

Habitats Regulations Assessment: Test of Likely Significance

**Assessment of potential impacts of the
proposed amendments to shellfish aquaculture
site C15 on the designated features of
Carlingford Lough SPA**

**Prepared by AFBI Fisheries and Aquatic Ecosystems Branch for the
Department of Agriculture and Rural Development**

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Introduction

The Fisheries and Environment Division of the Department of Agriculture and Rural Development (DARD) commissioned AFBI to update the Habitat Regulations Assessment (HRA) report for aquaculture site C15 within the Carlingford Lough Special Protection Area (SPA) in Northern Ireland to take into account a proposed amendment to the Fish Culture Licence (FCL). This document therefore assesses the potential impacts of aquaculture activities resulting from the proposed licence amendment at site C15 on the designated features and conservation objectives of the Natura 2000 designated site outlined above. This document should be read in conjunction with the original HRA for site C15 (AFBI 2013, Annex I). This assessment is based on information supplied by DARD, the Royal Society for the Protection of Birds (RSPB), the Wetlands Bird survey (WeBS), the Northern Ireland Environment Agency (NIEA), the Loughs Agency, through site visits, and through information provided by the applicant.

Carlingford Lough is a sea lough at the mouth of the Newry (or Clanrye) River on the east coast of Ireland, bordering both the Republic of Ireland (county Louth) and Northern Ireland (counties Down and Armagh). The upper reaches of the lough are dominated by fine muddy sand beds and intertidal mud-flats, whilst the seaward entrance to the lough is a mixture of boulder, cobble and bedrock forming numerous small islands and reefs. The areas of Carlingford Lough within Northern Irish jurisdiction have been designated as a SPA, an Area of Special Scientific Interest (ASSI), an Area of Outstanding Natural Beauty (AONB) and a RAMSAR site (as designated under the Convention on Wetlands of International Importance (also known as the Ramsar Convention)). The areas of Carlingford Lough within Southern Irish jurisdiction have been designated as a Special Area of Conservation (SAC), a SPA and a proposed Natural Heritage Area. Natura 2000 data forms list designated features as being classified either A, B, C, D, E etc. Only those features classified as either A, B, or C are considered as Natura 2000 features and need to be taken into consideration within impact assessments (Northern Ireland Environment Agency (NIEA) Competent Authority Habitat Regulations Assessment template).

In order to undertake a systematic assessment of the potential impacts of the proposed amendment to the FCL at site C15 on the features of the Carlingford Lough SPA the GIS programme ArcGIS 10 had been utilised.

Current aquaculture activities within the Northern area of Carlingford Lough

In the Northern side of Carlingford Lough the DARD Fisheries and Environment Division is responsible for the granting of FCL's, shellfish fishery licences and marine fish fishery licences under the Fisheries Act (Northern Ireland) 1966.

There are currently fourteen licensed aquaculture sites on the Northern side of Carlingford Lough. One is licensed for the intertidal trestle culture of Pacific oysters (*Crassostrea gigas*), four are licensed for the intertidal trestle culture of Pacific oysters (*Crassostrea gigas*) and native oysters (*Ostrea edulis*), three are licensed for the bottom culture of mussels (*Mytilus edulis*) and native oysters (*Ostrea edulis*) and six are licensed for the bottom culture of mussels (*M. edulis*). Records of exports of shellfish from Carlingford Lough aquaculture beds and imports of shellfish onto licensed aquaculture sites in Carlingford Lough for the period 2010 to present indicate that not all of the sites licensed for aquaculture are at present actively producing shellfish.

Assessment under Article six of the Habitats Directive

In accordance with Council Directive 92/43/EEC, the Department of Agriculture and Rural Development (DARD) has considered whether the project, plan or proposal either alone or in combination (neither being directly connected with or necessary to the management of the site) is likely to have a significant effect on the Natura 2000 site.

Screening Matrix: Application for an amendment to licensed aquaculture site C15 within Carlingford Lough.

Name of Project or Plan.	Application for an amendment to Licensed aquaculture site C15 within Carlingford Lough.
Name and location of Natura 2000 site (s)	<p>Carlingford Lough Special Protection Area</p> <p>Area: 827.12 hectares Grid Reference: J230129 Date Classified: 09/03/98</p> <p>See Figure 1 for a map of the site boundary.</p> <p>Carlingford Lough is a sea lough at the mouth of the Newry (or Clanrye) River on the east coast of Ireland bordering both the Irish Republic (county Louth) and Northern Ireland (counties Down and Armagh). The upper reaches of the lough are shallow and dominated by fine muddy sand beds and intertidal mud-flats, whilst the seaward entrance to the lough is a mixture of boulder, cobble and bedrock forming numerous small islands and reefs.</p> <p>The SPA lies between Killowen Point and Soldiers Point on the northern shores of the lough and the landward boundary is entirely coincident with that of the Carlingford Lough Area of Special Scientific Interest (ASSI). The SPA boundary includes all lands and intertidal areas seawards to the limits of territorial waters. Marine areas below mean low water are not included.</p> <p>Figure 2 shows the boundaries of the other designated sites within Carlingford Lough.</p>
Natura 2000 site features:	<p>This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:</p> <p>During the breeding season; <u>Common Tern</u> <i>Sterna hirundo</i>, 339 pairs representing 10.9% of the all-Ireland breeding population (5 year mean, 1993-1997).</p> <p><u>Sandwich Tern</u> <i>Sterna sandvicensis</i>, 575 pairs representing 13.1% of the all-Ireland breeding population (5 year mean,</p>

	<p>1993-1997).</p> <p>This site was designated before the UK SPA review which was undertaken in 2001 (Stroud <i>et al</i> 2001). During this review an additional qualifying species was identified for this site.</p> <p>As a result of the review described above this site now also qualifies under Article 4.2 of EC Directive 79/409 on the Conservation of Wild Birds by supporting populations of European importance of the following migratory species;</p> <p>Over Winter (non breeding); <u>Light-bellied Brent Goose</u> (<i>Branta bernicla hrota</i>). For the period 1990-1995 the five year peak mean for Light-bellied Brent Goose at this site was 319 individuals which represented 1.6% of the wintering Canada/Ireland population.</p> <p>The Natura 2000 standard data form for this site (site code UK9020161, Annex II) has to date not been updated to include the addition of Light-bellied Brent Goose. However the Northern Ireland Environment Agency (NIEA) has confirmed that this species is legally a designated feature of the Carlingford Lough SPA and should be included in all assessments.</p> <p>This site forms also part of an extended cross-border site which supports internationally important numbers of overwintering Light-bellied Brent Geese <i>Branta bernicla hrota</i>.</p> <p>The extended site also supports nationally important numbers of the following wader species:</p> <p>Oystercatcher <i>Haematopus ostralegus</i> 850 birds (five year mean for 1991/92 to 1995/96) representing 1.7 % of the Irish population.</p> <p>Ringed Plover <i>Charadrius hiaticula</i> 168 individuals (mean period not specified) representing 1.3% of the Irish population.</p> <p>Grey Plover <i>Pluvialis squatarola</i> 58 individuals (mean period not specified) representing 1.5% of the Irish population.</p> <p>Dunlin <i>Calidris alpina</i> 1494 individuals (mean period not specified) representing 1.2% of the Irish population.</p>
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	<p>Redshank <i>Tringa totanus</i> 640 individuals (mean period not specified) representing 2.6% of the Irish population.</p> <p>Although the site supports nationally important numbers of the above species they are not included within the Carlingford Lough SPA designation.</p>
<p>Description of the Project or Plan</p>	<p>The operator of licensed site C15 within Carlingford Lough has applied to the Department of Agriculture and Rural Development for an amendment to the current FCL. The current licence permits the culture of Pacific oysters (<i>Crassostrea gigas</i>) and native oysters (<i>Ostrea edulis</i>) on trestles within the intertidal zone at C15 which is located on the Northern shore of Carlingford Lough (Figures 3 and 4). The proposed amendments are to increase the numbers of trestles permitted from 1,000 (as currently licensed) to 3,000 and include mussels (<i>Mytilus edulis</i>) to the list of species permitted to be cultured.</p> <p>Size and scale</p> <p>The area of the licensed site C15 is approximately 29 hectares. The applicant wishes to increase the number of trestles permitted within this area from 1,000 trestles (3 m x 0.8 m x 0.65 m) to 3,000 trestles (3 m x 0.8 m x 0.65 m) for the culture of Pacific and native oysters.</p> <p>Land-take</p> <p>The applicant is proposing to install 3,000 trestles 3 m x 0.8 m x 0.65 m in dimension which amounts to an area of approximately 7,200 m². The area of site C15 is 29 hectares or 290,000 m² therefore the proposed number of trestles will occupy approximately 2.48% of the current licensed site.</p> <p>Distance to key features of the site</p> <p>Approximately 22 hectares (220,000 m²) of site C15 is within the boundary of the Carlingford Lough SPA (Figure 5). Therefore 7 hectares of the site, which equates to approximately 23.37% of the licensed area, is outwith the SPA boundary. The total area of Carlingford Lough SPA is approximately 830 hectares (8,300,000 m²) so therefore the licensed site occupies approximately 2.65% of the total designated area. The site operator has indicated that they wish to deploy the additional trestles within the lower regions of the site, a portion of which is outside the SPA boundary (Figure 6).</p>
<p>Is the Project or Plan</p>	<p>No</p>

<p>directly connected with or necessary to the management of the site (provide details)?</p>	
<p>Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.</p>	<p>The proposal is for an amendment to increase the number of trestles deployed at licensed aquaculture site C15 within Carlingford Lough and to add mussels (<i>Mytilus edulis</i>) to the list of species permitted to be cultured. The current FCL permits up to a maximum of 1,000 trestles to be deployed at the site and the site operator now wishes to increase this to up to a maximum of 3,000 trestles. These trestles will be placed as far out beyond the normal low water mark as possible in order to obtain maximum water coverage. The operator is proposing to culture mussels within some of the additional trestles alongside the Pacific (<i>Crassostrea gigas</i>) and native (<i>Ostrea edulis</i>) oysters already permitted. Pacific oysters cultured at this site are sourced from hatcheries and it is proposed that mussels will be cultured from naturally collected spat.</p> <p>The operator has estimated that the additional trestles will enable an annual production of approximately 24 tonnes of oysters and approximately 18 tonnes of mussels to be produced from the site.</p> <p>The operator has stated that servicing and maintenance activities at site C15 will not change as a result of the increase in trestle number (see AFBI 2013, Annex I for further information). The maximum time on site undertaking servicing and maintenance activities by two individuals will be between 24 - 30 hours per month spread over 7 low tides.</p> <p>The proposed additional trestles will be placed at the low end of the intertidal area minimising their visual impact and maximising the immersion of the shellfish.</p> <p>Access to the site will not change as a result of the proposed amendments (see AFBI 2013, Annex I for further information).</p> <p>The timing of seeding and harvesting activities at the site will not change as a result of the proposed amendments (see AFBI 2013, (Annex I of this report) for further information).</p>

Impacts that may occur to the designated features of the Carlingford Lough SPA as a result of the proposed application are:

- Disturbance to bird colonies

Breeding bird species

Carlingford Lough SPA is designated for breeding populations of two tern species, Sandwich Terns and Common Terns. These birds breed on three islands near the mouth of the Lough which are monitored annually by the Royal Society for the Protection of Birds (RSPB) (Figure 7).

The boundary of licensed site C15 will not change as a result of the proposed amendments. The number of people, and the time spent onsite will not change as a result of the proposed amendments. As a result of this there will be no additional potential sources of disturbance to breeding birds as a result of the proposed amendments.

Site C15 is approximately 2.3 km (at its closest point) from the islands on which Tern species breed within Carlingford Lough (Figure 7).

Overwintering bird species

The Carlingford Lough SPA is also designated due to the presence of overwintering populations of light bellied Brent Geese. Light Bellied Brent Goose numbers within Carlingford Lough are counted annually through the Wetland Bird Survey (WeBS) Wildfowl and Wader Core Counts. Figure 8 shows the WeBS count data for the Light Bellied Brent Goose population within Carlingford for the winters of 1989/90 to 2013/14 (Holt *et al* 2015). WeBS core count data are collected at high tide.

As stated above the level of human presence at the site (in terms of number of people and time spent onsite) will not change as a result of the proposed amendments. The timings of seeding and harvesting will also not change as a result of the proposed amendments. The route used to access the site will not change as a result of the proposed amendments.

The preferred food of Brent Geese is intertidal eelgrass (Owen and Black 1990, Hassall and Lane 2005, Inger *et al.* 2006). NIEA mapped the distribution of intertidal eelgrass on the Northern shores of Carlingford Lough in 2012 and

observed that eelgrass beds were confined to a small portion of the Mill Bay area of the Lough (Figure 9).

When investigating prey choice in the Brent goose populations within Strangford Lough (Northern Ireland) Inger *et al.* (2006) state that the “depletion of *Zostera* leads an increasing proportion of the population to seek alternative food sources”. These alternative food sources are cited as being green algae, saltmarsh plants and terrestrial grassland (Owen and Black 1990, Mathers and Montgomery 1997, Hughes and Green 2005, and Inger *et al.* 2006).

Previous surveys of this area (AFBI 2013) confirmed that the access route and site boundary were free from eelgrass and green algae. The proposed additional trestles will be deployed within the boundary of the current licensed site. AFBI Scientific Staff undertook a site survey of the area within which the operator wishes to deploy the additional trestles in January 2015 (see report in Annex III) and determined the area to be free of both eelgrass and green algal species.

- Removal of a feeding area for birds.

Breeding bird species

Terns are surface feeding seabirds (Furness and Tasker, 2000; Einoder, 2009) who feed primarily on fish species (Comeau *et al* 2009; Burger and Gochfeld 2003 and Cramp and Simmons, 2004 (cited in Christel *et al* 2013)). The proposed amendment to trestle numbers at aquaculture site C15 will therefore not impact on the feeding and foraging areas of Tern species within the Carlingford Lough SPA.

