

Site Special Conservation Interest Species:	Light-bellied Brent Goose
Baseline data period (I-WeBS)	
Carlingford Lough SPA (4078) Baseline period (1995/96 – 1999/00) – Mean peak number	253 (i)
Subsite - Carlingford to Greenore Baseline period (1995/96 – 1999/00) – Mean peak number	135
Subsite - Greenore to Ballagan Point Baseline period (1995/96 – 1999/00) – Mean peak number	167
Recent data period (I-WeBS)	
Subsite - Carlingford to Greenore (2009/10 - 2010/11) - Peak count winter (spring)	45 (145)
Subsite - Greenore to Ballagan Point (2006/07 – 2010/11) - Mean peak number *(peak number)	32 (93)

Notes: -

(i) denotes numbers of international importance; note that thresholds differ for the baseline and recent time periods used (refer to Wetlands International, 2002 and Wetlands International, 2012 respectively). * refers to the three-year peak mean from the period 2006/07 – 2010/11 (counts from 2008/09 and 2009/09 missing).

Table 5.2 Current site conservation condition – Light-bellied brent goose (adapted from Table 4.3 of NPWS, 2013a).

Special Conservation Interests	BoCCI Category [a]	Site Population Trend [b]	Site Conservation Condition	Current National Trend [c]	Current International Trend [d]
Light-bellied Brent Goose	Amber	-1	Intermediate Unfavourable	+ 62.3	Increase

Note: -

a After Colhoun & Cummins (2013); b Site population trend; see Table 4.2; c all-Ireland trend calculated for period 1994/95 to 2008/09 (I-WeBS); d international trend after Wetland International (2012).

5.2 The population trend of Light-bellied brent geese at Carlingford Lough is as follows (after Table 4.2 of NPWS, 2013a)[21]: -

[21] Short, medium and long-term trends for the data period 1998/99 to 2009/10.

- Short term (5 year) -2% Intermediate (Unfavourable)
- Medium term (10 years) +12% Favourable
- Long term (up to 25 years) -1% Intermediate (Unfavourable)

5.3 As a result of incomplete coverage during IWeBS, the population trend presented by NPWS in the SPA conservation objective supporting document (above) for Light-bellied brent geese at Carlingford lough is based on the UK Wetland Bird Survey '*Alerts System*' (after Cook *et al*., 2013; see https://www.bto.org/volunteer-surveys/webs/publications/webs-alerts/methods).

5.4 NPWS (2013a) states that "*the 'Intermediate' range (1.0% - -24.9% decline) allows for natural fluctuations and represents a range within which relatively small population declines have the potential to be reversible and less likely to influence conservation status in the long-term (Leech et al., 2002)*".

Carlingford Lough Waterbird Surveys 2010/11

5.5 As noted Carlingford Lough was not counted as part of the National Parks and Wildlife Service Waterbird Survey Program. The NPWS Conservation Objective supporting document (NPWS, 2013a) relies heavily on data which were collected during survey work undertaken at Carlingford Lough during the period October 2010 to April 2011 by Breffni Martin (Martin, 2011 in NPWS, 2013a).

5.6 Waterbirds were counted in two no. survey zones (Figure 2.4): -

- Zone 1 Ballagan to Greenore (i.e. approximates to IWeBS subsite 0Z480)
- Zone 2 Greenore to Carlingford (i.e. approximates to IWeBS subsite 0Z483)

5.7 Descriptions of the habitats characterising these areas are presented at the end of Chapter 5.0; paragraphs 5.44-5.45.

5.8 These surveys paid particular attention to the numbers, distribution, behaviour and movements of Light-bellied brent goose. Peak counts are summarised in Table 5.3; while the frequency of occurrence in Zone 1 and 2 are presented in Table 5.4. The distribution in relation to tidal state is summarised in Table 5.5. The habitats which characterise these areas are summarised below.

Table 5.3 Light-bellied brent goose numbers in Carlingford in 2010/11 (from Martin, 2011 – in NPWS, 2013a) - Peak zone counts and the peak site count*.

Month	Zone 1 Ballagan to Greenore	Zone 2 Greenore to Carlingford	Site*
October 2010	126	92	218
November 2010	109	317	411**
December 2010	275	412**	687**
January 2011	177	132	271
February 2011	346	176	522**
March 2011	438**	282	572**

Note: -

* Numbers in Zone 1 and Zone 2 combined within any one 60-minute period.

** exceeds international threshold of 400 after Wetlands International (2012).

Table 5.4 Frequency of occurrence of Light-bellied Brent Goose in Zone 1 and 2 – monthly.

Month	Zone 1* Frequency of Occurrence %	Zone 2 Frequency of Occurrence %
October 2010	53	100
November 2010	33	100
December 2010	53	100
January 2011	47	91
February 2011	56	100
March 2011	42	100

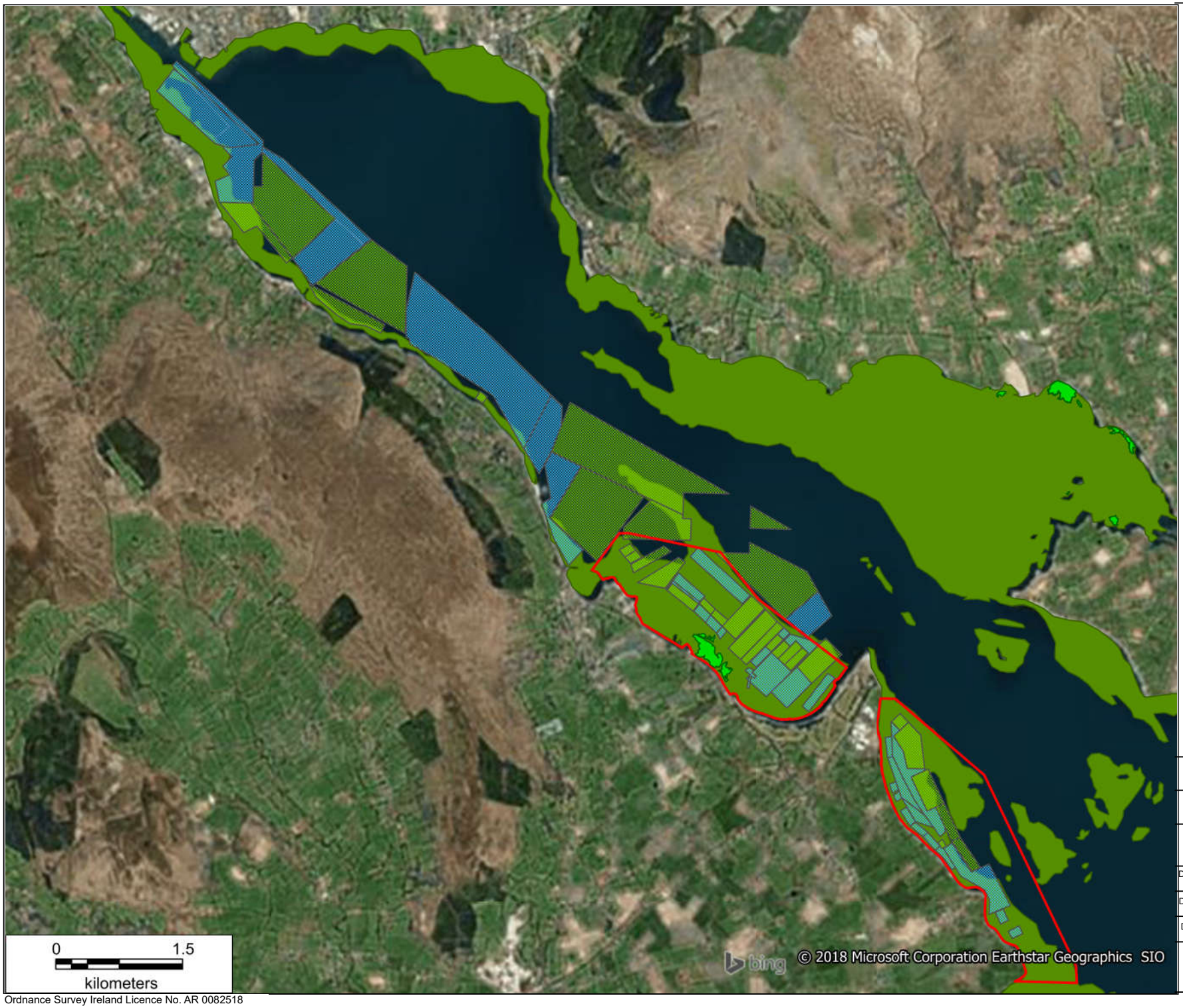
Note: -

*as Zone 1 was subdivided into count sectors, this refers to the peak frequency of occurrence recorded, in any of the count sectors.

Table 5.5 Distribution in relation to tidal stage.