Overwintering bird species

The proposed increase in trestle numbers at this site has the potential to cause disturbance to Light Bellied Brent Goose populations through human presence in the intertidal areas within which they are feeding.

Surveys undertaken in 2009 by DARD and AFBI (before the site was licensed), the NIEA eelgrass surveys in 2009 and 2012, and the 2015 AFBI survey did not find any eelgrass or green algae within the boundary of licensed site C15.

The proposed trestles will be placed on the lower shore in an area that will not be readily available as a feeding area for bird species as it is only expected to be exposed at very low tides. When the site is exposed Light Bellied Brent

	<p>Geese will be able to forage under, on and around the trestles.</p> <p>Preliminary studies on the effects of oyster trestles on bird feeding behaviour found that the percentage of birds observed feeding did not differ between the reference areas (free of aquaculture) and the trestle areas (Hilgerloh <i>et al</i> 2001). For some species of bird the trestles provided an additional food source. Hilgerloh <i>et al.</i> (2001) witnessed Wigeon (<i>Anas penelope</i>) feeding on green algae growing on trestles and noted that Brent Geese (<i>Branta bernicla</i>) have been observed showing similar behaviour within estuaries.</p> <p>Gittings and O'Donoghue (2012) investigated the effects of intertidal oyster aquaculture on the distribution of waterbirds within six sites in Ireland. Gittings and O'Donoghue (2012) state that "detectable disturbance impacts to birds were only observed occasionally and were usually minor (birds which flushed but resettled nearby)" and at some sites Light bellied Brent Geese were observed feeding on top of the oyster trestles. Within these investigations Gittings and O'Donoghue (2012) found that Light Bellied Brent Geese showed a variable response to oyster trestles.</p> <p>- Spread of a non native species</p> <p>The proposed additional species (<i>Mytilus edulis</i>) is native to the UK and seed will be ongrown from naturally collected spat.</p> <p>To date there are no reported feral populations of <i>Crassostrea gigas</i> present within Carlingford Lough.</p> <p>In order to minimise the risk of this non native species escaping and reproducing in the wild good husbandry practices should be followed at this site all times and only sterile Pacific oysters should be permitted to be cultured within site C15.</p> <p>- Pseudofaeces deposition under trestles.</p> <p>The bioaccumulation of pseudofaeces and faeces beneath the proposed additional intertidal trestles has the potential to impact benthic community structures. Within the scientific literature these impacts are generally considered to the small scale and localised (Nuges <i>et al</i>, 1996; Forrest and Creese 2006; Forrest <i>et al</i>, 2009 and the literature reviewed</p>
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	<p>within). Nuges <i>et al</i> (1996) studied the environmental impacts of Pacific oyster trestle culture in the River Exe estuary in Devon and noted small but detectable changes in benthic communities and sedimentation levels beneath trestles. Although sedimentation levels beneath the trestles were twice those in the control areas, they were not found to be statistically significant. Increased sedimentation beneath Pacific oyster trestles was observed by Forrest and Creese (2006) in a New Zealand estuary however, impacts from oyster culture was not noted 35 m from the sites. Forrest and Creese (2006) also noted that “effects on macrofauna were not severe enough to produce a marked trend in species richness”.</p> <p>The proposed additional trestles to be deployed at this site will be the same as those currently used by the operator. These trestles are approximately 0.65 m above the ground. This ensures that there is adequate circulation around the trestles and reduces sedimentation beneath them.</p> <p>In order to ensure that any changes in benthic sediments and communities remain small (i.e. not statistically significant) and localised a programme of monitoring within and adjacent to this intertidal aquaculture site will be established.</p>
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<p>N2K Feature: Mention all features</p>	<p>Describe any likely direct, indirect effects to the N2K features arising as a result of: Loss, reduction of habitat area; disturbance; habitat or species fragmentation; reduction in species density; changes in key indicators of conservation value (e.g. water quality, climate change).</p>	<p><u>*Effect Significant/Not Significant? Why?</u></p>
<p>Common Tern</p>	<p>Aquaculture activities have the potential to cause disturbance through human presence within nesting areas and damage/disturbance to feeding areas/species.</p>	<p>The proposed increase in the number of trestles deployed and the addition of mussels to the species cultured within licensed site C15 will not cause disturbance to nesting Terns or impact on prey availability for fish eating Tern species.</p> <p>Therefore this application for an</p>

		amendment to licensed site C15 will not negatively impact breeding Common Tern populations within Carlingford Lough.
Sandwich Tern	Aquaculture activities have the potential to cause disturbance through human presence within nesting areas and damage/disturbance to feeding areas/species.	<p>The proposed increase in the number of trestles deployed and the addition of mussels to the species cultured within licensed site C15 will not cause disturbance to nesting Terns or impact on prey availability for fish eating Tern species.</p> <p>Therefore this application for an amendment to licensed site C15 will not negatively impact breeding Sandwich Tern populations within Carlingford Lough.</p>
Light bellied Brent goose	Aquaculture activities have the potential to cause disturbance through human presence within preferred habitats and damage/disturbance to feeding areas/species.	<p>Studies on the impacts of oyster culture on waterbirds found that Light Bellied Brent Goose showed a variable response to oyster trestles and were observed feeding on top of the trestles at some sites.</p> <p>During surveys of the area inside the site boundary within which the applicant has indicated he wishes to deploy the proposed additional trestles no eelgrass or green algal species (the primary food source of Light Bellied Brent Geese) were observed.</p>

Describe any potential effects on the Natura 2000 site as a whole in terms of: interference with the key relationships that define the structure or	<p>Aquaculture activities have been undertaken within licensed site C15 since October 2013. To date no negative impacts of activities at this site on the designated features of the Carlingford Lough SPA have been reported/recorded.</p> <p>Proper management of aquaculture activities within site C15</p>
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function of the site	<p>will ensure that interference to the key relationships that define the structure of the site will be unlikely.</p> <p>Two of the bird species for which the site is designated feed on fish species and therefore do not forage in the intertidal zone. These species breed on islands approximately 2.3 km from the licensed site and are therefore not likely to be disturbed by human presence within the licensed area. The third species for which the site is designated feeds predominantly on eelgrass, which is absent within the boundary of the licensed site and the surrounding vicinity.</p> <p>Activities resulting from the proposed amendments at licensed site C15 will not negatively impact the conservation objectives of the designated features of the Carlingford Lough SPA.</p>
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Provide details of any other projects or plans that together with the project or plan being assessed could (directly or indirectly) affect the site.	Fast Ferry activity, yachting, pleasure boating, dog walkers, agriculture, bait collectors, seaweed collectors, recreational walkers, sewage discharges, scientific research, other fisheries and other leisure activities.
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Is the potential scale or magnitude of any effect likely to be significant? :	
Alone?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
In-combination with other projects of plans?	Yes <input type="checkbox"/> No <input type="checkbox"/>

List of Agencies / Organisations Consulted: Provide contact name and telephone or email address.	Mr Damian Campbell – DoE Marine Division
Habitats Regulations Assessment Summary	<p>Increasing the number of trestles deployed within aquaculture site C15 in Carlingford Lough has the potential to negatively impact the designated features of the Carlingford Lough SPA. However, it should be noted that this site was licensed in October 2013 and to date no negative impacts of activities at this site on the designated features of the Carlingford Lough SPA have been reported.</p> <p>The islands on which the Tern species within Carlingford Lough breed are approximately 2.3 km from the boundary</p>

	<p>of site C15 at the closest point (see AFBI 2013, Annex III). Fish are the main food source for Tern species. Therefore intertidal shellfish aquaculture will not impact on prey availability for Tern species.</p> <p>In recent years Tern numbers within Carlingford Lough have followed a general pattern of decline. This has been attributed to wet weather, high tides, predation by great black-backed gulls (Wolsey 2011, 2012), disturbance, food availability, winter mortality and shifts in breeding populations outside of the site (Cook <i>et al.</i> 2013).</p> <p>The preferred food of Light Bellied Brent Geese is eelgrass (<i>Zostera</i> spp.). Once eelgrass becomes depleted Light Bellied Brent Geese can switch to feeding on green algae such as <i>Enteromorpha</i> spp and <i>Ulva lactuca</i> (Mathers and Montgomery 1997). No eelgrass or green algal species were observed during surveys undertaken within the boundary of site C15.</p> <p>Studies on the impacts of oyster trestle culture on waterbirds ascertained that Light Bellied Brent Geese showed a variable response to trestles and at some sites they were observed feeding on top of the trestles.</p> <p>Activities resulting from the proposed amendments to aquaculture site C15 will not negatively impact the conservation objectives of the designated features of the Carlingford Lough SPA.</p>
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Conclusion: Is the proposal likely to have a significant effect on an N2K site?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Data collected to carry out the assessment

Who carried out the assessment?	The Agri-food and Bioscience Institute (AFBI) acting on behalf of the Department of Agriculture and Rural Development.
Sources of data	NIEA – eelgrass data WeBS – Core count data for Light bellied Brent Geese in Carlingford Lough Loughs Agency – Carlingford Lough bird data Seabird monitoring programme online database – Tern data DARD – Northern Ireland aquaculture shapefiles AFBI data holdings Site operator
Level of assessment completed	Stage one: Screening
Where can the full results of the assessment be accessed and viewed?	DARD Fisheries Division Dundonald house Belfast

Finding of No Significant Effects Report Matrix

Name of Project or Plan	Proposed amendment to the Fish Culture Licence (FCL) for aquaculture site C15 within Carlingford Lough
Name and location of Natura 2000 site	Carlingford Lough SPA
Description of the Project or Plan	<p>The FCL permitting shellfish culture within site C15 in Carlingford Lough was granted in October 2013. The operators of this site are currently authorised to cultivate Pacific oysters (<i>Crassostrea gigas</i>) and native oysters (<i>Ostrea edulis</i>) in bags on a maximum of 1,000 trestles (3 m x 0.8 m x 0.65 m).</p> <p>The site operator is proposing to increase the number of trestles currently deployed to a maximum of 3,000 (3 m x 0.8 m x 0.65 m) and add the blue mussel (<i>Mytilus edulis</i>) to the list of species permitted to be cultured. The operator is not proposing any change in the boundary of the licensed area or any changes to the husbandry activities currently undertaken at the site.</p>
Is the Project or Plan directly connected with or necessary to the management of the site (provide details)?	No
Are there other projects or plans that together with the project of plan being assessed could affect the site (provide details)?	No

The Assessment of Significance of Effects	
Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site	<p>Increasing the number of trestles deployed within aquaculture site C15 in Carlingford Lough has the potential to negatively impact the designated features of the Carlingford Lough SPA. However, it should be noted that this site was licensed in October 2013 and to date no negative impacts of activities at this site on the designated features of the Carlingford Lough SPA have been reported.</p> <p>Intertidal aquaculture activities resulting from the proposed amendments to site C15 have the potential to cause disturbance to breeding tern populations through an increase in human presence within nesting areas and</p>

	<p>damage/disturbance to feeding areas/species.</p> <p>Intertidal aquaculture activities resulting from the proposed amendments to site C15 have the potential to cause disturbance to Light Bellied Brent Goose populations through increased human presence within preferred habitats and damage to feeding areas and species (e.g. trampling of eelgrass beds).</p>
<p>Explain why these effects are not considered significant</p>	<p>There will not be an increase in human activities at site C15 (in terms of man hour's onsite undertaking husbandry/stocking/maintenance activities) as a result of the proposed increase in trestle number.</p> <p>Site C15 is approximately 2.3 km (at its closest point) from the islands on which Tern species breed within Carlingford Lough. As fish are the main food source for Tern species intertidal shellfish aquaculture will not impact on prey availability.</p> <p>Therefore this application for an amendment to the species cultured and number of trestles deployed within aquaculture site C15 will not negatively impact breeding Tern populations within the Carlingford Lough SPA.</p> <p>Studies on the impacts of oyster culture on waterbirds found that Light Bellied Brent Geese show a variable response to oyster trestles and at some sites have been observed feeding on top of the trestles.</p> <p>No eelgrass or green algal species (the primary food source of Brent Geese) were observed during surveys of the area within the site boundary where the operator is proposing to deploy the additional trestles.</p> <p>Therefore this application for an amendment to the species cultured and number of trestles deployed within aquaculture site C15 will not negatively impact overwintering Light Bellied Brent Geese populations within the Carlingford Lough SPA.</p> <p>The FCL for site C15 was granted in October 2013. To date no concerns have been raised regarding impacts on Light Bellied Brent Geese or Tern populations resulting from current activities at this site.</p>
<p>List of Agencies Consulted: Provide contact name and telephone or email address.</p>	<p>DoE Marine Division NIEA</p>

Response to consultation			
Data Collected to Carry out the Assessment			
Who carried out the assessment	Sources of Data	Level of assessment completed	Where can the full results of the assessment be accessed and viewed?
AFBI	NIEA WeBS Loughs Agency SMP online database DARD AFBI Site Operator	Stage one screening	AFBI Newforge Lane Belfast

Ecological Carrying Capacity

The Sustainable Mariculture in northern Irish Lough ecosystems (SMILE) model is a model used for the collation and processing of scientific information. It enables the application of an integrated framework for the determination of sustainable carrying capacity in the shellfish production areas for which it was developed (namely; Carlingford Lough, Strangford Lough, Belfast Lough, Larne Lough and Lough Foyle). For further information on the SMILE model please see Ferreira *et al* (2007).

For the purpose of this assessment the SMILE model was applied to three scenarios, which simulated the impact on the ecosystem of Carlingford Lough of increasing the abundance of filter-feeding organisms in Carlingford Lough as a result of the proposed amendments to licensed site C15. It should be noted that as a result of previous runs of the SMILE model for this site (AFBI 2013) we recommended that no aquaculture activities be undertaken within the portion of site C15 that is within SMILE model Box 37. Currently there are no trestles deployed within this area and the areas within which the site operator has indicated the additional trestles will be deployed are also outwith SMILE model Box 37. Resultantly no aquaculture activities have been included within model Box 37 for any of the model runs undertaken for this report. Chlorophyll a (Chl a) has been used as a proxy for phytoplankton biomass within Carlingford Lough. The three scenarios represented the levels of Chl a present within the Lough if;

- a) Run 1 - There was no aquaculture within the Lough (only wild species present). This run is used as a baseline as wild species will always be present.
- b) Run 2 – **All** currently licensed aquaculture sites within Carlingford Lough were activated. Current licensed aquaculture sites within the Northern area of Carlingford Lough were activated at their rate of production for the year 2014 (as per data supplied by DARD). Current licensed aquaculture sites within the Southern area of Carlingford Lough were activated at their rate of production as per data supplied during SMILE development. (As wild species is to be used as a baseline this component was also activated for this run).

- c) Run 3 - **All** currently licensed aquaculture sites within Carlingford Lough were activated. Current licensed aquaculture sites within the Northern area of Carlingford Lough were activated at their rate of production for the year 2014 (as per data supplied by DARD). Production levels* within site C15 were increased to account for production of oysters and mussels on the proposed additional trestles. Current licensed aquaculture sites within the Southern area of Carlingford Lough were activated at their rate of production as per data supplied during SMILE development. (As wild species is to be used as a baseline this component was also activated for this run).

* Production figures for mussels were derived from proposed annual production figures supplied by the applicant. Production figures for oysters resulting from the increase in trestle numbers were derived from 2014 import figures for this site. Currently there are 400 trestles on site C15 therefore 2014 import figures were multiplied by a factor of 7.5 to scale production up to the maximum 3,000 trestles proposed.

Analysis of measured data for nutrient levels within Carlingford Lough (taken from Taylor *et al* 1999) shows up to -62% annual variation within Chl a values (using 90th percentile figures) recorded between sampling years. This observed range in Chl a values was between -14% and -62%. From this we would recommend that a minimum of 70%, of baseline values, of Chl a remains within the system available for wild species. This therefore implies that aquaculture activities should not reduce Chlorophyll a concentrations by greater than -30% of baseline values (Run 1). Therefore all boxes with Chl a reduction greater than -30% are highlighted in Tables 1 and 2. The location of licensed aquaculture site C15 in relation to SMILE model Boxes is shown within Figure 10.

As can be seen from Tables 1 and 2 impact (in terms of reduction in Chl a values) was observed in model boxes 26, 27, and 37 within which no aquaculture was undertaken. This is attributed to the knock-on effect of aquaculture activities within adjacent boxes resulting from the movement of phytoplankton by water currents and shifts of water between boxes.

From the results of model Runs 2 and 3 (Tables 1 and 2) it can be seen that increasing the production at site C15 and including the production of mussels at this site had an impact on Chl a availability within all adjacent boxes. This impact is shown in Table 3 and ranged from an increase in the % reduction in Chl a values (from those obtained in Run 2) of 0.04 (Model Box 27) to 0.31 (model Box 31). As

expected the largest impact was observed within Model box 31 within which licensed site C15 is situated.

Changing the production levels and adding mussels within licensed aquaculture site C15 did not result in an increase in the number of model boxes within which the change in Chl a exceeds the -30% threshold. As can be seen from Tables 1, 2 and 3 changing the production levels and adding mussels within licensed aquaculture site C15 had a minor impact (<0.5% increase in Chl a reduction values from Baseline) on Chl a reduction values within adjacent model Boxes.

Table 1: Simulated Chl a values (90th percentile calculated over index period, April to October). Results from Run 1 were used as a baseline and the % change in Chl a is shown to illustrate the impact when filtration by aquaculture species within current licensed sites is taken into account (Run 2). Only those boxes in the vicinity of Site C15 are presented. The turquoise shaded area represents the model boxes with a Chl a reduction greater than -30%. Site C15 is within model box 31.

SMILE box	Species	Run 1	Run 2	% Change
Box 32	mussel	7.03	4.62	-34.27
Box 23	mussel	5.82	3.98	-31.73
Box 27	no	5.71	3.96	-30.55
Box 22	Oys_mus	4.99	3.56	-28.73
Box 26	no	4.40	3.39	-22.91
Box 31	Oys_mus	4.10	3.31	-19.19
Box 24	Oys	3.44	2.87	-16.67
Box 37	no	2.05	1.77	-13.66

Table 2: Simulated Chl a values (90th percentile calculated over index period, April to October). Results from Run 1 were used as a baseline and the % change in Chl a is shown to illustrate the impact when filtration by aquaculture species within current licensed sites and the change in production resulting from increasing trestle numbers within site C15 is taken into account (Run 3). Turquoise shaded areas show the model Boxes in the vicinity of site C15 with Chl a reduction values >-30%.

SMILE Box	Species	Run 1	Run 3	% change
Box 32	mussel	7.03	4.62	-34.35
Box 23	mussel	5.82	3.97	-31.78
Box 27	no	5.71	3.96	-30.59
Box 22	Oys_mus	4.99	3.55	-28.80
Box 26	no	4.40	3.38	-23.01
Box 31	Oys_mus	4.10	3.30	-19.49
Box 24	Oys	3.44	2.86	-16.80
Box 37	no	2.05	1.77	-13.80

Table 3: Change in % reduction of Chl a between Run 2 and Run 3 to illustrate the impact when filtration by aquaculture species resulting from increasing trestle numbers (and hence production) within site C15 is taken into account. Turquoise shaded areas show the model Boxes in the vicinity of site C15 with Chl a reduction values >30%.

SMILE Box	Species	R2 % reduction from R1	R7 % reduction from R1	Difference between R2 and R3 values
Box 32	mussel	34.27	34.35	0.07
Box 23	mussel	31.73	31.78	0.05
Box 27	no	30.55	30.59	0.04
Box 22	Oys_mus	28.73	28.80	0.07
Box 26	no	22.91	23.01	0.10
Box 31	Oys_mus	19.19	19.49	0.31
Box 24	Oys	16.67	16.80	0.13
Box 37	no	13.66	13.80	0.14

Conclusions

Aquaculture activities have been undertaken within licensed site C15 in Carlingford Lough since 2013. During the eighteen months within which this site has been operational no concerns have been raised regarding negative impacts on Light Bellied Brent Geese or Tern populations within Carlingford Lough resulting from activities at this site. The site boundary and site access routes used will not change as a result of the proposed increase in trestle numbers at this site.

The Conservation Objectives for the Carlingford Lough SPA are “To maintain each feature in favourable condition” (NIEA 2015). The Condition Assessment for each site is based on a series of attributes and measures.

For breeding Tern populations (both Common and Sandwich Terns) within the Carlingford Lough SPA the Condition Assessment targets are that there should be no significant decrease in the breeding population against national trends (NIEA 2015).

The proposed amendments to the number of trestles permitted within the boundary of site C15 and adding mussels to the list of species cultured will not result in a significant decrease in breeding Tern population numbers as;

- The proposed aquaculture site is approximately 2.3 km from the Islands within Carlingford Lough on which Tern populations breed.
- Tern species feed mainly on fish therefore intertidal oyster and mussel aquaculture will not impact on the availability of prey species for these birds.
- The decline in Tern populations within Carlingford Lough in recent years has been attributed wet weather, high tides, predation by Black backed gulls (Wolsey 2011 and 2012), disturbance, food availability, winter mortality and shifts in breeding populations outside of the site (Cook *et al.* 2013).

The current status of both the Common Tern and Sandwich Tern populations within Carlingford Lough is Unfavourable (NIEA 2015).

For the Light Bellied Brent Goose population within the Carlingford Lough SPA the Condition Assessment targets are that there should be no significant decrease in the population against national trends (NIEA 2015).

The proposed amendments to the number of trestles permitted within the boundary of site C15 and adding mussels to the list of species cultured will not result in a significant decrease in the Light Bellied Brent Goose population numbers as;

- Licensed site C15 occupies approximately 2.65% of the total area of the Carlingford Lough SPA.
- The proposed 3,000 trestles (each of which is 3 m x 0.8 m x 0.65 m in dimension) will occupy an area of approximately 7,200 m² which equates to approximately 2.48% of the total licensed area.
- The preferred food of Light Bellied Brent Geese is eelgrass of the species *Zostera*. Once eelgrass becomes depleted Light Bellied Brent Geese can feed on green algal species such as *Enteromorpha* spp and *Ulva lactuca* (Mathers and Montgomery 1997). During surveys of the areas within the site boundary where the applicant wishes to deploy the additional trestles no eelgrass or green algal species were observed.
- The proposed trestles will be placed on the lower shore in an area that will not be readily available as a feeding area for bird species as it is only expected to be exposed at very low tides. When the site is exposed Light Bellied Brent Geese will be able to forage under, on and around the trestles.
- Gittings and O'Donoghue (2012) found that Light Bellied Brent Goose showed a variable response to oyster trestles and at some sites investigated they were observed feeding on top of the oyster trestles.
- Light Bellied Brent Geese numbers within Carlingford Lough are relatively stable (NIEA pers comm.).
- From the SMILE model results it can be seen that changing the production levels and adding mussels to licensed aquaculture site C15, resulted in a maximum increase in the % change in Chl a of **less than 0.5%**.

- From the SMILE model results it can be seen that changing the production levels and adding mussels within licensed aquaculture site C15 did not result in an increase in the number of model boxes within which the reduction in Chl a exceeds the 30% threshold.

The most recent Condition Assessment for the Light Bellied Brent Goose population within the Carlingford Lough SPA states that this feature is currently in favourable condition (NIEA 2015).

Recommendations

In light of the information contained within the above sections AFBI have the following recommendations for the management of aquaculture activities within site C15 in light of the proposed amendments to the Fish Culture Licence;

- Operations at the site (access routes used, time spent onsite, maintenance activities etc) should continue at the current level.
- Rows of trestles should be spaced so as to allow adequate water circulation.
- A programme of benthic monitoring (Particle Size Analysis (PSA), sediment carbon, and infaunal samples) at designated stations should be established.
- If monitoring reveals that the licensed activity is having a significant impact on a designated feature the Competent Authority shall adapt the consent to eliminate this impact.
- In order to inhibit the spread of feral populations of Pacific oysters the site should only be stocked with sterile Pacific oysters and all hatchery reared spat should be sourced from hatcheries containing the appropriate health certifications.
- All spat and juveniles must be sourced from areas free from known invasive non native species.

If these conditions are met then based on the information contained within this report we recommend that the proposed amendments to the Fish Culture License at site C15 within Carlingford Lough should be granted by the Department.

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Figures (all maps are projected in ING)

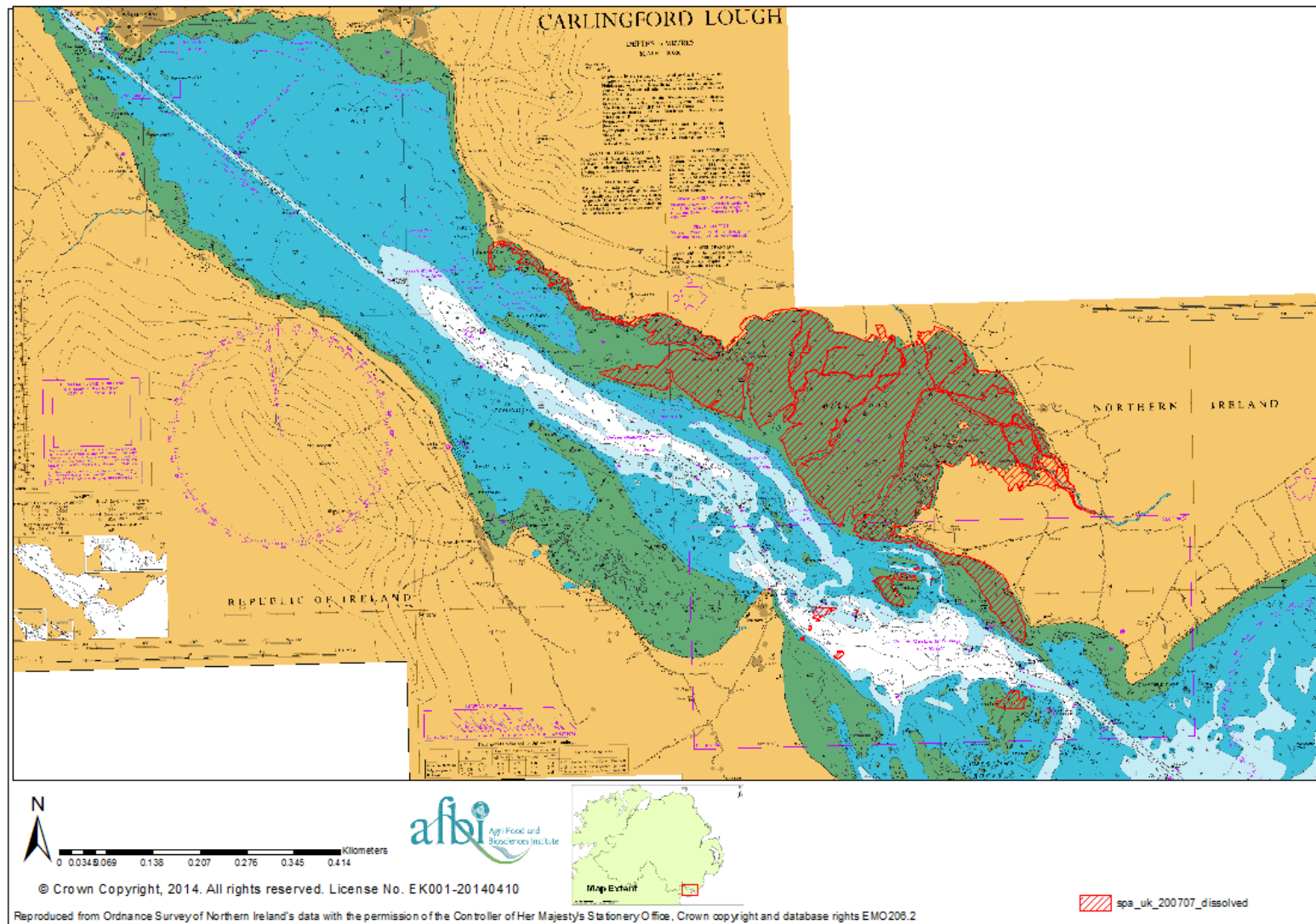


Figure 1: Map showing the boundary of the Carlingford Lough SPA.