	Tide Stage 1		Tide Stage 2		Tide Stage 3		Tide Stage 4	
	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2
Minimum no. geese	0	55	0	49	0	2	0	0
Maximum no. geese	77	375	346	343	593	412	100	282
Average no. geese	5	136	79	163	123	188	5	113
Frequency of occurrence (%)	16	100	82	100	74	100	8	93

5.9 The more recent counts from Martin (2011) (Table 5.3) are significantly higher than those presented in Table 5.1. They are not in line with the suggested trend (Table 5.2); but show a large increase in numbers from the baseline population of 253 (1995/96-1999/00). The maximum recorded was 687 birds in December 2010 (a count of international importance). This is more in-line with the observed national trend for Light-bellied brent geese which is positive.



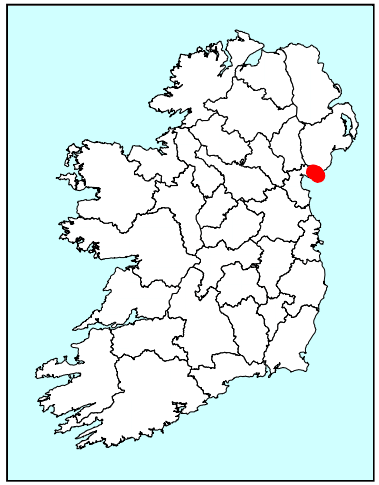
N

Legend

- Carlingford Lough SPA
- *Zostera noltii*
- Intertidal zone

2018 aquaculture plot status

- Licensed
- Application



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Date: 17/12/2018	Date: 17/12/2018	Date: 17/12/2018
Drawing No: 5.1		Rev: 0

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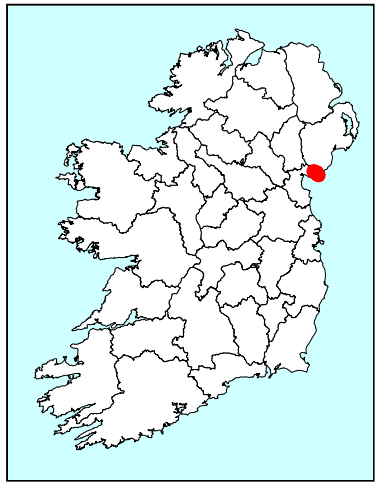
N

Legend

- Carlingford Lough SPA
- *Zostera noltii*

2018 aquaculture plot status

- Licensed
- Application
- Access routes



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Project: Carlingford Lough SPA AA of Aquaculture

Title: Distribution of Zostera noltii within Carlingford Lough SPA.

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Drawing No: 5.2a		Rev: 0

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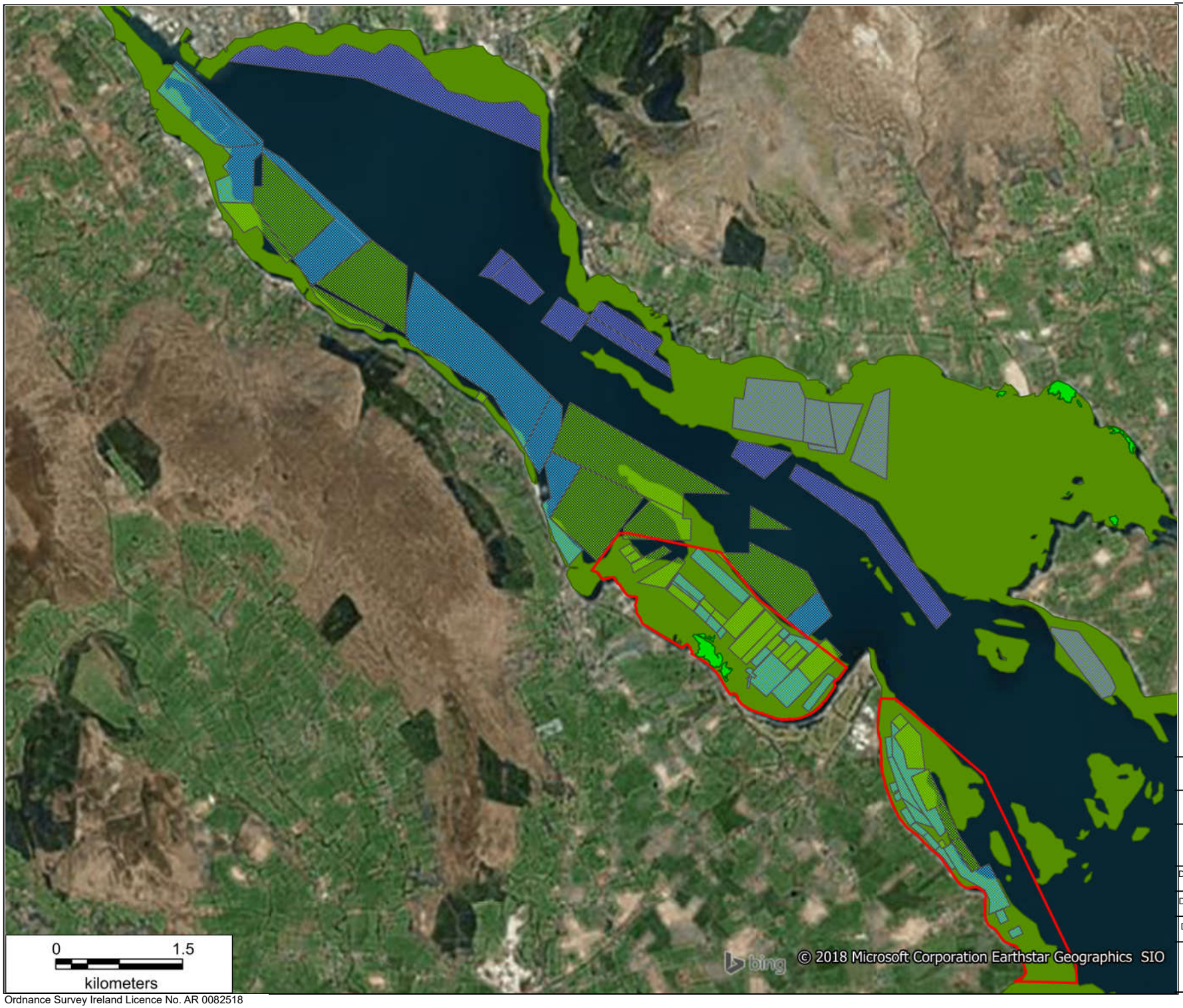

Client: Marine Institute

Project: Carlingford Lough SPA AA of Aquaculture

Title: Distribution of eelgrass and aquaculture in wider lough.

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Drawing No: 5.2b		Rev: 0

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Light-bellied brent geese in Carlingford Lough (B. Martin, 2018)

Introduction

5.10 As noted the NPWS Conservation Objective supporting document relied heavily on work undertaken by B. Martin in 2010 / 2011. Atkins commissioned B. Martin to provide an update to this in which the use of Carlingford Lough by Light-bellied brent geese is summarised. During the winter of 2010/11 an extensive survey was undertaken on waterbird usage of Carlingford Lough, in particular Light-bellied brent geese. The purpose of the 2010/11 study, amongst other things, was to attempt to determine the underlying reasons for the certain behaviour observed in relation to the Lough during Irish Wetland Bird Surveys undertaken by the author; as well as during other surveys undertaken since 1995 (the start of IWeBS); as well as general observations by the author since 2002. These can be summarised as follows: -

- The numbers of Light-bellied brent geese observed using Carlingford Lough between 2002 and 2010 were highly variable over the course of a season ranging from less than 10 brent geese to over 7,000.

- While like other goose species, Light-bellied brent geese typically do roost on water as near to feeding areas as possible, in Carlingford Lough Light-bellied brent geese do not roost at night in the southern parts of the lough near *Zostera* beds (see Figure 5.2a) used for feeding.

- Light-bellied brent geese will day-roost during high-tide on water in the southern parts of Carlingford Lough.

- Light-bellied brent geese apparently make an 18-24 km commute to the *Zostera* beds in Carlingford Lough from their roosting areas in Dundalk Bay (see Figure 5.3).

- In their commute Light-bellied brent geese rarely cross overland even though this would result in an 8km reduction in their commute (this behaviour was only once observed by the author over eight years of observation; it occurred during a southerly gale where geese were apparently pushed off their normal course by the wind) (see Figure 5.3).

- Generally speaking Light-bellied brent geese feed primarily preferentially on eel grass (*Zostera* spp.; see Figure 5.2) when available switching to green algae (*Ulva* spp.) when it is not available. In certain circumstances Light-bellied brent geese will feed on grasslands, particularly amenity grass, and even on occasion saltmarsh grasses. For example, feeding on amenity grasslands during high tide has been recently observed in suburban Dublin and may be a reflection of the lack of availability of suitable habitat during high tide in Dublin bay, combined with a significant increase in goose population over the last few decades.

- Light-bellied brent geese very rarely feed on agricultural/pasture grass in the Cooley peninsula (never observed by author), but sometimes feed on the amenity grassland in Greenore golf club, or saltmarsh grasses during high tide; whereas in other parts of the country (notably at Mooretown, part of Dundalk Bay SPA), particularly in Spring, Light-bellied brent geese regularly feed on emergent winter cereal crops and amenity grassland through high tide (authors observation).

- Light-bellied brent geese in the southern shore appear well habituated to almost constant disturbance from walkers, dogs, and various recreational activities as well as aquaculture activities but as the population increases this may need change.

- Difference between usage of Zone 1 (outer lough no *Zostera*) and Zone 2 (inner lough, copious eel grass) given extensive algae in both areas (see Figure 2.4).

Methods

5.11 The study involved over 400 hours of counting from four vantage points simultaneously and covered dawn to dusk on each count day, and on alternate counts part repeating this with a single counter. Thus a count was made every two weeks during the 2010/11 season. Data on numbers and movements were recorded on each count day. On non-count days observations were made at roosting sites and along the commute route into Carlingford Lough. Goose distribution and behaviour was recorded. Data was then compiled and analysed, taking into account data from previous IWeBS surveys.

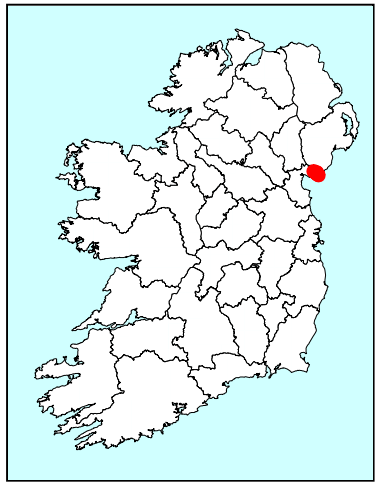
N

Legend

Light-bellied Brent Goose Flight Path

Zostera noltii

Brent Goose flight path from roosting to feeding areas: 23.4km



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Date: 19/12/2018	Date: 19/12/2018	Date: 19/12/2018	
Drawing No: 5.3		Rev: 0	

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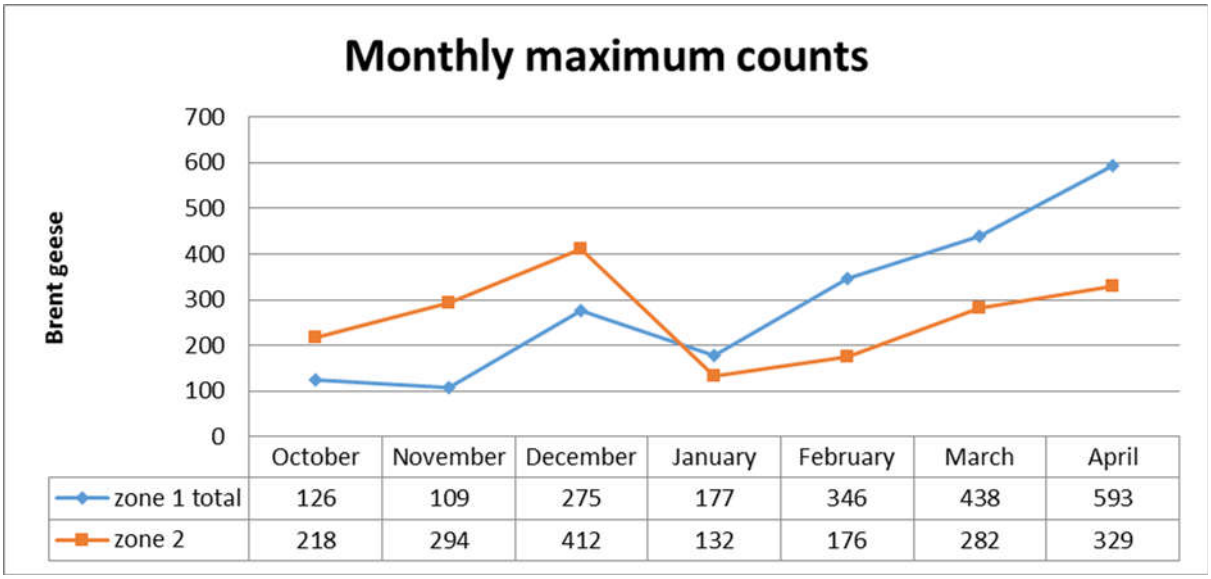
Results

5.12 Light-bellied brent geese maximum count ranged from 35 to 922 birds and followed a seasonal pattern with a pulse of birds arriving in late September (not seen during 2010 but noted on previous years during IWeBS and other surveys) early October. These birds voraciously feed on eel grass in the bay between Greenore and Carlingford, then birds disperse around the coast to other overwintering areas (see Figure 5.4).

5.13 During the middle part of the winter birds feed on *Ulva* spp. along the shore, often truncating their commute when feeding opportunities present (*Ulva* may bloom from small streams and drains along the shore, particularly if fertiliser is present, or following a few days of warm weather).

5.14 In Spring, numbers again increase in a second pulse as birds stage to push back to Strangford Lough on their return to Canadian breeding grounds.



	October	November	December	January	February	March	April
zone 1 total	126	109	275	177	346	438	593
zone 2	218	294	412	132	176	282	329

Figure 5.4 Monthly maximum brent geese counts in Zone 1 & 2.

5.15 This pattern can be summarised as follows; in general, four main seasonally affected foraging behaviours could be discerned: -

(1) September – November: Migratory arrival from Iceland primarily and preferentially feeding on *Zostera* spp. with *Ulva* spp. as a second choice.

(2) December to January: Primarily feeding on *Ulva* spp. with agricultural grass as a second choice.

(3) February to March: Almost exclusively feeding *Ulva* spp.

(4) April: Gathering/staging for migration to breeding grounds.

Plate 5.1 Light-bellied brent geese feeding through the high tide by up-ending.

Discussion

5.16 The 2010/11 was able to show that the reason for the variation in numbers is due to two factors: staging pre and post migration and the availability of eel grass (only available on the inner lough between Greenore and Carlingford). The likely explanation for the lack of roosting in Carlingford lough was primarily tidal; the velocity of the tidal interchange may move birds roosting on the water into unfavourable locations. The improbable commute (ca. 40km + round trip) is explained by the fact that the birds are in fact stopping and picking up again along the Cooley shore, exploiting algal blooms as they occur along the shingle, so that a single goose is unlikely to make the whole trip in a single 24 hour period. This also explains why they avoid an overland transit: in effect the commute enables the birds to survey available algal blooms for feeding and there is little suitable cereal crop cultivation in proximity to the shore. It is also noteworthy that feeding on these blooms and on *Zostera* in Carlingford Lough, may proceed through the tidal cycle by up-ending (geese upend using their long necks to reach the underwater vegetation), often aided by the fact that algae grow on oyster bags on top of trestles, bringing it within reach of the surface (see Plate 5.1). Geese are therefore not limited to feeding only on low tide.

5.17 Given that Light-bellied brent geese habits have been seen to change over the years, particularly in sub-urban Dublin, it may be that in the future brent will switch to agricultural grass/crops, perhaps in response to population growth, climate change, lack of availability of eel grass or a combination of these factors. However, there is no evidence in Carlingford Lough for this at present, and if this was the case, the Cooley peninsula presents an extensive area of various types of undisturbed grassland that would be available.

Conclusions

5.18 In relation to the questions posed in the introduction: -

5.19 Variability in numbers: Number vary because of two transitions through the habitat, one in Autumn and the other in Spring, as they depart and return to Strangford lough as part of staging through outward and return migration.

5.20 Roosting: Light-bellied brent geese avoid night roosting along the southern shore for two reasons. During high tides at night roosting birds may be carried out into the channel by the current (5 knots/hr); at low tide they could be subject to predation at night.

5.21 Commute: In many instances, Light-bellied brent geese do not complete the 48 km round trip commute between Carlingford Lough and Dundalk Bay every day because feeding opportunities are available through the route of the coastal commute. Instead birds will drop off and pick up along the shore where algal blooms give rise to opportunistic feeding in an unpredictable way (may be triggered by release of agricultural fertiliser, brief warm spells etc.). This algae grows along the rocky intertidal areas from Gyles Quay onwards and is available through most tides (as noted Light-bellied brent geese can upend to reach the algae at high tide).

5.22 Aquaculture: Light-bellied brent geese are very well habituated to aquaculture activities, and though oyster trestles and bags may deprive brent of some foraging habitat, this is probably more than offset by the fact that algae grows on oyster bags, which brings it within reach of upending brent geese at high tide.

5.23 Grassland feeding: Light-bellied brent geese could occasionally be seen feeding on grassland in Greenore Golf Course early in the morning but otherwise were only very rarely use grassland areas - following reasons are postulated: copious alternative more secure and nutritionally superior food source available through tidal cycle; lack of suitable cereal crop habitats in open undisturbed areas adjacent to the coast around Cooley; presence of mature pasture sward with longer grass/tussocks unsuitable for geese who prefer new growth for nutrition and short grass for rapid escape if necessary.

WEBS & Loughs Agency, 2012 brent geese data

5.24 Additional data for the bay were extracted from *Cumulative Impact Assessment: Aquaculture activities within and adjacent to Natura 2000 designated sites in Carlingford Lough* prepared by AFBI (2015). Wetland Bird Survey Counts for the period 1989/90 – 2013/14 are presented in Table 5.6. These counts cover the entire lough as illustrated in Figure 2.2. Annual trends are illustrated in Figure 5.5.