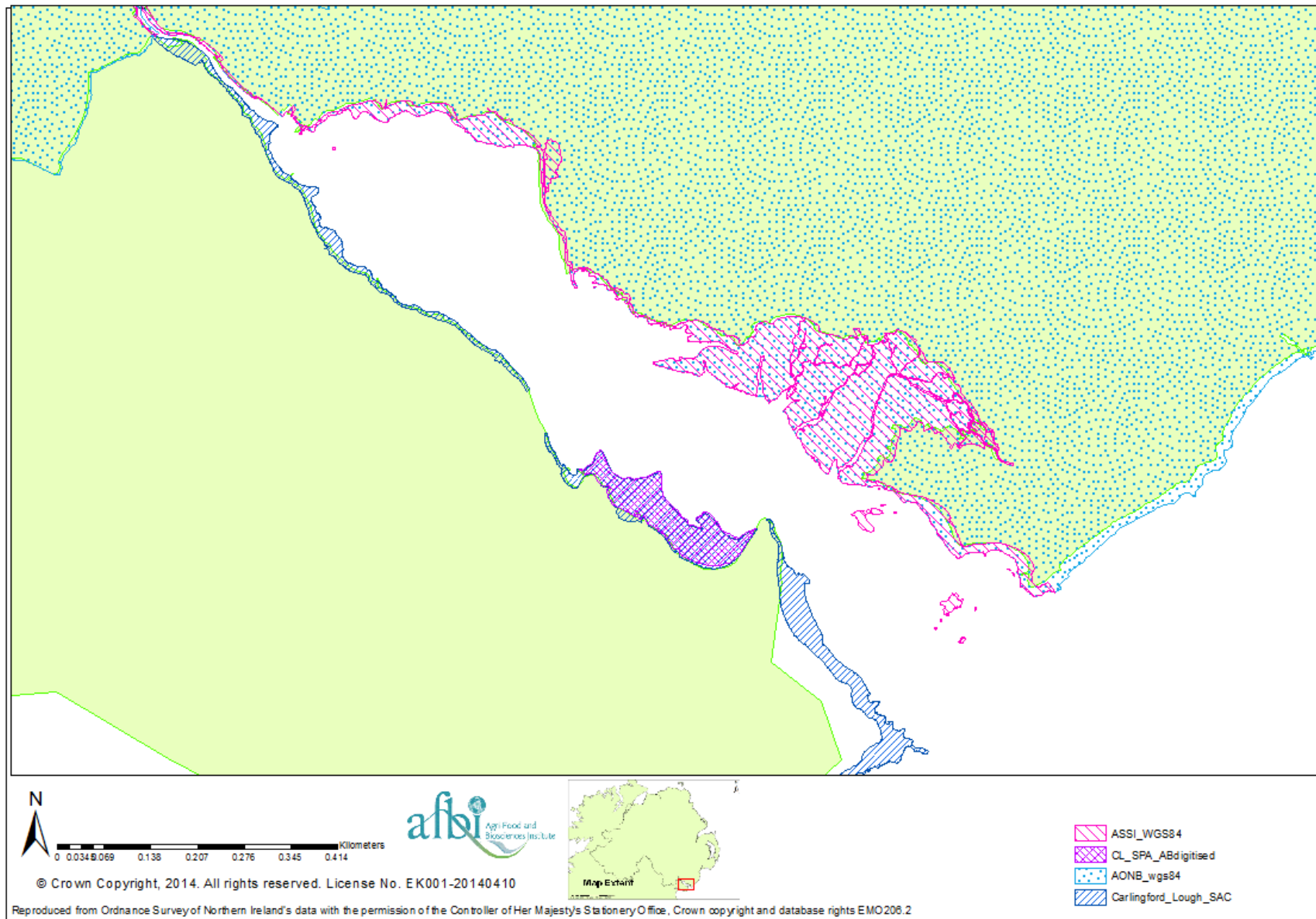


Figure 2: Map showing the boundaries of other designated sites within Carlingford Lough.

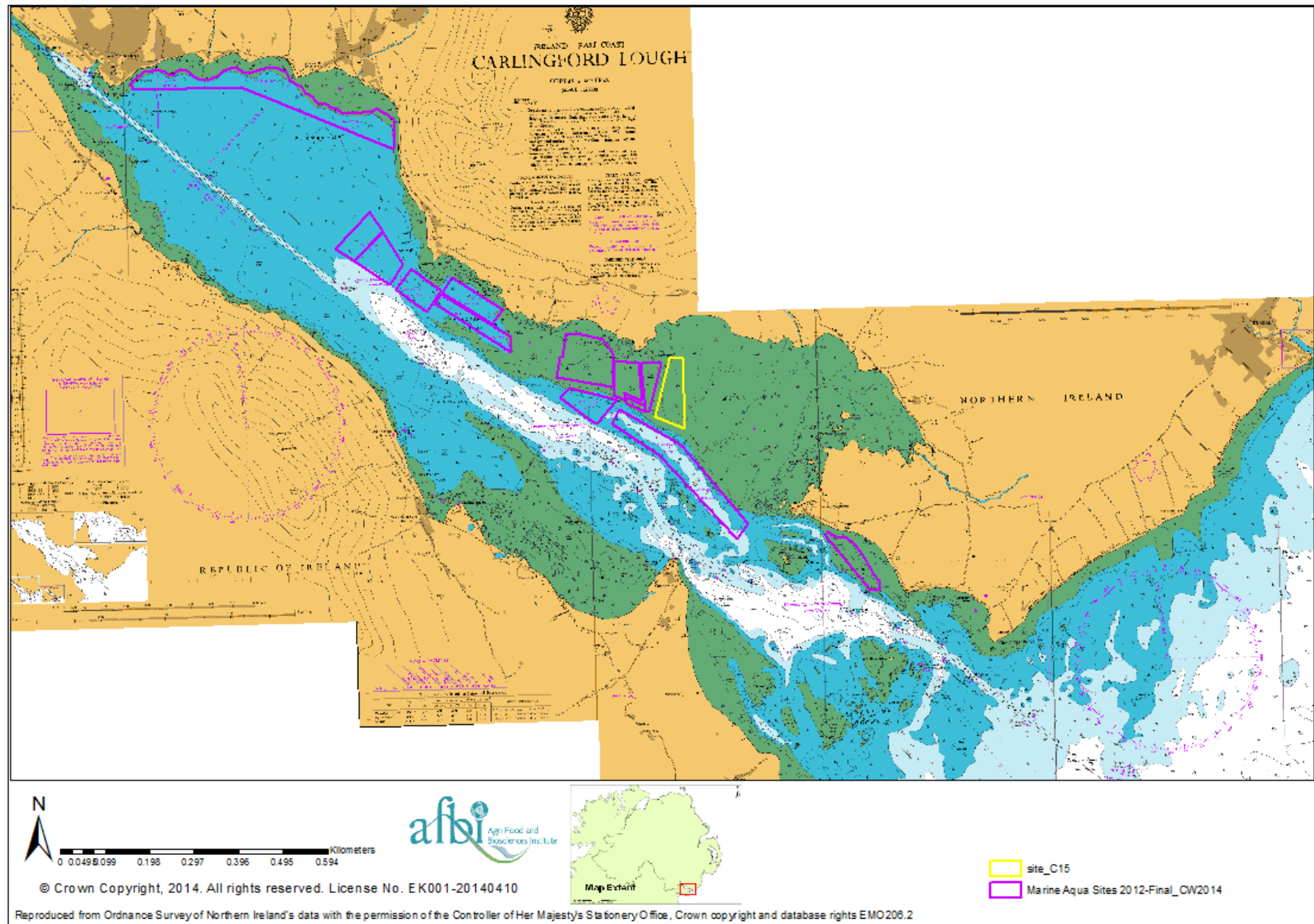


Figure 3: Map showing the location of site C15 (yellow outlined area on the map) within Carlingford Lough.

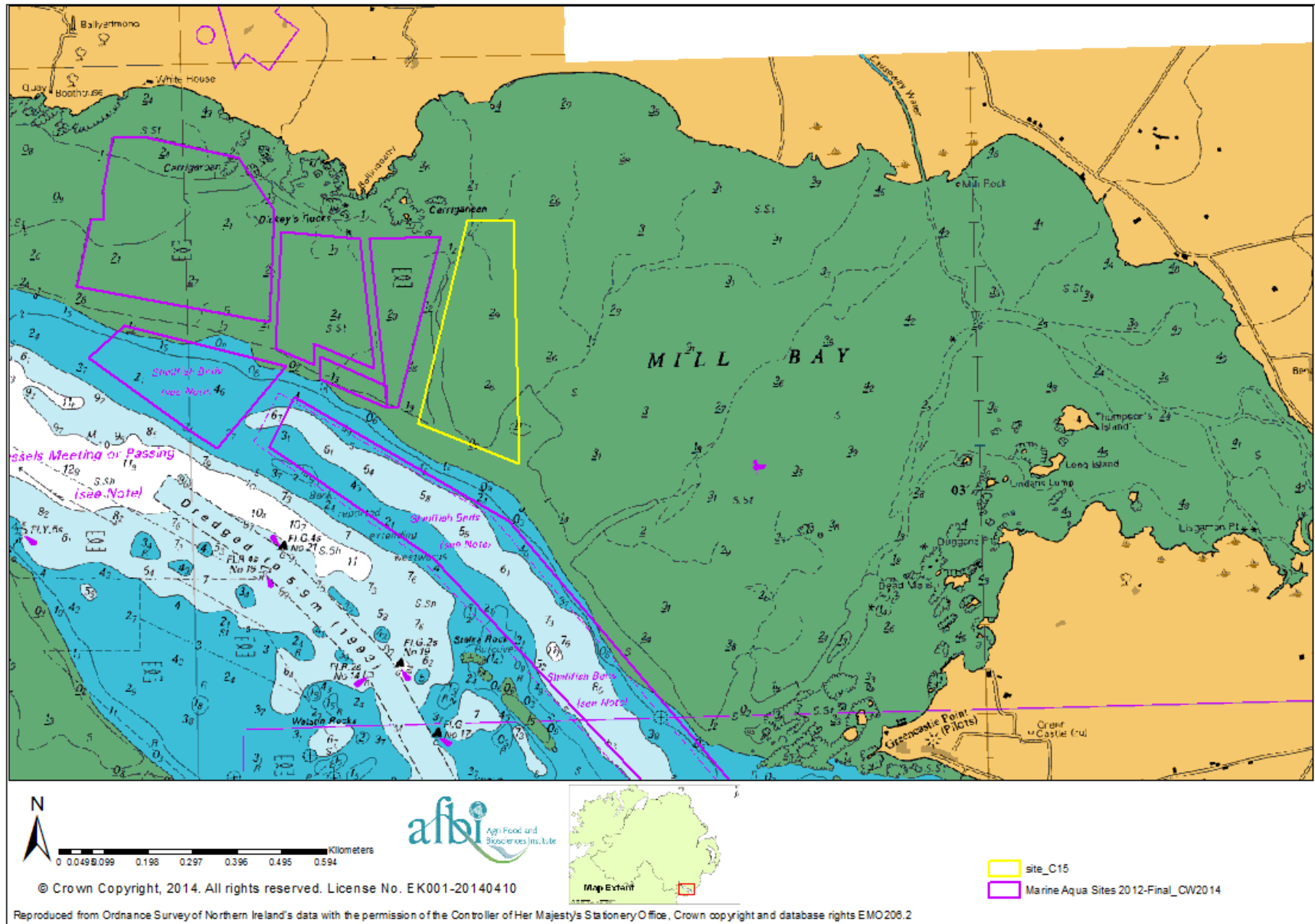


Figure 4: Map showing the location of site C15 (yellow outlined area on map) within the Mill Bay area of Carlingford Lough.

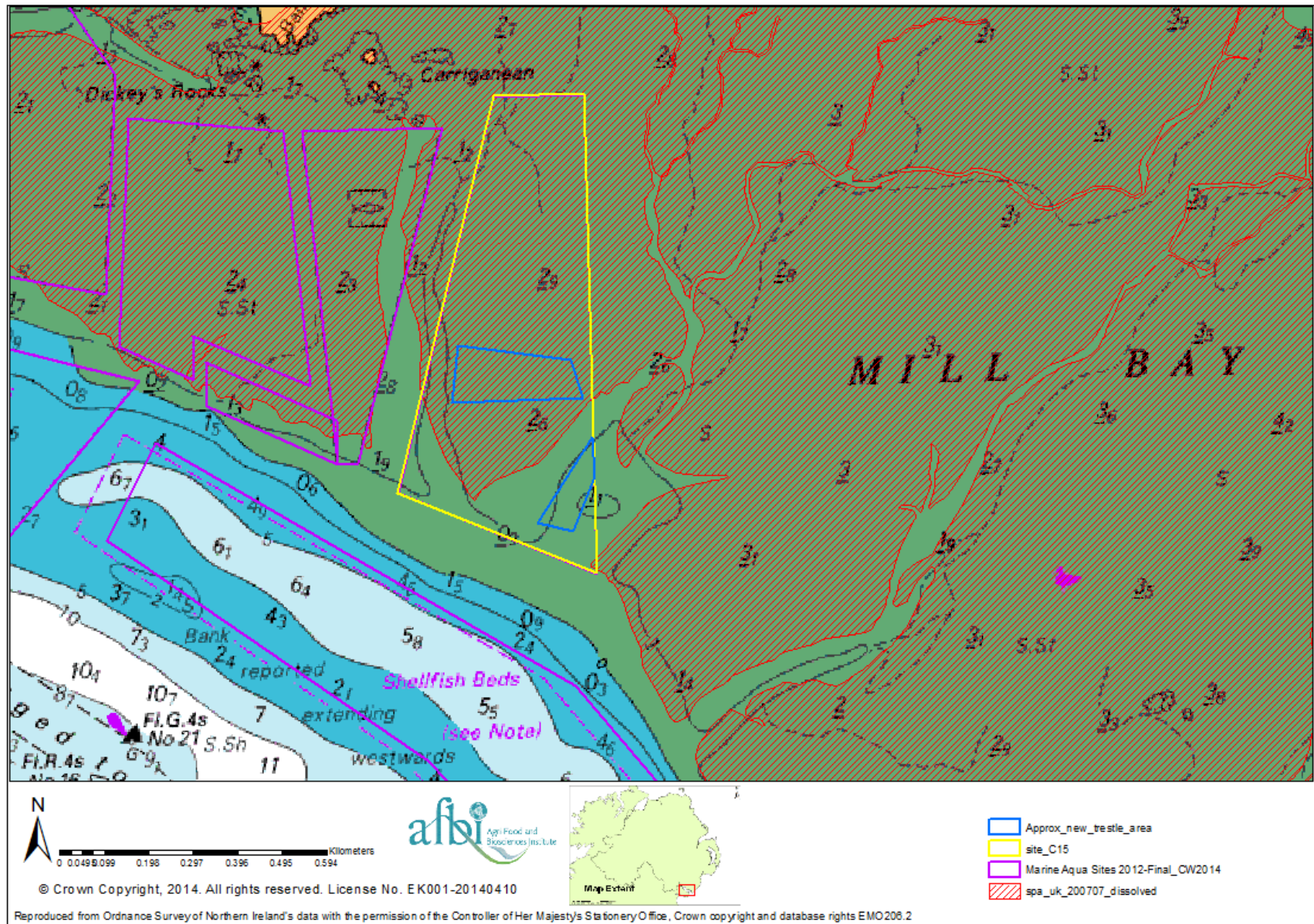


Figure 6: Map showing the approximate location of the areas within which the applicant has indicated the proposed additional trestles will be deployed (blue outlined areas on map).