Table 5.6 Light-bellied Brent Geese counted within the WeBS core counts (high tide counts) for the winters 1989/90 - 2013/14.

Year	Winter Count
1989/90	259
1990/91	200
1991/92	267
1992/93	243
1993/94	596
1994/95	301
1995/96	189
1996/97	242
1997/98	317
1998/99	642
1999/00	437
2000/01	498
2001/02	259
2002/03	319
2003/04	570
2004/05	538
2005/06	508

Year	Winter Count
2006/07	542
2007/08	483
2008/09	626
2009/10	626
2010/11	160
2011/12	278
2012/13	1320
2013/14	477

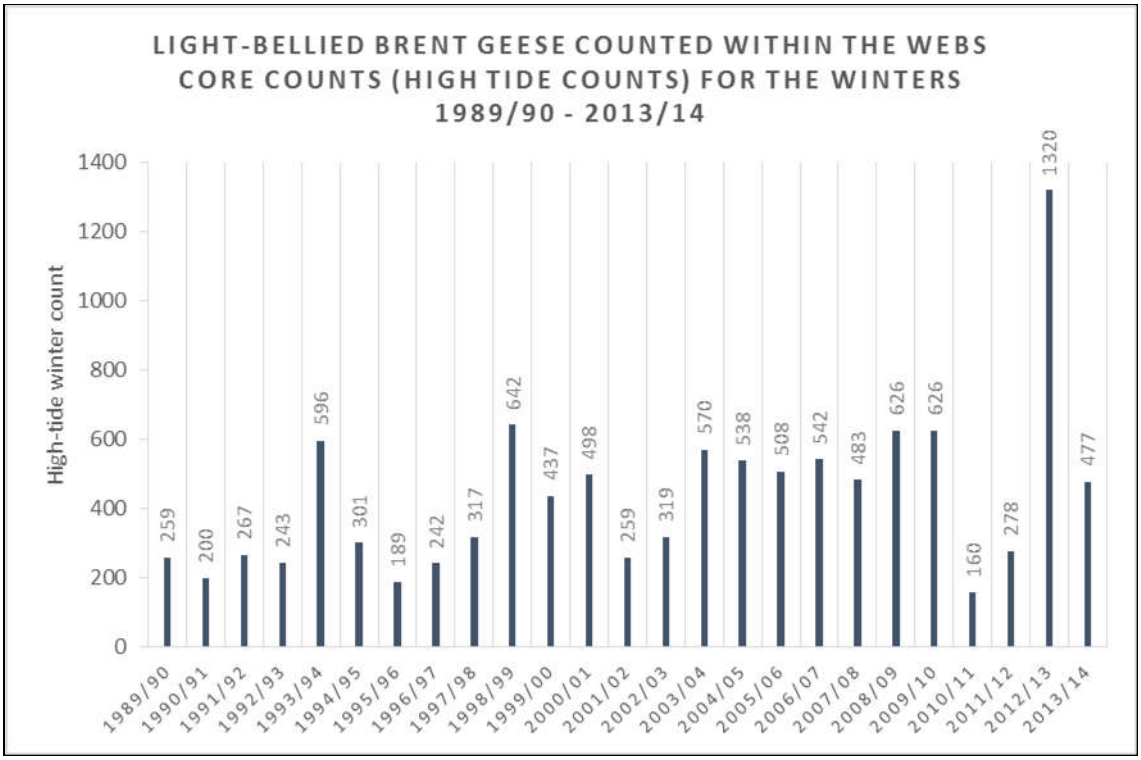


Figure 5.5 Light-bellied Brent Geese counted within the WeBS core counts (high tide counts) for the winters 1989/90 - 2013/14 (from Figure 2.14 of AFBI, 2015).

5.25 As noted the Loughs Agency also undertook a series of counts of Light-bellied brent geese between January and December 2012. Count sectors are illustrated on Figure 2.3 (extracted from Figure 2.16 of AFBI, 2015). Sector S2 & S3 is located with IWeBS count sector 0Z480 and within the southerly part of Carlingford Lough SPA (IE004028) (see Figure 2.1; east of Greenore).

5.26 IWeBS count sector 0Z482, which is within the northerly part of Carlingford Lough SPA (IE004028) (see Figure 2.1; west of Greenore) was not count by the Loughs Agency; sector S4 is, however, located immediately west of the SPA.

5.27 Peak low tide counts were 193 (Nov; S2) and 23 (Jan; S3) and 91 (March; S4); while peak high tide counts were 4 (Dec; S2) and 5 (Dec; S3) and 0 (S4). Loughs Agency monthly count data suggests that area S3 supports only low numbers of brent geese; sector S2 appears to be of greater importance supporting geese between September and April [Sept – 4; Oct – 38; Nov – 193; Jan – 25; Feb – 131; Mar – 95; and Apr – 40; from Figure 2.16 of AFBI, 2015].

5.28 The most important areas within the lough appear from Loughs Agency monthly count data are sector N1 (max 422; Mar); S1 (299; Feb) and S2 (193, Nov) (see also count of total number of brent geese recorded at a count sector during the 2012 low tide counts.

Table 5.7 Peak counts of Light-bellied Brent Geese counted by the Loughs Agency from January to December 2012 within Carlingford Lough survey sites (see Figure 2.3 for count sectors).

Count Section	Low tide (month)	High tide (month)
N1	422 (March)	84 (Feb)
N2	36 (March)	20 (Feb)
N3	78 (Jan)	55 (March)
N4	67 (Feb)	0
N5	15 (March)	26 (Dec)
S1	299 (Feb)	24 (Dec)
S2	193 (Nov)	4 (Dec)
S3	23 (Jan)	5 (Dec)
S4	91 (March)	0
S5	17 (March)	0
S6	1 (Feb)	13 (Dec)

Table 5.8 Total low tide counts of Light-bellied Brent Geese counted by the Loughs Agency from Jan to Dec 2012 within Carlingford Lough survey sites (see Figure 2.3 for count sectors).

Count Section	Total Bird Count
N1	704
N2	92
N3	207
N4	109
N5	19
S1	431
S2	526
S3	60
S4	112
S5	26
S6	1

Sandwich Tern

5.29 Sandwich Tern is listed on Annex I of the EU Birds Directive. As a breeding species it is listed as a qualifying interest of Carlingford Lough SPA in Northern Ireland. They nest on Green Island at the mouth of the Lough; to the southeast of Greenore. The site qualifies for designation under Article 4.1 of The Birds Directive by supporting populations of European importance of a number of species listed on Annex I of the directive during the breeding season: including Sandwich Tern. The SPA supported a five year mean number of breeding pairs (1993 – 1997) of 575 pairs. This represented 1.2% of the international population and 13.1% of the Irish population of Sandwich Tern.

5.30 In Northern Ireland Sandwich Tern breed on a small number of colonies; these are Strangford Lough, Larne Lough, Lower Lough Erne, Carlingford Lough and Cockle Island, Groomsport. Most colonies are located on low-lying coastal islands, almost always close to shore; or on islands within brackish lagoons, estuaries and sea inlets (Cabot and Nisbet, 2013). Exceptions include the colony on Lower Lough Erne in Co. Fermanagh.

5.31 While Sandwich Tern is a qualifying interest of Carlingford Lough SPA, breeding numbers collapsed to just 7 apparently occupied nests (AONs) in 2016 after there having been 250 AONs in 2015. Numbers increased in 2017 to 71. Despite improved breeding success at Carlingford Lough between 2011 – 2015 (due to a programme of monitoring and conservation), no checks fledged in 2017 (from Booth Jones and Wolsey, 2017).

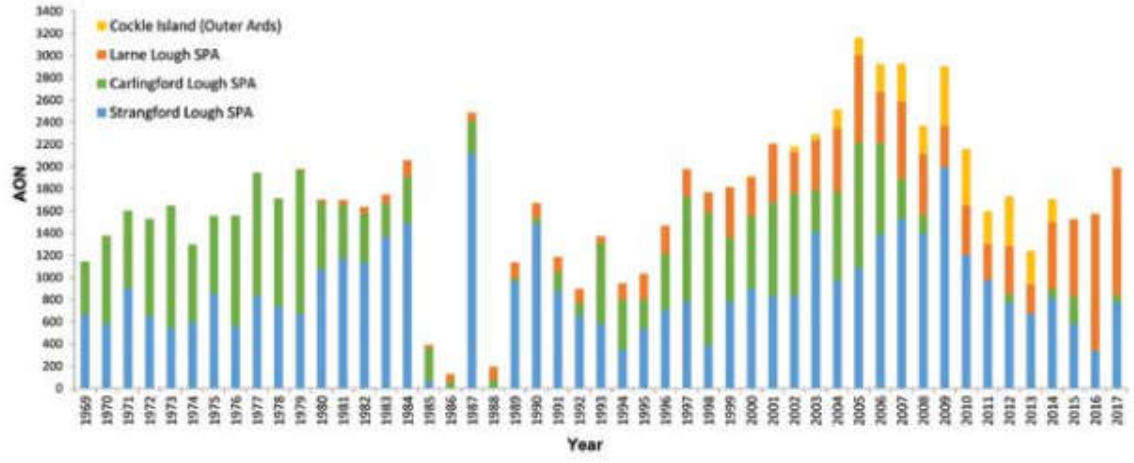


Figure 5.6 Cumulative Sandwich Tern Numbers (AONs) at Cockle Island, Larne Lough, Carlingford Lough and Strangford Lough, 1696-2017 (reproduced from Booth Jones and Wolsey, 2017).

5.32 Various studies have reported foraging ranges from breeding colonies: 6.6-12.9 km (Perrow *et al*., 2011), mean 13.1 km, maximum 15 km (Fasola and Bogliani, 1990), 15.4 km (Pearson, 1968). However, Cramp and Simmons (2004) state that Sandwich Terns "*may travel much further to obtain food for young … c. 67 km recorded*". More recently Fijn *et al*. (2017) indicated that breeding Sandwich Tern may travel on average 27km from the colony to forage and they can vary in habitat use between years. The Seabird Wikispace gives a mean foraging range of 15 km, a mean maximum of 42 km and a maximum of 70 km from breeding colonies, but states that "*most Sandwich Terns apparently forage within 20 km of the colony*".

5.33 The Seabird Wikispace describes its key foraging habitats as: "*shallow marine waters such as bays, inlets and outflows, gullies, shoals, inshore waters, reefs, and sandbanks; also more open waters nearshore or offshore, including open sea*". They mainly catch their prey in the upper 1.5-2 m of the

sea surface. Herring, sand eel and sprat generally make up large proportions of the diet of Sandwich Terns. Herring are likely to be an important pelagic species in the open water for tern populations and in particular for Sandwich Terns, which travel over a wide range when foraging. Herring are more likely to be important prey resource in the deeper subtidal environment.

5.34 In a recent study of five breeding colonies in Belgium and Netherlands between 2007 and 2015, Courtens *et al*. (2017) found adult Sandwich Tern diet to be dominated by only three prey items; Herring and spratt (Clupeidae) dominated, making up 40-70% of the diet, with Ammodytidae (e.g. sandlance) accounting for another 20-60% of diet composition. In all years *Nereis* polychaete worms were also found in the diet.

Common Tern

5.35 Breeding Common Tern is also it is listed as a qualifying interest of Carlingford Lough SPA in Northern Ireland. They nest on Green Island at the mouth of the Lough; to the southeast of Greenore. The site qualifies for designation under Article 4.1 of The Birds Directive by supporting populations of European importance of a number of species listed on Annex I of the directive during the breeding season: including Common Tern. The SPA supported a five year mean number of breeding pairs (1993 – 1997) of 339 pairs. This represented 12.6% of the Irish population of Common Tern.

5.36 Common Terns typically feed within 3-10 km of their breeding colonies (studies quoted by Cramp and Simmons, 2004; Rock *et al*., 2007; Perrow *et al*., 2009), although distances of up to 22 km (Pearson, 1968), 37 km (Andrews, 1971, quoted by Cramp and Simmons, 2004) and 'some scores' of kilometres (Borodulina 1960, quoted by Cramp and Simmons, 2004) have been reported. Newton (2012) states that Common Terns "*range more widely [than Little Terns] but would be expected to forage within a 5-10 km zone around their colony during the chick-rearing period*".

5.37 The Seabird Wikispace gives a mean foraging range of 9 km, a mean maximum of 34 km and a maximum of 37 km from breeding colonies, but states that "*breeding birds commonly range up to 20 km from the colony, less frequently to around 30 km*".

5.38 The Seabird Wikispace describes its key foraging habitats as: "*shallow coastal waters, bays, inlets, shoals, tide-rips, drift lines, beaches, saltmarsh creeks, lakes, ponds, or rivers."* They probably catch their prey in the upper 1-2 m of the sea surface. Herring, sand eel and sprat generally make up large proportions of the diet of Common Terns. While sandeel and herring are favoured food items for Common Terns, it may avail of intertidal fish in addition to subtidal species such as herring. Intertidal species of importance may include sand goby, have been identified as a prey item in various studies (including Lindström & Ranta, 1992, in addition to studies quoted by Cramp and Simmons, 2004).

5.39 Common tern's diet is usually dominated by small fish up to 150mm long, (e.g. Herring *Clupea harengus*, sprat *C. sprattus*, sandeels *Ammodytes marinus*, *A. tobianus*, sticklebacks *Gasterosteus aculeatus*, whiting *Gadus merlangus*, cod *G. morhua*, etc.) and crustaceans (e.g. shrimp *Crangon vulgaris*, *C. crangon*, prawns *Leander serratus*, *Palaemonetes varians*, shore crab *Carcinus maenas*, etc.) though this can vary between sites as insects may form their primary prey base in certain colonies (e.g. Coleoptera, especially water-beetle larvae *Cybister laterimarginalis*, *Dytiscus marginalis*, etc. and cockchafers Melolonthinae, and occasionally caddisflies *Phryganea* sp., butterflies, true flies, ants, bees, grasshoppers and crickets, mayflies, dragonflies, cicadas, etc.) They are generally an opportunistic feeder, and can adapt to varying circumstances by shifting their prey base and feeding methods (Cramp and Simmons, 2004).

5.40 Stickleback have been identified as the main prey item in the diet of common tern at Greifswalder Bodden (German Baltic coast) in autumn during migration when sticklebacks accounted for >90% of the diet. It is therefore plausible that stickleback is a key prey item for common tern. Prey is generally

caught by hovering followed by plunge-diving from the air at a height of 1-6m, diving to a depth of 0.3-0.5m (Kirkham and Nisbet, 1987; Duffy, 1986; Boecker, 1967; Dunn, 1972a, quoted by Cramp and Simmons, 2004). However, they also dip to surface for crustaceans, insects and other small aquatic invertebrates, pursue insects mid-air, and kleptoparsitise other Terns (Cramp and Simmons, 2004). They are also known to scavenge offal and discards from fishing vessels (Cramp and Simmons, 2004).

5.41 The main coastal colonies of Common Tern in Northern Ireland are at Strangford Lough, Larne Lough, Belfast Lough and Carlingford Lough. No chicks fledged on Green Island, Carlingford Lough in 2016, but in 2017 nine chicks were produced from 147 AONs (from Booth Jones and Wolsey, 2017).

Other terns

5.42 While not a qualifying interest of the SPA Carlingford Lough was in the past notable for also supporting breeding Roseate Tern (*Sterna dougallii*). In 2017 there was only a single pair recorded attempting to breed in Northern Ireland; in Larne Lough.

5.43 In 2017 Green Island, Carlingford Lough supported 20 AONs of Arctic Tern (*Sterna paradisaea*).

Waterbird habitats

Intertidal Habitats

5.44 As noted above, waterbird counts were undertaken in 2010/11 in two zones, roughly coinciding with the two sections of Carlingford Lough SPA. Descriptions of the habitat type characterising each zone is presented in section 5.3.2 Intertidal habitats of the study area of NPWS, 2013a. These are reproduced below for completeness.

Zone 1 (Ballagan to Greenore): -

> *"**Zone 1** is composed of a shingle bank plus an extensive area of mudflats that is exposed at low tide. Most of the lower shore is used for aquaculture, the cultivation of Oysters (*Crassostrea gigas*).*
>
> *The benthic community is described as 'sandy mud to mixed sediment with Tharyx sp.' (NPWS, 2012). The sediment ranges from sandy mud to mixed sediments and mud and fine sand account for between 53.8% and 98.3% of the sediment. The distinguishing fauna of this community complex are the polychaetes* Tharyx *sp.,* Nephtys hombergii*,* Scoloplos armiger *and* Notomastus latericeus*, the crustaceans* Corophium volutator *and* Crangon crangon *and the bivalve* Scrobicularia plana *(NPWS, 2012).*
>
> *On the lower shore in the south of Zone 1 is a sandy community with polychaetes. This complex is distinguished by the polychaetes* Capitella capitata*,* Arenicola marina *and* Polydora cornuta *while other polychaetes include* Eteone longa*,* Nephtys cirrosa*,* Galathowenia oculata*,* Owenia fusiformis*,* Pygospio elegans *and* Lanice conchilega*.*
>
> *Vegetation comprises various brown fucoid seaweed, red seaweed and green algae, as well as vegetation typical of shingle banks. Two small streams flow into this zone and support algal growth. Further growth of algae is widespread across the survey zone with a layer of filamentous* Ulva *spp. (formerly* Enteromorpha *spp.) occurring along the base of the shingle bank, and observed growing between and upon the aquaculture trestles.* Zostera noltii[22] *does not occur in this zone.*
>
> *From approximately mid-tide, the whole intertidal area is covered and the only high tide roost opportunity is the shingle bank along the shore. At very low tides several islands become exposed offshore.*
>
> *The southern part of the SPA (between the boundary of Zone 1 and Ballagan Point) is composed of rock which supports various seaweeds. Zone 1 is significantly more exposed than Zone 2, particularly with southerly or easterly winds".*

Zone 2 (Greenore to Carlingford): -

> **"*Zone 2** is a significantly more diverse area than Zone 1. Habitats include shingle shore, mudflats, rocky outcrops and islands at high tide, plus upper saltmarsh, three significant streams, a tidal inlet and adjacent brackish ponds. As with Zone 1, it also includes an extensive aquaculture area.*
>
> *The benthic community is described as 'sandy mud to mixed sediment with Tharyx sp.' (NPWS, 2012). The sediment of this community ranges from sandy mud to mixed sediments and mud and fine sand account for between 53.8% and 98.3%. The proportion of coarse material increases toward Greenore Point. The distinguishing fauna of this community complex are the polychaetes* Tharyx *sp.,* Nephtys hombergii*,* Scoloplos armiger *and* Notomastus latericeus*, the crustaceans*

[22] See also Figure 3.6 & 3.7.