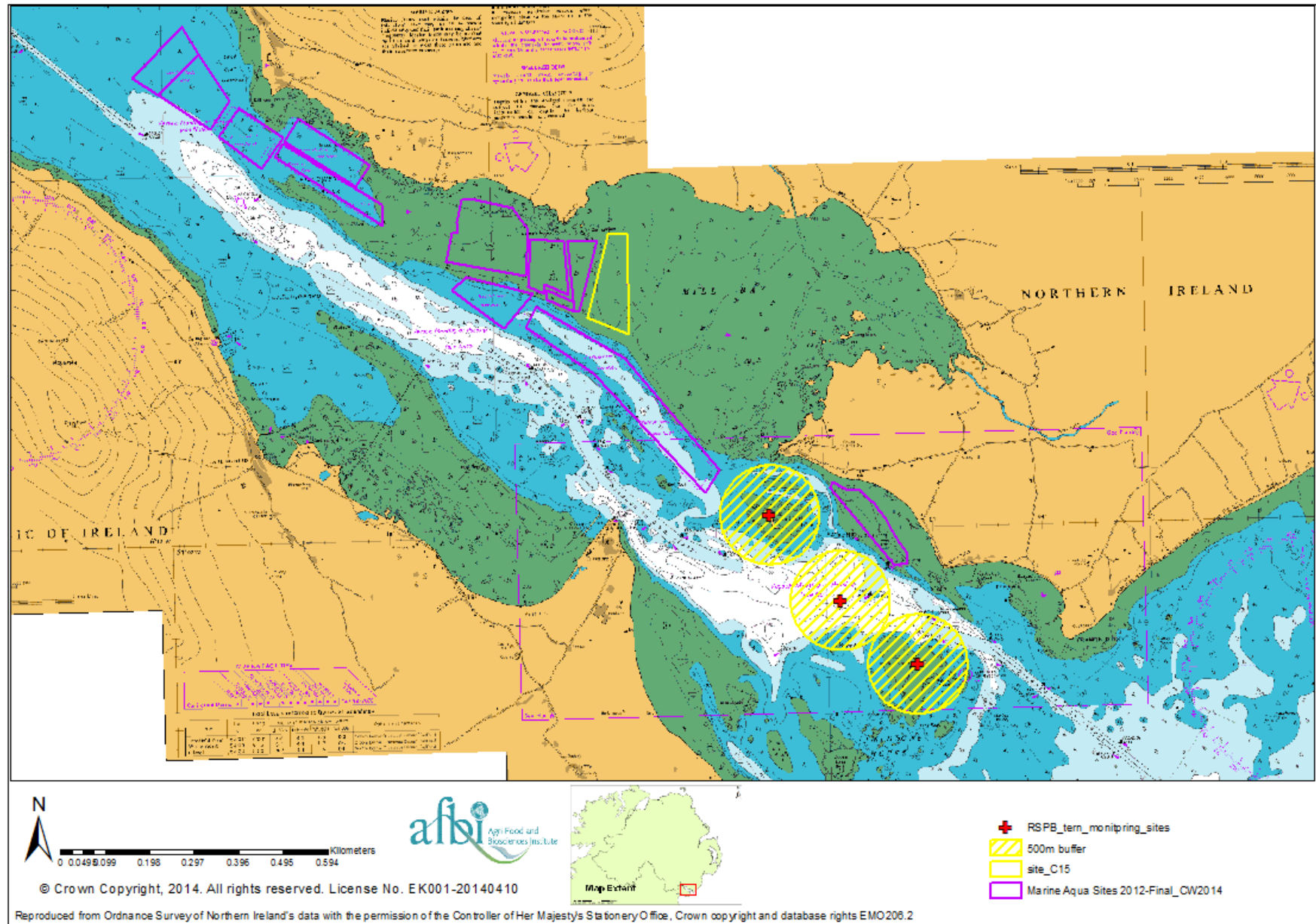


Figure 7: Map showing the location of site C15 in relation to the islands within Carlingford Lough used as breeding sites by Tern species.

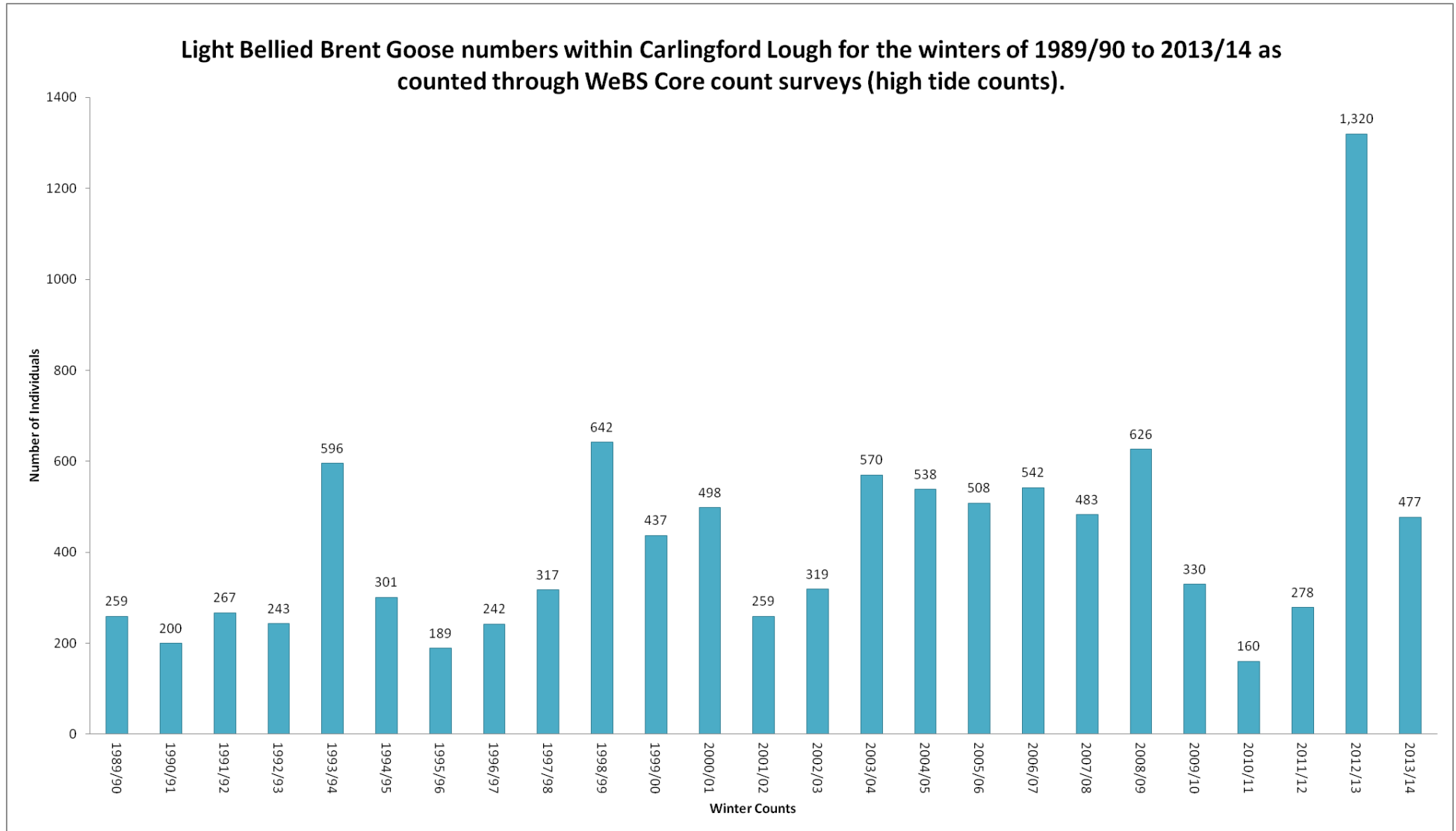


Figure 8: Graph showing the numbers of Light bellied Brent Goose counted within WeBS Core counts (high tide counts) in Carlingford Lough for the winters of 1989/90 to 2013/14 (Holt *et al* 2015).

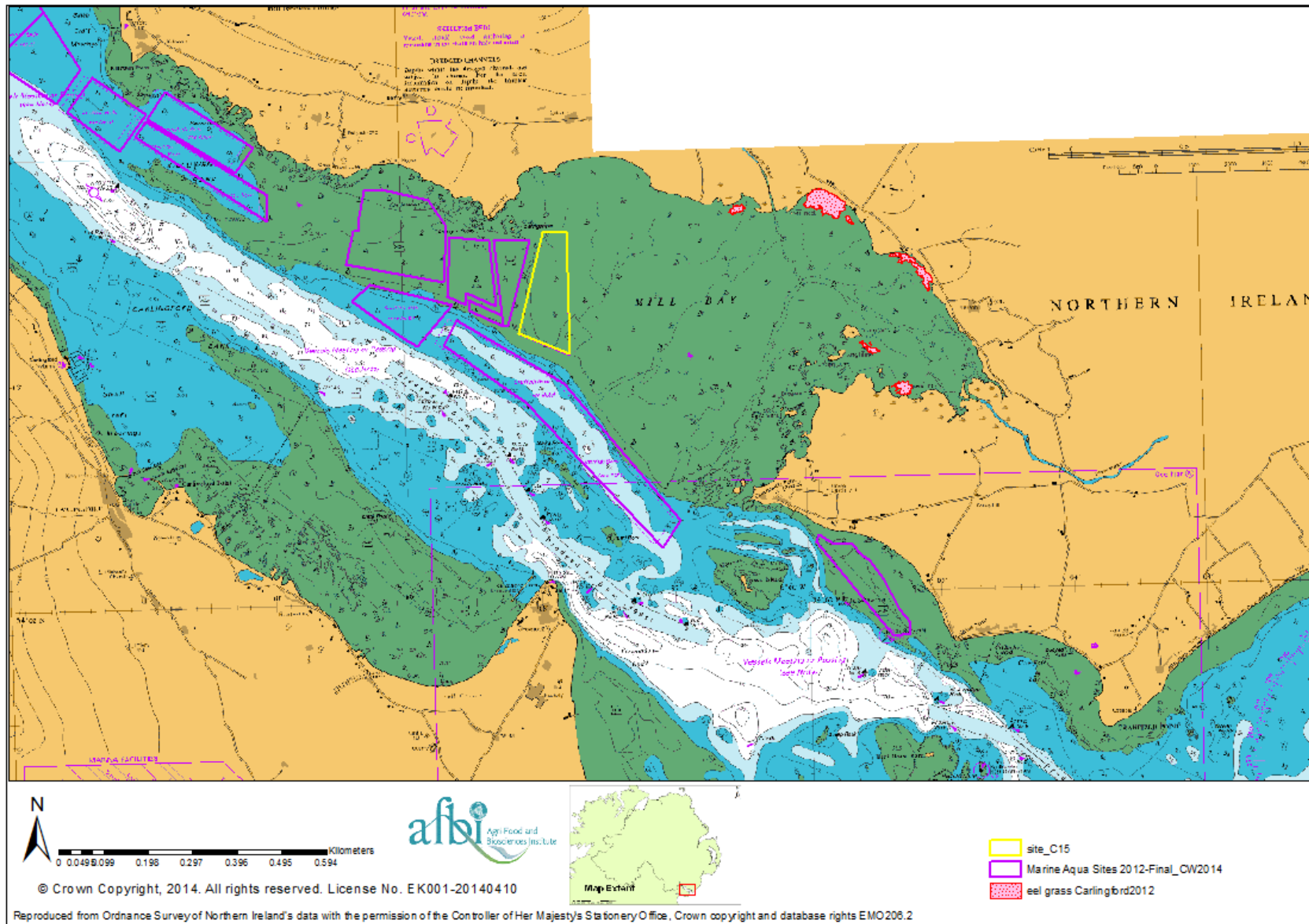


Figure 9: Map showing distribution of intertidal eelgrass on the Northern shores of Carlingford Lough as mapped by NIEA, in relation of the location of site C15.