Corophium volutator *and* Crangon crangon *and the bivalve* Scrobicularia plana *(NPWS, 2012).*

A Zostera noltii *dominated-community is recorded at three locations between Shilties Lough and Greenore. It occurs most extensively south of Shilties Lough (NPWS, 2012). Natural mussel beds of the species* Mytilus edulis *occur along the shore. While providing a direct source of food for Oystercatchers, these mussel beds may indirectly provide food for Light-bellied Brent Geese, in that the beds, acting as a hard surface, provide attachment for green macroalgae such as* Ulva *spp. Extensive amounts of green algae are found, especially along the outlet of a brackish pond and at the outlet from Shilties Lough, a sea inlet fed by a stream. Green algae (*Ulva *spp.) were noted growing in extensive patches throughout the zone, with the wider 'sea lettuce' form in the rockier and more sheltered areas, and the filamentous form upon the sandflats. A greater area was occupied by green algae in Zone 2 than in Zone 1 during the survey period (November 2010).*

Zone 2 is less exposed than Zone 1 due to its aspect and because of a more gradual foreshore gradient. Of further note is that the intertidal area of Zone 2 is exposed for a significantly longer period than that in Zone 1.

Subtidal Habitats

5.45 EUNIS Habitat Map types for Carlingford Lough (centred on the navigational channel) were reviewed on the EMODnet Seabed Habitats webpage. The inner lough is dominated by a mixture of A5.2 Sublittoral sand along the navigational channel with A5.343 *Philine aperta*[23] and *Virgularia mirabilis*[24] in soft stable infralittoral mud dominating elsewhere. Southeast of Killowen Point a number of other habitats begin to dominate as rock becomes more dominant and there is more energy influencing habitat type: -

- A4.21 Echinoderms and crustose communities on circalittoral rock (particularly dominant from just north of Greenore to outside the mouth of the lough);
- A5.43 Infralittoral mixed sediments (some areas off Greenore; dominant just outside the mouth of the lough).
- A5.14 Deep circalittoral coarse sediment

[23] A sublittoral sea slug of sandy / muddy substrate.

[24] Slender sea pen. Lives in fine sediments (muddy sand to soft mud); often very abundant in loughs.

6. Assessment of Potential Impacts

Light-bellied brent geese

6.1 Numbers and spatial distribution of Light-bellied brent geese in Carlingford Lough are discussed in detail in Chapter 5.0, above. In summary, Light-bellied brent geese roost in Dundalk Bay (within the SPA) and fly around to Carlingford Lough SPA to forage. Early in the season they preferentially forage on eelgrass, the main areas of which occur midway between Greenore and Carlingford (Figure 3.6); there are also small areas of eelgrass present in Northern Ireland at the eastern end of Mill Bay. There are existing access tracks to oyster trestles in and around this area of eelgrass. Count data suggests that early in the season birds use Carlingford Lough to forage before travelling on to sites further down the east coast. Turnover of individual birds at the site and the numbers actually using Carlingford early in the season is not known. While there is no spatial overlap between existing licences or new applications and this area of eelgrass, it will be critical to maintain the integrity of this area of eelgrass as well as providing secure access to it by foraging brent geese in the early autumn. In addition to feeding on eelgrass, Light-bellied brent geese switch to feeding on green algae as the season progresses. Field feeding at Carlingford is limited compared to other sites in Ireland.

6.2 The total area of aquaculture being applied for is 1,144.69ha; this includes 440.42ha in new applications and 704.27ha of existing licences. These, however are located both within the SPA (oysters) and outside the SPA (mussels).

Mussels

6.3 The area of current mussel aquaculture licences is 591.6ha; while there are applications for a further 322.96ha. This gives a total of 914.56ha of current applications. Subtidal mussel cultivation is located entirely outside of Carlingford Lough SPA (see Figure 3.3). Waters deeper than 0.5m are beyond the feeding range for Light-bellied brent geese (Clausen, 2000) and would not be used by geese for foraging. As noted, while birds may occasionally roost on such waters during daylight hours, Light-bellied brent geese using Carlingford Lough roost overnight in Dundalk Bay. Patterns of boat activity outlined in Chapter 3.0, and presented in more detail in AFBI, 2015, should not therefore negatively impact on brent geese use of the SPA.

6.4 As described above mussels are laid on the seabed; there are no physical structures on the shoreline or subtidally. Geese will continue to have access to the shore to feed on intertidal algae. Negative impacts on Light-bellied brent geese are not anticipated from the licencing of existing and new applications. Indeed the reef system produced by subtidal laying of mussels can provide more robust attachment sites (than underlying muds) and in this way may provide additional feeding resources for Light-bellied brent geese during shallow water phases of the tidal cycle (i.e. <0.5m). See Plate 5.1 which shows brent geese foraging in shallow subtidal waters by upending. One bird can be seen with green algae (probably *Ulva* sp.) hanging from its bill. As noted in Clausen (2000) brent geese can feed by upending to a depth of 0.5m.

Conclusion

6.5 It is not anticipated that Light-bellied brent geese would be negatively impacted by the licencing of mussel cultivation in Carlingford Lough. This includes renewal of existing licences and new applications.

Oysters

6.6 With respect to oyster cultivation there are 112.7ha previously licenced and 117.47ha of new applications (230.13ha). These are largely located within the SPA.

6.7 Carlingford Lough SPA is comprised of 304ha of subtidal habitat; 285ha of intertidal habitat and 9ha of supratidal habitat (NPWS, 2013a) (i.e. 598ha). In total the Lough is ca. 51km^2 in area (5,100ha). However, based on admiralty charts and NPWS mapping of annexed habitat 1160 *large shallow inlets and bays* the amount of available intertidal / shallow subtidal waters (across the tidal range) can extend to as much as 475ha within the SPA (ca. 80% of available habitat within the SPA; see Figure 5.1). With respect to oyster cultivation the applications could result in trestle coverage of ca. 23.7% of available habitat for existing licences and ca. 24.7% for new applications; or 48.4% of available habitat within the SPA; this figure will increase on neap tides, but could decrease somewhat on spring tides.

6.8 As outlined in the methods the approach taken in the past has been to look at the relationship between area proposed for aquaculture and areas of suitable habitat within the SPA / bay. However, in the case of Carlingford Lough only a small portion of the bay is designated as an SPA, while Light-bellied brent geese are known to use extensive areas outside the SPA; along the north shore in Northern Ireland and within the SPA in UK waters. Therefore to take the above percentages as representative of the level of displacement within Carlingford Lough as a whole would be misleading as there are extensive areas of shoreline and intertidal habitat used by Light-bellied brent geese throughout the lough. Use of the wider lough was therefore also considered. Also the loss of foraging habitat due to placement of trestles may also be offset in part by these structures acting as stable sites upon which green algae can grow; though it should be noted that maintenance of oyster bags will seek to remove excess algae growth to prevent negative impacts on oysters being cultivated

6.9 Table 5.8 presents total low tide counts of Light-bellied Brent Geese from counts undertaken by the Loughs Agency from January to December 2012 within Carlingford Lough survey sites. While a snapshot from a single year, they do give a sense of site utilisation in the wider lough. This clearly illustrates the importance of count sites such as N1 (704; 30.8%), N3 (207; 9.05%); S1 (431; 18.9%) and S2 (526; 23%) (see Figure 2.3 for count sectors).

6.10 Of these count sector S2 lies within Carlingford Lough SPA east of Greenore (Zone 1 as counted by Martin, 2011) and can be seen to support large numbers of brent geese. The western part of Carlingford Lough SPA was not counted during the 2012 counts. The existing trestles on the lower shore do appear to have moved up the shore to follow the shoreline and avoid the deeper subtidal channel. Behind the trestles is an area of shore that can be utilised by Light-bellied brent geese. However, the new applications propose to extend further up the shore as well as extend the area of trestle cover southwards towards Ballagan. While brent geese seem to have acclimated to present patterns of aquaculture activity it is not clear whether they could continue to use the site if the area between the existing trestles and the shoreline were infilled; or if loss of foraging opportunities would be adequately offset by growth of green algae on the trestles. Based on figures presented in Table 5.8 this accounts for 23% of observations of the course of this study, and would result in a significant level of displacement if geese were displaced by proposed activities.