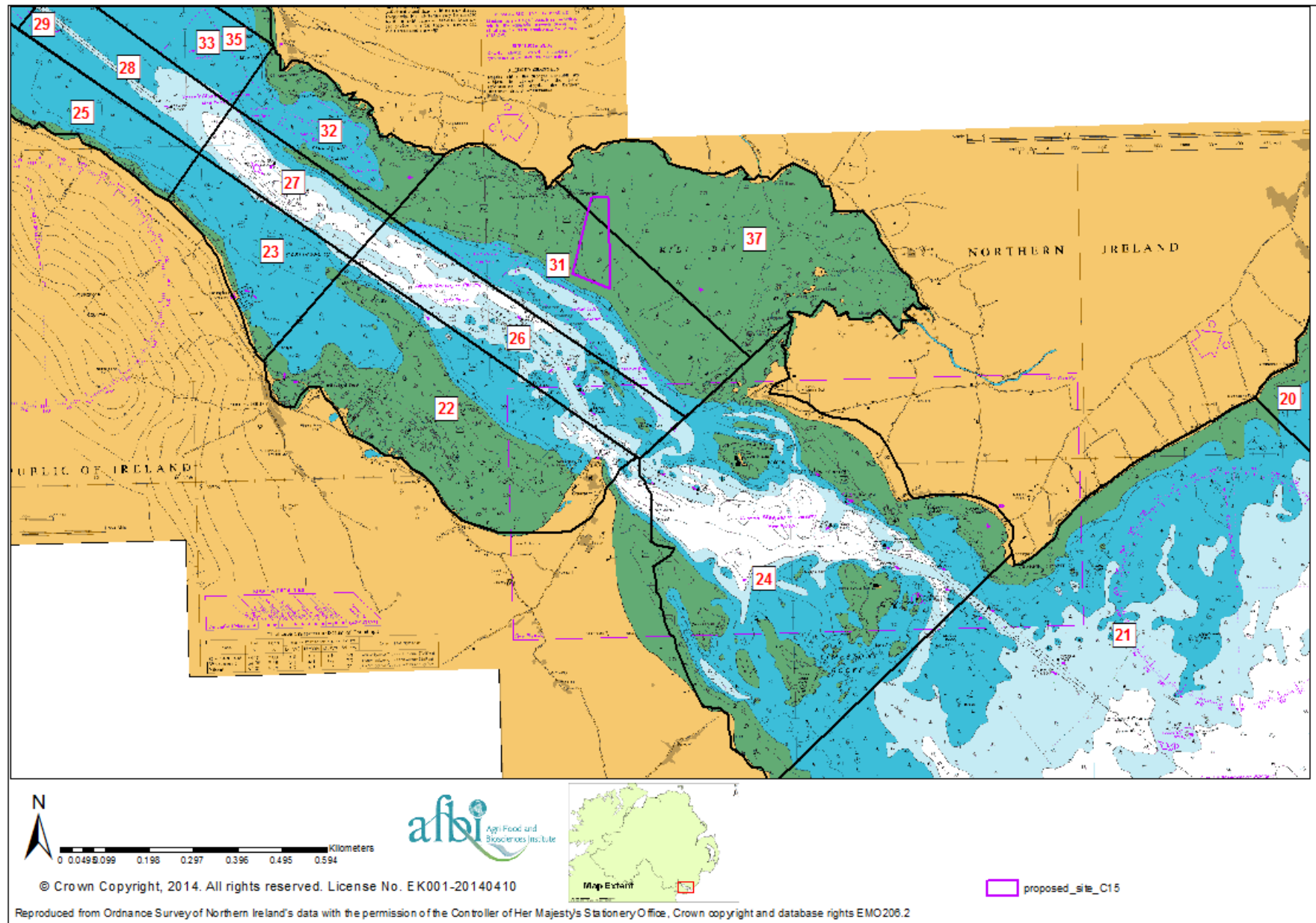


Figure 10: Map showing the location of site C15 in relation to the SMILE model E2K Boxes.

Annex I: AFBI 2013, Habitats Regulations Assessment: Test of Likely Significance: Licence application by Mr S. O'Hare for an aquaculture site for the culture of Pacific and native oysters in Carlingford Lough (DARD ref C15).

Habitats Regulations Assessment: Test of Likely Significance

**Licence application by Mr S. O'Hare for an
aquaculture site for the culture of Pacific and
Native oysters in Carlingford Lough
(DARD ref C15).**

**Prepared by AFBI Fisheries and Aquatic Ecosystems Branch for the
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Introduction

The Fisheries and Environment Division of the Department of Agriculture and Rural Development (DARD) commissioned AFBI to undertake a Habitat Regulations Assessment report for a proposed new aquaculture site within Carlingford Lough Special Protection Area (SPA) in Northern Ireland. This document therefore assesses the potential impacts of aquaculture activities at the proposed location on the designated features and conservation objectives of the Natura 2000 designated site outlined above. This assessment is based on information supplied by DARD, the Royal Society for the Protection of Birds (RSPB), the Wetlands Bird survey (WeBS), the Northern Ireland Environment Agency (NIEA), the Loughs Agency, through site visits, and through information provided by the applicant.

Carlingford Lough is a sea lough at the mouth of the Newry (or Clanrye) River on the east coast of Ireland, bordering both the Republic of Ireland (county Louth) and Northern Ireland (counties Down and Armagh). The upper reaches of the lough are dominated by fine muddy sand beds and intertidal mud-flats, whilst the seaward entrance to the lough is a mixture of boulder, cobble and bedrock forming numerous small islands and reefs. The areas of Carlingford Lough within Northern Irish jurisdiction have been designated as a SPA, an Area of Special Scientific Interest (ASSI), an Area of Outstanding Natural Beauty (AONB) and a RAMSAR site (as designated under the Convention on Wetlands of International Importance (also known as the Ramsar Convention)). The areas of Carlingford Lough within Southern Irish jurisdiction have been designated as a Special Area of Conservation (SAC), a SPA and a proposed Natural Heritage Area. Natura 2000 data forms list designated features as being classified either A, B, C, D, E etc. Only those features classified as either A, B, or C are considered as Natura 2000 features and need to be taken into consideration within impact assessments (Northern Ireland Environment Agency (NIEA) Competent Authority Habitat Regulations Assessment template).

In order to undertake a systematic assessment of the impacts of aquaculture activities at the proposed new site on the features of the Carlingford Lough SPA the GIS programme ArcGIS was used to map the distribution of designated features (where available) in relation to the area of the aquaculture site applied for.

Current aquaculture activities within the Northern area of Carlingford Lough

In the Northern side of Carlingford Lough the DARD Fisheries and Environment Division is responsible for the granting of fish culture licences, shellfish fishery licences and marine fish fishery licences under the Fisheries Act (Northern Ireland) 1966.

There are currently eleven licensed aquaculture sites on the Northern side of Carlingford Lough. Three are licensed for the intertidal trestle culture of Pacific oysters (*Crassostrea gigas*), two are licensed for the bottom culture of mussels (*Mytilus edulis*) and native oysters (*Ostrea edulis*) and six are licensed for the bottom culture of mussels (*M. edulis*). Records of exports of shellfish from Carlingford Lough aquaculture beds and imports of shellfish onto licensed aquaculture sites in Carlingford Lough for the period 2010 to present indicate that not all of the sites licensed for aquaculture are at present actively producing shellfish.

Assessment under Article six of the Habitats Directive

In accordance with Council Directive 92/43/EEC, the Department of Agriculture and Rural Development (DARD) has considered whether the project, plan or proposal either alone or in combination (neither being directly connected with or necessary to the management of the site) is likely to have a significant effect on the Natura 2000 site.

**Screening Matrix: Application for a new aquaculture site within
Carlingford Lough (DARD ref C15).**

Name of Project or Plan.	Application for a new site for the culture of Pacific and native oysters within Carlingford Lough.
Name and location of Natura 2000 site (s)	<p>Carlingford Lough Special Protection Area</p> <p>Area: 827.12 hectares Grid Reference: J230129 Date Classified: 09/03/98</p> <p>See Figure 1 for a map of the site boundary.</p> <p>Carlingford Lough is a sea lough at the mouth of the Newry (or Clanrye) River on the east coast of Ireland bordering both the Irish Republic (county Louth) and Northern Ireland (counties Down and Armagh). The upper reaches of the lough are shallow and dominated by fine muddy sand beds and intertidal mud-flats, whilst the seaward entrance to the lough is a mixture of boulder, cobble and bedrock forming numerous small islands and reefs.</p> <p>The SPA lies between Killowen Point and Soldiers Point on the northern shores of the lough and the landward boundary is entirely coincident with that of the Carlingford Lough Area of Special Scientific Interest (ASSI). The SPA boundary includes all lands and intertidal areas seawards to the limits of territorial waters. Marine areas below mean low water are not included.</p> <p>Figure 2 shows the boundaries of the other designated sites within Carlingford Lough.</p>
Natura 2000 site features:	<p>This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:</p> <p>During the breeding season; <u>Common Tern</u> <i>Sterna hirundo</i>, 339 pairs representing 10.9% of the all-Ireland breeding population (5 year mean, 1993-1997).</p> <p><u>Sandwich Tern</u> <i>Sterna sandvicensis</i>, 575 pairs representing 13.1% of the all-Ireland breeding population (5 year mean,</p>

	<p>1993-1997).</p> <p>This site was designated before the UK SPA review which was undertaken in 2001 (Stroud <i>et al</i> 2001). During this review an additional qualifying species was identified for this site.</p> <p>As a result of the review described above this site now also qualifies under Article 4.2 of EC Directive 79/409 on the Conservation of Wild Birds by supporting populations of European importance of the following migratory species;</p> <p>Over Winter (non breeding); <u>Light-bellied Brent Goose</u> (<i>Branta bernicla hrota</i>). For the period 1990-1995 the five year peak mean for Light-bellied Brent Goose at this site was 319 individuals which represented 1.6% of the wintering Canada/Ireland population.</p> <p>The Natura 2000 standard data form for this site (site code UK9020161, Annex I) has to date not been updated to include the addition of Light-bellied Brent Goose. However the Northern Ireland Environment Agency (NIEA) has confirmed that this species is legally a designated feature of the Carlingford Lough SPA and should be included in all assessments.</p> <p>This site forms also part of an extended cross-border site which supports internationally important numbers of overwintering Light-bellied Brent Geese <i>Branta bernicla hrota</i>.</p> <p>The extended site also supports nationally important numbers of the following wader species:</p> <p>Oystercatcher <i>Haematopus ostralegus</i> 850 birds (five year mean for 1991/92 to 1995/96) representing 1.7 % of the Irish population.</p> <p>Ringed Plover <i>Charadrius hiaticula</i> 168 individuals (mean period not specified) representing 1.3% of the Irish population.</p> <p>Grey Plover <i>Pluvialis squatarola</i> 58 individuals (mean period not specified) representing 1.5% of the Irish population.</p> <p>Dunlin <i>Calidris alpina</i> 1494 individuals (mean period not specified) representing 1.2% of the Irish population.</p>
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	<p>Redshank <i>Tringa totanus</i> 640 individuals (mean period not specified) representing 2.6% of the Irish population.</p> <p>Although the site supports nationally important numbers of the above species they are not included within the Carlingford Lough SPA designation.</p> <p>The conservation objectives of the Carlingford Lough SPA are listed in Annex II.</p>
<p>Description of the Project or Plan</p>	<p>An application for a fish culture and shellfish fishery licence has been submitted to the Department of Agriculture and Rural Development for the culture of Pacific oysters (<i>Crassostrea gigas</i>) and native oysters (<i>Ostrea edulis</i>) on trestles within the intertidal zone at a site on the Northern shore of Carlingford Lough (Figures 3 and 4).</p> <p>Size and scale</p> <p>The area of the proposed application is approximately 29 hectares. The applicant wishes to install 1,000 trestles (5m x 1m x 1m) within this area for the culture of Pacific and native oysters. The applicant has stated that the estimated annual production from this site will be 40 tonnes of Pacific oysters and 40 tonnes of native oysters.</p> <p>Land-take</p> <p>The applicant is proposing to install 1,000 trestles 5m x 1m x 1m in dimension which amounts to an area of 5,000m². The area applied for is 29 hectares or 290,000m² which will therefore provide ample space to ensure adequate water flow between trestles.</p> <p>Distance to key features of the site</p> <p>Approximately 22 hectares (220,000m²) of the proposed site is within the boundary of the Carlingford Lough SPA (Figure 5). The total area of Carlingford Lough SPA is approximately 830 hectares so therefore the proposed site occupies approximately 2.65% of the total designated area.</p>
<p>Is the Project or Plan directly connected with or necessary to the management of the site (provide details)?</p>	<p>No</p>
<p>Describe the individual elements of the project</p>	<p>The proposal is for an aquaculture site within Carlingford Lough for the rearing of both native and Pacific oysters in</p>

<p>(either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.</p>	<p>mesh bags placed on trestles in the intertidal zone. These trestles will be placed as far out beyond the normal low water mark as possible in order to obtain maximum water coverage.</p> <p>Within the original application the applicant stated that he wished to install a total of 1000 trestles (5mx1mx1m). After taking onboard comments from NIEA and DARD the applicant wrote to DARD wishing to reduce this to 20 trestles in the first year with the hope of installing an additional 30 trestles the following year. The applicant has since contacted DARD outlining that he now wishes to revert back to the 1,000 trestles stated within the original application.</p> <p>Originally the applicant indicated that during the first few years of operation the site would be serviced by two people who would be on the shore for an average 5-6 hours per month. With the recent increase in the number of trestles to 1,000 (as requested in the original application), DARD have since consulted with the Cross Border Aquaculture Initiative who advised that a more realistic figure, for servicing and maintenance activities on a site of this size by two individuals would be 30 hours per month spread over 7 low tides.</p> <p>Access to the site will be at low tide via an existing pathway currently used to access other aquaculture sites in the area (see site survey report in Annex III). Servicing and maintenance at the proposed site will be undertaken using a tractor and trailer and will involve laying down trestles, turning bags, removing bags for storage and grading onshore and the subsequent return of these bags to the trestles.</p> <p>Trestles will be placed at the low end of the intertidal area minimising their visual impact and maximising the immersion of the shellfish.</p> <p>It has been proposed that the site will be seeded between the start of March and the end of April and it is estimated that this will last approximately 1-2 weeks.</p> <p>Harvesting of market sized oysters from the site is expected to take place annually. This process is expected to be carried out between the end of September and the end of December.</p>
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Impacts that may occur to the designated features of the Carlingford Lough SPA as a result of the proposed application are:

- Disturbance to bird colonies

Breeding bird species

Sandwich Tern and Common Tern (the two species for which Carlingford Lough SPA is designated) breed on three islands near the mouth of Carlingford Lough which are monitored annually by the Royal Society for the Protection of Birds (RSPB) (Figure 6). All available data for breeding Tern species within Carlingford Lough was extracted from the Seabird Monitoring Programme (SMP) online database and is represented graphically in Figures 7-9. As can be seen in Figures 7-9 Tern numbers within Carlingford Lough have fallen in recent years. This decline in numbers is not in line with the general trend of Tern populations within other Northern Irish Tern monitoring sites (NIEA pers comm.) and has been attributed to wet weather, high tides and predation by great black-backed gulls (Wolsey 2011, 2012).