6.11 Martin (2011) recorded peak counts of 438 birds in Zone 1 (Ballagan to Greenore; March 2011) and 412 in Zone 2 (Greenore to Carlingford; Dec 2010); both sites clearly can support large numbers of brent geese. Frequency of occurrence was 100% (apart from 91% in January 2011) in Zone 2 compared with between 33% - 56% in Zone 1.

6.12 The trestle study (Gittings and O' Donoghue, 2012) concluded that Light-bellied Brent Goose showed a variable response to oyster trestles: at some sites observed numbers within the oyster trestle blocks were broadly in line with predicted numbers, while at other sites the observed numbers were generally lower than the predicted numbers. Differences between sites may reflect differences in the management of the trestles: the geese feed on algae attached to the trestles so more intensive management may reduce the food availability. There are also likely to be seasonal differences in the pattern of usage of the trestles, as algal cover of the trestles will be highest in the autumn and will gradually decline over the winter. The fieldwork for the trestle study was carried out during the late winter period, so the results of this study may underestimate Light-bellied Brent Goose usage of areas occupied by trestles. We also have some anecdotal evidence that Light-bellied Brent Goose may be more sensitive to disturbance than other waterbird species, so the intensity of husbandry activity relative to the area occupied by the trestles may affect the patterns of usage. Observations from Carlingford (Martin *pers comm*) would in contrast suggest that geese are very well acclimated to aquaculture activities.

6.13 In recent work at Donegal Bay (Gittings and O'Donoghue, 2013b), Light-bellied Brent Goose flock distribution within trestle blocks broadly corresponded to the distribution of trestle blocks with high algal cover, and the timing of their occurrence corresponded to times when no tractors were present within the trestle blocks. However, this timing pattern could, alternatively, be explained by an association with times when the tide is flooding/ebbing over the trestle blocks, making it easier for the geese to graze on the algae, which is lifted by the tide. Other anecdotal evidence in support of a disturbance factor being important includes the fact that at one of the sites (Ballymacoda Bay) in the trestle study where Light-bellied Brent Goose generally showed a negative response, the one day on which observed numbers were higher than predicted numbers was the only day on which there were no husbandry activity. Another supporting observation is that on a visit to Dungarvan Harbour on 17th March 2013, an exceptional count of 690 Light-bellied brent goose within the trestle blocks was recorded (T. Gittings, unpublished data); there was no husbandry activity taking place on this bank holiday.

6.14 However, in contrast to this Martin concluded that Light-bellied brent geese in the southern shore of Carlingford Lough appear well habituated to almost constant disturbance from walkers, dogs, and various recreational activities as well as aquaculture activities but as the population increases this may change.

Conclusion

6.15 The *hrota* population of Light-bellied Brent Geese that over winter in Ireland and breed in the Canadian high Arctic have shown increases in population since the early 1990's (Boland and Crowe, 2012) with a peak population estimate of 39,000 in 2007 (Hall and Colhoun, 2007 in Boland and Crowe, 2012). The population has been calculated to be increasing at an annual rate of 5.1 percent overall (Boland and Crowe, 2012). Internationally, the population trend also shows increases (Wetland International, 2012). Overall, the data would suggest that the population at Carlingford is also increasing.

6.16 It is not anticipated that Light-bellied brent geese would be negatively impacted by the renewal of existing licencing for oyster cultivation in Carlingford Lough.

6.17 With respect to licencing of new applications, however, there are a number of areas of uncertainty. These include: -

- Potential for increased levels of activity and infilling to negatively impact on early season use of eelgrass beds north of Greenore. In particular the risk of increased usage of access tracks could result in displacement of birds and loss of foraging time. The importance of eelgrass to

birds early in the season and potential for use by birds using Carlingford Lough as a stopover before continuing to migrate to site further south is of note.

- Interestingly in the Martin (2011) survey, geese were observed on nearly 100% of all counts in Zone 2; compared to 33%-56% in Zone 1. This may reflect the relative value of these sites for geese and the presence of eelgrass in Zone 2; but could also be influenced by the much larger area of intertidal habitat behind the trestles in Zone 2 (allowing geese to maintain a comfortable buffer distance between them and trestles while workers are on site). The risk that infilling with trestles towards the shoreline might displace birds from foraging in Zone 1 and 2 and in utilising the eelgrass in Zone 2 cannot therefore be fully discounted.

6.18 It is recommended that a programme of monitoring of numbers and spatial distribution of Light-bellied brent geese be implemented in Carlingford Lough. As part of this the use of trestles for foraging should be investigated; looking at frequency of use; numbers feeding; timing during the tidal cycle and seasonality. The objective would be to provide a more quantitative understanding of the degree that trestles provide foraging opportunities for Light-bellied brent geese and to what degree this can compensate for habitat loss.

6.19 Incidents of disturbance should also be recorded. This should consider issues such as response to tractors using the access lanes and response to workers. When workers are on site how close do brent geese forage to trestles. This would help to inform the decision on new applications and the degree to which infilling and extension towards the shore might negatively impact upon geese.

6.20 Monitoring should also look at patterns of use of eelgrass within the lough. There is an ongoing programme of colour ringing Light-bellied brent geese which would allow for the identification of individual birds. This can also assist with looking for patterns of turnover of individuals early in the season, which will in turn give a greater understanding of the numbers of birds using Carlingford Lough during autumn migration; over-winter and during spring migration.

6.21 Any such programme may need to be implemented in co-operation with the Loughs Agency.

Terns

6.22 As noted above, tern numbers have been declining in recent years at Carlingford Lough. This pattern is at odds with the general trends for terns in Northern Ireland (NIEA comment referenced in AFBI, 2015). The decline was attributed to wet weather, high tides, predation by Black-headed gulls (Wolsey, 2011; 2012) as well as disturbance, food availability, winter mortality and shifts in breeding populations outside of Carlingford Lough (Cook et al. 2013). Active conservation measures are currently in place at these sites.

6.23 There is no spatial overlap between the proposed aquaculture sites and the nesting sites on islands at the mouth of Carlingford Lough. Access by boat and tractor will also not result in disturbance of birds nesting on these islands. The minimum distance between aquaculture sites and nesting terns would be from sites south of Greenore and Green Island; ca. 1.3km. This increases to ca. 1.8km to Block House Island. This is well outside the buffer distance of 500m used by AFBI, 2015. Published buffer distance quoted by AFBI, 2015 included 100 m (Rodgers and Smith, 1997), 180 m (Rodgers and Smith, 1995) and 200 m (Erwin 1989) (see also Burger, 1998). These were used to infer that activities at an intertidal aquaculture site over 500 m from Tern nest sites are unlikely to cause significant negative impacts on this feature of the SPA (AFBI, 2015). The proposed aquaculture activities at sites south of Greenore are therefore well outside this distance. Access will be from the shoreline as shown on Figure 3.7, and not by boat.

6.24 Furthermore, both Common Tern and Sandwich Tern routinely forage close to areas of human activity; and in the case of Common Tern regularly nest on man-made structures, such as in Dublin Port; rafts on the Lagan in Belfast etc. Disturbance to nesting terns from current proposals to cultivate oysters is not anticipated.

6.25 Both species feed in shallow inshore waters and in the case of Sandwich Tern also in offshore waters. Maintenance works on oyster trestles / bags occur during periods of low tide when terns would not be foraging over these area. At high tide no works take place over trestles; works would however, take place over mussel beds in the inner lough (see below).

6.26 While Sandwich Tern also feeds in subtidal waters; the main period of operation on mussel beds is presented in Table 3.3. The location and scale of operations proposed will not impact a significant proportion of the area of suitable subtidal foraging habitat used by Sandwich Tern; the latter can feed as far as 50km from their nesting site; or by Common Terns. Sandwich Tern differ from other terns in that pre-laying activity tends to takes place away from the breeding site. Most chicks hatch in late May – early June (incubation – 25 days); and fledge in late June to July (fledging – 29 days). Egg laying can be highly synchronised and is likely to be in May in Carlingford Lough. As can be seen in Table 3.3 levels of activity on the mussel beds is predicted to be *Low* during these months, compared to months when both Sandwich Tern and Common Tern would be absent from the lough. Most harvesting activity is predicted to be *High* from August – December and in January / February. These patterns of activity would also minimise the risk to nesting Common Tern. However, as noted terns routinely forage in areas with high levels of anthropogenic disturbance; displacement of foraging birds is not anticipated.

6.27 Wilson *et al*. 2014 published a report Quantifying usage of the marine environment by terns Sterna sp. around their breeding colony SPAs. While no specific tracking data was available for Carlingford Lough, predicted tracks were modelled. Predicted usage was highest around the colony at Green Island, with decreasing activity at increasing distances. The model predicted low levels of foraging activity in the Inner Lough- where mussel cultivation is based, (for both Common Tern and Sandwich Tern) with most activity south of Killowen Point.

6.28 It is considered unlikely that increases in mussel density would impact negatively on fishes and prey availability for foraging terns. In fact, it is possible that fish production/abundance would increase. The mussel, 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 in the case of oysters, *Crassostrea virginica* in the US (see Lenhert and Allen, 2002; Scyphers, et al., 2011; Tolley and Volety, 2005).

Conclusion

6.29 It is not anticipated that licencing of the mussel or oyster cultivation licences would negatively impact upon tern species for which Carlingford Lough SPA (UK9020161) has been designated.

7. Cumulative Impacts

7.1 This section presents an assessment of potential cumulative impacts from intertidal oyster cultivation in combination with other activities.

Cross Border Impacts

7.2 Cross border impacts on Carlingford Lough SPA (UK9020161) have been considered above.

7.3 In 2015 the Agri-Food and Bioscience Institute published a *Cumulative Impact Assessment: Aquaculture activities within and adjacent to Natura 2000 designated sites in Carlingford Lough*. The concluded that current patterns of aquaculture activity, both North and South, were not negatively impacting upon Carlingford Lough.

Industrial Activity

7.4 Industry Activity is minimal around Carlingford Lough but Greenore and Warrenpoint are significant commercial freight ports.

7.5 In order to ensure adequate clearance for commercial vessels Warrenpoint Harbour authority undertakes periodic capital and maintenance dredging. The last major maintenance dredging was conducted in 2011/12 with a campaign normally required every 5 to 6 years using a Trailing Suction Hopper Dredger. The volume of maintenance material has varied between 270,000m³ and 390,000m³. The volume has increased in part due to several capital dredging campaigns between 2005 and 2008.

7.6 Dredge material is deposited at an offshore licenced disposal site (ca. 11km offshore). Warrenpoint Harbour was examining the feasibility of establishing an in-lough disposal site; a proposal being opposed by the aquaculture industry and environmental groups. The proposal included plans to investigate the viability of dumping dredged material near the mouth of the lough instead of the more expensive practice of taking it much further out to sea for disposal. These plans have recently been abandoned due to environmental concerns[25].

Fisheries

7.7 Traditional commercial fisheries of herring (*Clupea harengus*) and oyster (*Ostrea edulis*) collapsed in the 19th century, but the cultivation of pacific oyster (*Crassostrea gigas*) and edible mussel (*Mytilus edulis*) amongst other species have created a new growth industry exporting largely to the European market. Extensive crab (*Cancer pagarus*) and lobster (*Homarus gammarus*) potting also occurs in the lough and on the adjacent outer coast.

7.8 Winkle (*Littorina littorea*) picking is common with local sources stating that 3-6 winkle pickers commonly operate along the Co. Louth coast. The winter months of November to March appear to be a key period for harvesting (Cummins *et al*., 2002). This would coincide with Light-bellied brent geese using the shoreline

7.9 A public fishery for mussels occurs in the Narrow water region of the Lough, north of Warrenpoint (i.e. at the northern end of the Lough). The average harvest volume 2015-2017 was 577t (this is

[25] Dundalk Democrat - https://www.dundalkdemocrat.ie/news/home/352710/plans-to-change-dredging-site-on-carlingford-lough-ended.html.

self-reported so the quality of this data cannot be confirmed) and typically a maximum of 6-8 vessels exploit the fishery.

7.10 Some potting of green crab also occurs around the mussel sites principally as a predator control exercise.

7.11 Greenore is known to support a notable population of Black Guillemot (*Cepphus grylle*) nesting on man-made structures (Mitchell *et al.*, 2004). These would not be impacted be proposed aquaculture activities.

7.12 Management of fisheries within the Lough comes under the Loughs Agency.

Water Quality and Shellfish Designated areas

7.13 The high current speed and shallow nature of the Lough mean a short residency time. The tides dominate motion in the Irish Sea and thus Carlingford Lough, influencing the distribution of sediments, nutrients and of areas of water stratification. The greater Carlingford catchment is extensive covering some 590 km^2. The main freshwater input is from the Newry (Clanrye) River which discharges at the head of the Lough, with a relatively low flow rate that can vary from 1m^3 s^{-1} in summer to 9m^3s^{-1} in winter (Ferreira, Duarte and Ball, 1998). Other freshwater discharges include the Ryland, Moygannon, Rostrevor, Whitewater, Ballincurry and Ghan rivers, the majority of which are spate rivers.

7.14 There are a number of sewage discharges to the Lough with treatment facilities located at Newry, Warrenpoint, Cranfield and Carlingford. In addition to these there are a number of additional untreated discharges (Omeath and Greenore) and various other non-point sources associated with agricultural land use, tourism and wildfowl.

7.15 Carlingford Lough (Site Code GBNIIE6NB030) has not been assigned a status under the WFD but recently €3.2 million of European funding has been allocated to SWELL, the Shared Waters Enhancement and Loughs Legacy; this initiative involves a detailed investigation into the causes of water pollution on both sides of the border. The funding award also has the potential to unlock up to an additional €32 million in InterReg funding to improve wastewater treatment.

7.16 Aquaculture areas in the Republic (IE) and Northern Ireland (NI) are designated under the WFD as shellfish producing areas. In Northern Ireland, Carlingford Lough was designated under the Shellfish Waters Directive in 2009 when the existing designations of Ballyedmond and Casey Water were realigned to include all licensed shellfish beds. In Carlingford Lough there are fourteen shellfish farms licensed by DARD within the Shellfish Water Protected Area and one wild shellfish harvesting area at Narrow Water, which is outside the Shellfish Water Protected Area. Carlingford is currently meeting guideline standards and has a 2021 objective - Good Ecological Status & Class B under EU Hygiene Regulations. Current bivalve mollusc production classification status is B for oysters and mussels in the aquaculture areas and a seasonal B/C for the Narrow water fishery EC Regulation 854/2004[26].

7.17 In the Republic the last publicly available data for Shellfish Designation Monitoring relates to 2012, the results of monitoring undertaken at that time indicated that there are water quality issues with faecal coliform levels within / in the vicinity of this shellfish area. The bivalve mollusc production areas in Carlingford Lough are currently classified as 'Seasonal Class A' for razor clams, A for

[26] Regulation (EC) No. 854/2004 of the European Parliament and of the Council lays down specific rules for the organisation of official controls on products of animal origin intended for human consumption.

oysters and Seasonal A mussels and in the outer section of the Lough and as 'B' for mussels in the inner lough for the purposes of EC Regulation 854/2004.

Hunting

7.18 Wildfowling is mainly centred on Mill Bay on the north side of the Lough; Mourne Game and Wildfowl Club (affiliated to the British Association for Shooting and Conservation) (NPWS, 2013a). We have no data on the level of hunting activity along the southern shore.

Recreational Pressures

7.19 Pressures from recreational activities include recreational boating; walking (notably with dogs); sea angling along the shoreline and wildfowling (see above). The shoreline from Carlingford to Omeath is designated as a scenic area (Louth County Council, 2009) and hence is popular amongst visitors and walkers.

Other disturbances

7.20 Other sources of disturbance noted by Martin (2011) and referenced in NPWS (2013a) included traffic along local roads; sailing and shipping have the potential to be disturbing, but boat traffic was minimal during the winter months when Light-bellied brent geese use the shoreline; loose dogs and predatory birds hunting over the lough.

Potential impacts

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

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

Activities affecting waterbird food resources

Bait digging and shellfish collecting

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

7.24 NPWS (2013) Conservation Objective Supporting document notes that hand gathering of molluscs occurs and appears to be increasing often with associated disturbance from quad bikes. We have insufficient information on the frequency and distribution of these pressures in Carlingford Lough to comment further.

Effluent discharge

7.25 Organic and nutrient inputs to estuaries increase productivity and may increase food resources for waterbirds. Therefore, adverse impacts to waterbirds might be expected to be caused by declines in organic and nutrient inputs associated with improvements in wastewater treatment There are a number of studies that document the effects of organic and nutrient loading from effluent discharges on the benthic fauna and typically the zones affected by individual discharges are restricted to within a few hundred metres of the outfall (Burton *et al*., 2002). The available evidence on the effects of nutrient reductions on estuarine waterbird populations is limited but, to date, no significant impacts have been reported (Burton *et al*., 2002, 2003). One study (Alves *et al*., 2012) has reported localised (within 100 m) association between wastewater inputs and bird distribution; in this study the outfalls discharged in the intertidal zone and streams of sewage ran across the intertidal habitat. The growth of green algae with a bay / lough can be heavily influence by the pattern of nutrient discharge to the bay, including diffuse discharge from agricultural sources. However, as noted Carlingford Lough is shallow and characterised by high current speeds; resulting in a short residency time. It is therefore likely that nutrients pass quickly out of the lough. Paragraph 3.16-3.20 summarises discharges and water quality. A waste water treatment plant / discharge is located at Omeath, Greenore and Carlingford. Irish Water is progressing a project to upgrade the Omeath Sewerage Scheme to stop the discharge of untreated wastewater into Carlingford Lough (due for completion in 2020). It should also be noted that any new waste water infrastructure developments must be subject to their own Appropriate Assessment[27]. In recent years plants required to implement Pollution Reduction Programme for Shellfish waters included Greenore, Carlingford and Omeath.

[27] Irish Water (n.a.). Natura Impact Statement to inform the Appropriate Assessment of the Proposed Sewerage Scheme at Omeath, Co. Louth.

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