As can be seen from Figure 6 the islands on which the Tern species within Carlingford Lough breed are approximately **2.3km** from the proposed aquaculture site at the closest point.

Terns are colonial breeding waterbirds (Gonzalez-Solis *et al* 2001) and their high density nesting habits make them particularly sensitive to human disturbance (Rodgers and Smith, 1995). Several studies in America have investigated the distance at which terns flushed in response to human disturbance. These distances ranged from 100m (Rodgers and Smith, 1997), to 180m (Rodgers and Smith, 1995) and 200m (Erwin 1989). Using these values as a guide in the absence of any site specific field data we can surmise that human activities at an intertidal aquaculture site **approximately 2.3km** from Tern nest sites will therefore not cause significant negative impacts on this feature of the SPA.

Overwintering bird species

This site is also designated due to the presence of overwintering populations of light bellied Brent Geese. Light Bellied Brent Goose numbers within Carlingford Lough are counted annually through the Wetland Bird Survey (WeBS) Wildfowl and Wader Core Counts. Figure 10 shows the

WeBS count data for the Light Bellied Brent Goose population within Carlingford for the winters of 1989/90 to 2010/11. WeBS core count data are collected at high tide. During 2012 the Loughs Agency undertook monthly bird surveys at several predetermined sites within Carlingford Lough (Figure 11). Counts were undertaken at both low and high tides. The high and low tide data for Light Bellied Brent Goose was extracted (Figure 12 and Figure 13) and analysed using a one-way ANOVA to test the null hypothesis that there was no significant difference between the high and low tide monthly counts at each site. P was determined to be < 0.05 showing that the numbers of Light Bellied Brent Geese counted at low tide were significantly higher than those counted at high tide. This therefore indicates that when investigating the potential impacts of intertidal aquaculture on this species it would be preferable to use low tide counts where available.

Two of the Loughs Agency survey sites (sites N3 and N4) are in the vicinity of the proposed aquaculture area (Figure 14). As can be seen in Figure 12 the largest numbers of Light Bellied Brent Goose were observed at site N3 in January and the largest numbers at site N4 were observed in February. This is outwith the periods of proposed highest activity at the site, namely seeding (March- April) and Harvesting (end of September to end of December).

The preferred food of Brent Geese is intertidal eelgrass (Owen and Black 1990, Hassall and Lane 2005, Inger *et al.* 2006). On the Northern shores of Carlingford Lough intertidal eelgrass beds are confined to a small portion of the Mill Bay area of the Lough (Figure 15).

Access to the site will be via an existing pathway across the intertidal area used by the licence holders of other aquaculture sites in the vicinity. During site visits to the proposed aquaculture area in 2009, staff from AFBI along with staff from the fisheries inspectorate at DARD explored the area for the presence of *Zostera* and did not observe this species within the vicinity of the proposed site (see site survey report in Annex III). However before site construction, seeding, maintenance, and harvesting operations can be undertaken the operator should ensure that no large aggregations of Brent Geese are observed within the area.

- **Removal of a feeding area for birds.**

Breeding bird species

Terns are surface feeding seabirds (Furness and Tasker, 2000; Einoder, 2009) who feed primarily on fish species (Comeau *et al* 2009; Burger and Gochfeld 2003 and Cramp and Simmons, 2004 (cited in Christel *et al* 2013)). Becker and Ludwigs, (2004) (cited in Dänhardt and Becker, 2011) state the maximum diving depth for Common Tern as 0.5m. The proposed intertidal aquaculture site will therefore not impact on the feeding and foraging areas of the Tern species for which the Carlingford Lough SPA is designated.

Overwintering bird species

As previously mentioned the preferred food of Light Bellied Brent Geese is eel grass of the species *Zostera*. Intertidal oyster culture within the proposed site has the potential to cause disturbance to Light Bellied Brent Goose populations through human presence in the intertidal areas within which they are grazing on eel grass.

NIEA mapped the distribution of eelgrass within the Northern shores of Carlingford Lough during 2009 (Beer and McQuaid 2011). However due to access issues this survey was not completed and so the distribution of eelgrass within Carlingford Lough was mapped again in 2012 (Figure 15). From Figure 15 it can be seen that the intertidal eelgrass beds are confined to a small portion of the Mill Bay area of the Lough.

DARD fisheries inspectorate staff along with an AFBI Scientific Officer visited the area of the proposed aquaculture site in 2009 and confirmed the absence of eel grass (Annex III).

It is expected that the proposed trestles will be placed on the shore in an area that will not be readily available as a feeding area for bird species as it is only expected to be exposed at very low tides.

Preliminary studies on the effects of oyster trestles on bird feeding behaviour found that the percentage of birds observed feeding did not differ between the reference areas (free of aquaculture) and the trestle areas (Hilgerloh *et al* 2001). For some species of bird the trestles provided an additional food source. Hilgerloh *et al.* (2001) witnessed Wigeon (*Anas penelope*) feeding on green algae growing on

trestles and noted that Brent Geese (*Branta bernicla*) have been observed showing similar behaviour within estuaries.

Gittings and O'Donoghue (2012) investigated the effects of intertidal oyster aquaculture on the distribution of waterbirds within six sites in Ireland. They classified species responses to intertidal oyster culture as; neutral/positive, variable (species responses varied between sites), negative, and exclusion (species completely excluded from oyster trestle areas). Within these investigations Gittings and O'Donoghue (2012) found that Light Bellied Brent Goose showed a variable response to oyster trestles.

Gittings and O'Donoghue (2012) state that “detectable disturbance impacts to birds were only observed occasionally and were usually minor (birds which flushed but resettled nearby)” and at some sites Light bellied Brent Geese were observed feeding on top of the oyster trestles.

- **Spread of a non native species**

The pacific oyster *Crassostrea gigas* is not native to UK waters. It was previously believed that this species was unable to breed in the colder UK waters, but the presence of established feral populations at several sites have shown that this is not the case.

To date there are no reported feral populations of *Crassostrea gigas* present within Carlingford Lough.

In order to minimise the risk of this non native species escaping and reproducing in the wild good husbandry practices should be followed at all times and only sterile Pacific oysters should be permitted to be cultured at this site.

With the recent discovery of the non native species *Crepidula fornicata* in Belfast Lough and *Styela clava* in Larne Lough all oyster spat placed on this site must be sourced from areas known to be free from both species.

- **Pseudofaeces deposition under the proposed trestles.**

Pseudofaeces and faeces bioaccumulation beneath intertidal oyster trestles has the potential to impact benthic community structures. These impacts are generally considered to be small scale and localised (Nuges *et al*,

	<p>1996; Forrest and Creese 2006; Forrest <i>et al</i>, 2009 and the literature reviewed within). Nuges <i>et al</i> (1996) studied the environmental impacts of Pacific oyster trestle culture in the River Exe estuary in Devon. They noted small but detectable changes in benthic communities and sedimentation levels beneath trestles that were twice those in the control areas, although the changes in sedimentation were not found to be statistically significant. Increased sedimentation beneath Pacific oyster trestles was observed by Forrest and Creese (2006) in a New Zealand estuary however, impacts from oyster culture was not noted 35m from the sites. Forrest and Creese (2006) also noted that “effects on macrofauna were not severe enough to produce a marked trend in species richness”.</p> <p>The proposed oyster trestles to be deployed at this site are stated as being 1m above the ground. This will ensure adequate circulation and reduce sedimentation beneath the trestles. However in order to ensure that any changes in benthic sediments and communities remain small and localised a programme of monitoring within and adjacent to the proposed intertidal oyster culture site should be established.</p> <p>Alongside increased deposition beneath the trestles it is also possible that some sediment scouring in the vicinity of the proposed trestles could occur as a result of alterations to tidal flows within the area. These effects can be minimised through proper management and positioning of the trestles at least one metre apart to ensure adequate water flow and circulation between them.</p>
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N2K Feature: Mention all features	Describe any likely direct, indirect effects to the N2K features arising as a result of: Loss, reduction of habitat area; disturbance; habitat or species fragmentation; reduction in species density; changes in key indicators of conservation value (e.g. water quality, climate change).	<u>*Effect Significant/Not Significant? Why?</u>
Common Tern	Aquaculture activities have the potential to cause disturbance through human presence within nesting areas and	The proposed site is approximately 2.3km from the islands within Carlingford Lough on which Common Tern breed.

	<p>damage/disturbance to feeding areas/species.</p>	<p>Fish is the main food source for Tern species. Therefore intertidal shellfish aquaculture will not impact on prey availability for Tern species.</p> <p>Therefore this application will not negatively impact breeding Common Tern populations within Carlingford Lough.</p>
<p>Sandwich Tern</p>	<p>Aquaculture activities have the potential to cause disturbance through human presence within nesting areas and damage/disturbance to feeding areas/species.</p>	<p>The proposed site is approximately 2.3km from the islands within Carlingford Lough on which Sandwich Tern breed. Fish is the main food source for Tern species. Therefore intertidal shellfish aquaculture will not impact on prey availability for Tern species.</p> <p>Therefore this application will not negatively impact breeding Sandwich Tern populations within Carlingford Lough.</p>
<p>Light bellied Brent goose</p>	<p>Aquaculture activities have the potential to cause disturbance through human presence within preferred habitats and damage/disturbance to feeding areas/species.</p>	<p>Studies on the impacts of oyster culture on waterbirds found that Light Bellied Brent Goose showed a variable response to oyster trestles and were observed feeding on top of the oyster trestles at some sites.</p> <p>Light Bellied Brent Geese feed mainly on eelgrass. NIEA did not identify the area of the proposed site as being an eelgrass bed during their most recent eelgrass survey of Carlingford Lough. No eelgrass was observed within the area of the proposed aquaculture site during the DARD and AFBI site visit.</p>

<p>Describe any potential effects on the Natura 2000 site as a whole in terms of: interference with the key relationships that define the structure or function of the site</p>	<p>Proper management of the proposed oyster aquaculture site will ensure that interference to the key relationships that define the structure of the site will be unlikely. Two of the bird species for which the site is designated feed on fish species and therefore do not forage in the intertidal zone. These species breed on islands some distance from the proposed site and are therefore not likely to be disturbed by human presence on the site. The third species for which the site is designated feeds on eel grass, which is absent from the area of the proposed site and the surrounding vicinity. As activities on the site will only be undertaken at such times when large aggregations of Brent Geese are not observed within the area then interference should be minimised/negligible.</p> <p>Activities at the proposed site will not negatively impact the conservation objectives of the designated features of the Carlingford Lough SPA.</p>
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<p>Provide details of any other projects or plans that together with the project or plan being assessed could (directly or indirectly) affect the site.</p>	<p>Fast Ferry activity, yachting, pleasure boating, dog walkers, agriculture, bait collectors, seaweed collectors, recreational walkers, sewage discharges, scientific research, other fisheries and other leisure activities.</p>
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<p>Is the potential scale or magnitude of any effect likely to be significant? :</p>	
<p>Alone?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>
<p>In-combination with other projects of plans?</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>

<p>List of Agencies / Organisations Consulted: Provide contact name and telephone or email address.</p>	<p>Dr Liz Pothanikat – NIEA, CDP Birdwatch Ireland (Siobhan Egan – info@birdwatchireland.ie) RSPB (Claire Ferry – claire.ferry@rspb.org.uk); Council for Nature, Conservation and Countryside (Patrick Casement – secretariat-hillst@doeni.gov.uk); Ulster Wildlife Trust (Melanie Gomes – melanie.gomes@ulsterwildlifetrust.org); NIEA Conservation Designations and Protection (Paul Byrne – paul.byrne@doeni.gov.uk); NIEA .Water Management Unit (Claire Vincent –</p>
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	<p>claire.vincent@doeni.gov.uk</p> <p>See Annex IV for comments summary.</p>
<p>Habitats Regulations Assessment Summary</p>	<p>The islands on which the Tern species within Carlingford Lough breed are approximately 2.3km from the proposed aquaculture site at the closest point. Fish is the main food source for Tern species. Therefore intertidal shellfish aquaculture will not impact on prey availability for Tern species.</p> <p>Light Bellied Brent Geese feed mainly on eelgrass. NIEA did not identify the area of the proposed site as being an eelgrass bed during their most recent eelgrass survey of Carlingford Lough. No eelgrass was observed within the area of the proposed aquaculture site during the DARD and AFBI site visit.</p> <p>Studies on the impacts of oyster culture on waterbirds found that Light Bellied Brent Goose showed a variable response to oyster trestles and were observed feeding on top of the oyster trestles at some sites.</p> <p>Activities at the proposed site will not negatively impact the conservation objectives of the designated features of the Carlingford Lough SPA.</p>

<p>Conclusion: Is the proposal likely to have a significant effect on an N2K site?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>
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Data collected to carry out the assessment

Who carried out the assessment?	The Agri-food and Bioscience Institute (AFBI) acting on behalf of the Department of Agriculture and Rural Development.
Sources of data	<p>NIEA – eelgrass data</p> <p>WeBS – Core count data for Light bellied Brent Geese in Carlingford Lough</p> <p>Loughs Agency – Carlingford Lough bird data</p> <p>Seabird monitoring programme online database – Tern data</p> <p>DARD – Northern Ireland aquaculture shapefiles</p>
Level of assessment completed	Stage one: Screening
Where can the full results of the assessment be accessed and viewed?	DARD Fisheries Division Dundonald house Belfast

Ecological Carrying Capacity

The Sustainable Mariculture in northern Irish Lough ecosystems (SMILE) model is a model used for the collation and processing of scientific information. It enables the application of an integrated framework for the determination of sustainable carrying capacity in shellfish production areas. For further information on the SMILE model please refer to Ferreira *et al* (2007).

For the purpose of this assessment the SMILE model was applied to three scenarios, which simulated the impact on the ecosystem of increasing the abundance of filter-feeding organisms in Carlingford Lough. Upon analysis of the results of Runs 1-3 a further Run (Run 4) was then undertaken. Chlorophyll a (Chl a) was used as a proxy for phytoplankton biomass within Carlingford Lough. The Four scenarios represented the levels of Chl a present within the Lough if;

- d) Run 1 - There was no aquaculture within the Lough (only wild species present). This run is used as a baseline as wild species will always be present.
- e) Run 2- Current licensed aquaculture sites were activated at their rate of production as per data supplied during SMILE development. (As wild species is to be used as a baseline this component was also activated for this run).
- f) Run 3 - Aquaculture activities were increased to include the applications currently in progress on the Northern side of the Lough.
- g) Run 4 - Aquaculture activities were increased to include all the applications currently in progress on the Northern side of the Lough, but the area of the current application (C15) was reduced to exclude the portion within E2K box 37.

Analysis of measured data (taken from Taylor *et al* 1999) shows up to -62% annual variations within chlorophyll a values (using 90th percentile figures) recorded between sampling years. This observed range in Chlorophyll a values was between -14% and -62%. From this we would recommend that a minimum of 70%, of baseline values, of Chl a remains within the system available for wild species. This therefore implies that aquaculture activities should not reduce Chlorophyll a concentrations by greater than -30% of baseline values (Run 1). Therefore all boxes with Chl a reduction greater than -30% are highlighted in Tables 1, 2 and 3.

From Table 1 below it can be seen that at current levels aquaculture species reduce the overall ecosystem phytoplankton biomass and hence food availability for other organisms within Carlingford Lough by up to a maximum of -40.13%. This value ranges from -24.87 to -40.13% in model boxes where only mussel aquaculture is undertaken to -15.88 to -16.49% in model boxes where only intertidal oyster culture is currently undertaken. Impact (in terms of reduction in Chl a values) was observed in model boxes within which no aquaculture was undertaken due to the knock-on effect of aquaculture activities within adjacent boxes. This is due to the movement of phytoplankton by water currents and shifts of water between boxes.

As can be seen from Table 2 the most notable impact of the addition of all the pending aquaculture applications was observed within E2K box 37 which showed an increase in the Chl a reduction from -11.77% to -57.42% between Runs 2 and 3. From Figure 16 it can be seen that approximately 19% of the area of the proposed application is within Box 37 (the remainder is within E2K box 31). As a result of these findings a further Run of the model was undertaken, Run 4 which represented the levels of Chl a present within the Lough if the area of the proposed site was reduced to exclude the 19% present within box 37 (Figure 17). The results from this Run are shown in Table 3. As is shown in Table 3, restricting the area of the proposed site to within the boundaries of E2K box 31 reduces the impact on Chl a levels within box 37 from a reduction of -57.42% (as observed during Run 3, Table 2) to a reduction of -11.98% (as observed during Run 4, Table 3). We would therefore recommend that the area of the proposed aquaculture site is reduced to exclude the area of the site within E2K box 37 as per Figure 17.

Table 1: Simulated Chl a values (90th percentile calculated over index period, April to October). Results from Run 1 were used as a baseline and the % reduction of Chl a is shown to illustrate the impact when filtration by aquaculture species within current licensed sites is taken into account (Run 2).

E2K Box	Species	Run 1	Run 2	% reduction
Box 25	mussel	6.56	3.93	-40.13
Box 38	mussel	11.38	7.02	-38.31
Box 36	mussel	10.59	7.20	-31.99
Box 23	mussel	5.82	4.01	-31.19
Box 32	mussel	7.03	4.90	-30.35
Box 29	mussel	9.09	6.37	-29.94
Box 22	Oys_mussel	4.99	3.50	-29.90
Box 28	mussel	6.90	4.89	-29.15
Box 33	mussel	8.05	5.82	-27.70
Box 27	no	5.71	4.20	-26.34
Box 35	mussel	9.58	7.06	-26.27
Box 34	mussel	9.11	6.85	-24.87
Box 26	no	4.40	3.42	-22.19
Box 30	no	10.95	8.66	-20.93
Box 31	Oys_mussel	4.10	3.42	-16.49
Box 24	Oys	3.44	2.90	-15.88
Box 37	no	2.05	1.81	-11.77

Table 2: Simulated Chl a values (90th percentile calculated over index period, April to October). Results from Run 1 were used as a baseline and the % reduction of Chl a is shown to illustrate the impact when filtration by aquaculture species within current licensed sites and sites currently under application is taken into account (Run 3).

E2K Box	Species	Run 1	Run 3	% reduction
Box 37	Oys	2.05	0.87	-57.42
Box 25	mussel	6.56	3.82	-41.83
Box 38	mussel	11.38	6.72	-41.01
Box 36	mussel	10.59	6.87	-35.08
Box 32	mussel	7.03	4.63	-34.13
Box 29	mussel	9.09	6.13	-32.50
Box 23	mussel	5.82	3.94	-32.28
Box 28	mussel	6.90	4.74	-31.24
Box 33	mussel	8.05	5.55	-31.09
Box 22	Oys_mussel	4.99	3.44	-31.06
Box 35	mussel	9.58	6.69	-30.21
Box 27	no	5.71	4.07	-28.73
Box 34	mussel	9.11	6.63	-27.22
Box 26	no	4.40	3.33	-24.28
Box 30	no	10.95	8.54	-22.00
Box 31	Oys	4.10	3.29	-19.80
Box 24	Oys	3.44	2.84	-17.48

Table 3: Simulated Chl a values (90th percentile calculated over index period, April to October). Results from Run 1 were used as a baseline and the % reduction of Chl a is shown to illustrate the impact when filtration by aquaculture species within current licensed sites and sites currently under application, with the area of the proposed new intertidal aquaculture site (C15) reduced to exclude the section within E2K box 37, is taken into account (Run 4).

E2K Box	Species	Run 1	Run 4	% reduction
Box 25	mussel	6.56	3.91	-40.41
Box 38	mussel	11.38	6.95	-38.96
Box 36	mussel	10.59	7.12	-32.72
Box 23	mussel	5.82	4.00	-31.37
Box 32	mussel	7.03	4.85	-30.98
Box 29	mussel	9.09	6.32	-30.40
Box 22	Oys_mussel	4.99	3.49	-30.08
Box 28	mussel	6.90	4.86	-29.45
Box 33	mussel	8.05	5.78	-28.27
Box 35	mussel	9.58	6.95	-27.44
Box 27	no	5.71	4.18	-26.74
Box 34	mussel	9.11	6.80	-25.33
Box 26	no	4.40	3.41	-22.46
Box 30	no	10.95	8.63	-21.22
Box 31	Oys	4.10	3.40	-16.93
Box 24	Oys	3.44	2.89	-16.10
Box 37	no	2.05	1.80	-11.98

Conclusions

- The proposed site, as applied for, occupies approximately 2.65% of the total area of the Carlingford Lough SPA. If the area of the proposed site is reduced to exclude the portion within E2K box 37 (as recommended below) then the new site will occupy approximately 2.01% of the total area of the Carlingford Lough SPA.
- The proposed aquaculture site is not within 500m of the Islands within Carlingford Lough on which Tern populations breed.
- As Tern species feed mainly on fish, intertidal oyster aquaculture will not impact on the availability of prey species for these birds.
- The decline in Tern populations within Carlingford Lough in recent years has been attributed to wet weather, high tides, and predation by Black backed gulls (Wolsey 2011 and 2012). There is no evidence to suggest that aquaculture activities within the proposed site will negatively impact the conservation objectives for this designated feature of the Carlingford Lough SPA.
- The preferred food of Light bellied Brent Geese is intertidal eelgrass (Owen and Black 1990, Hassall and Lane 2005, Inger *et al.* 2006). The proposed aquaculture site is not within an area of Carlingford Lough identified as intertidal eelgrass beds.
- Gittings and O'Donoghue (2012) found that Light Bellied Brent Goose showed a variable response to oyster trestles and at some sites investigated they were observed feeding on top of the oyster trestles.
- Light Bellied Brent Geese numbers within Carlingford Lough are relatively stable (NIEA pers comm.). There is no evidence to suggest that aquaculture activities within the proposed site will negatively impact the conservation objectives for this designated feature of the Carlingford Lough SPA.

Recommendations

In order to adequately minimise potential disturbance to the SPA, and reduce the potential for far field impacts, it is recommended that the proposed oyster aquaculture site within Carlingford Lough be allowed to proceed under the following conditions;

- As far as practicable, maintenance activities should avoid times when the site is occupied by large groups of feeding birds.
- As far as practicable, maintenance activities should avoid disturbance to Brent geese utilising the surrounding area.
- **Maintenance activities will be limited to a maximum of 30 hours per month spread over 7 low tides**
- Rows of trestles should be spaced so as to allow adequate water circulation.
- In order to inhibit the spread of feral populations of Pacific oysters the site should only be stocked with sterile Pacific oysters and all hatchery reared spat should be sourced from hatcheries containing the appropriate health certifications.
- All spat and juveniles must be sourced from areas free from known invasive non native species.
- The licensed area should be restricted to exclude the area within E2K box 37 as per Figure 17.

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Figures (all maps are projected in ING)

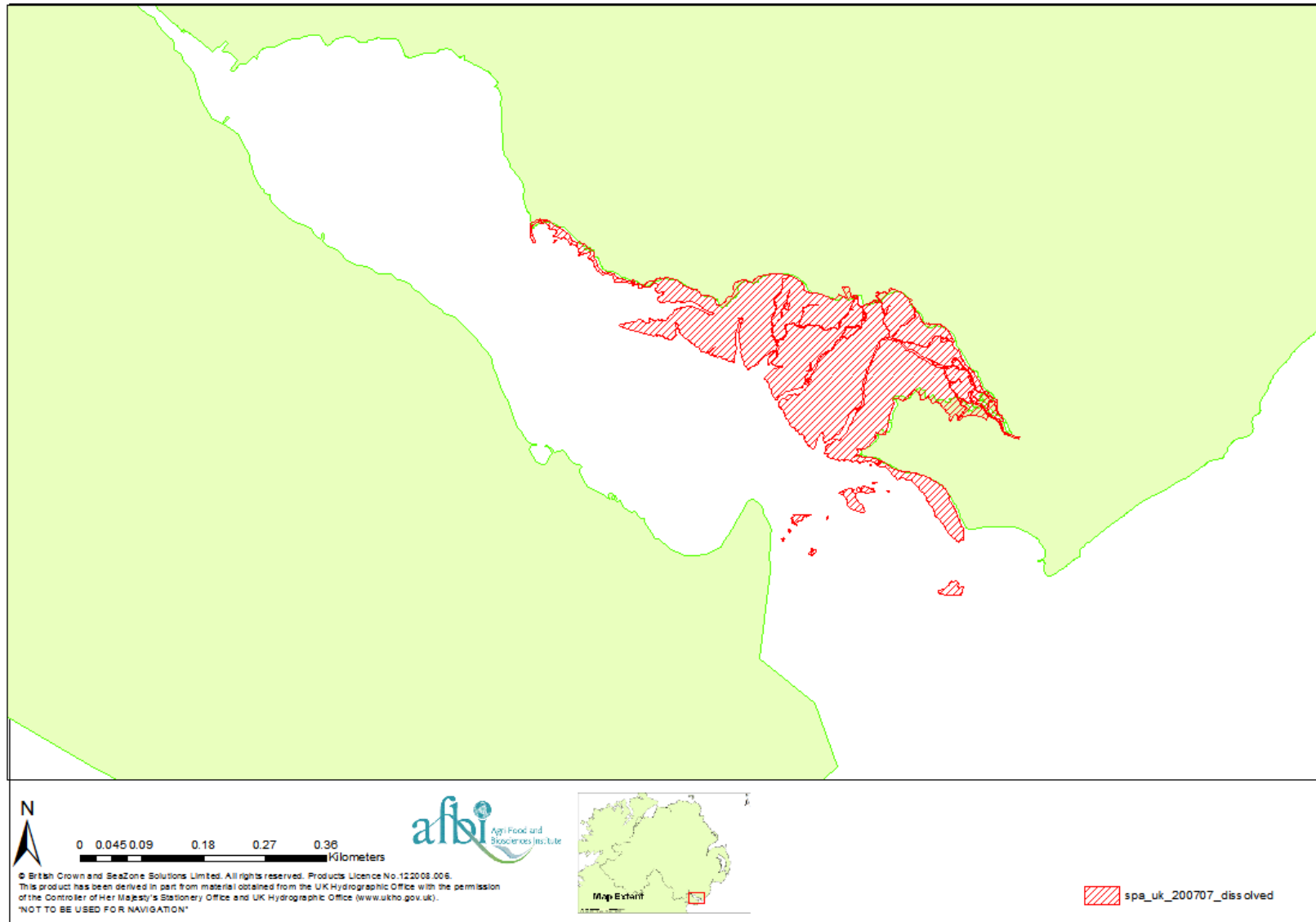


Figure 1: Map showing the boundary of the Carlingford Lough SPA.

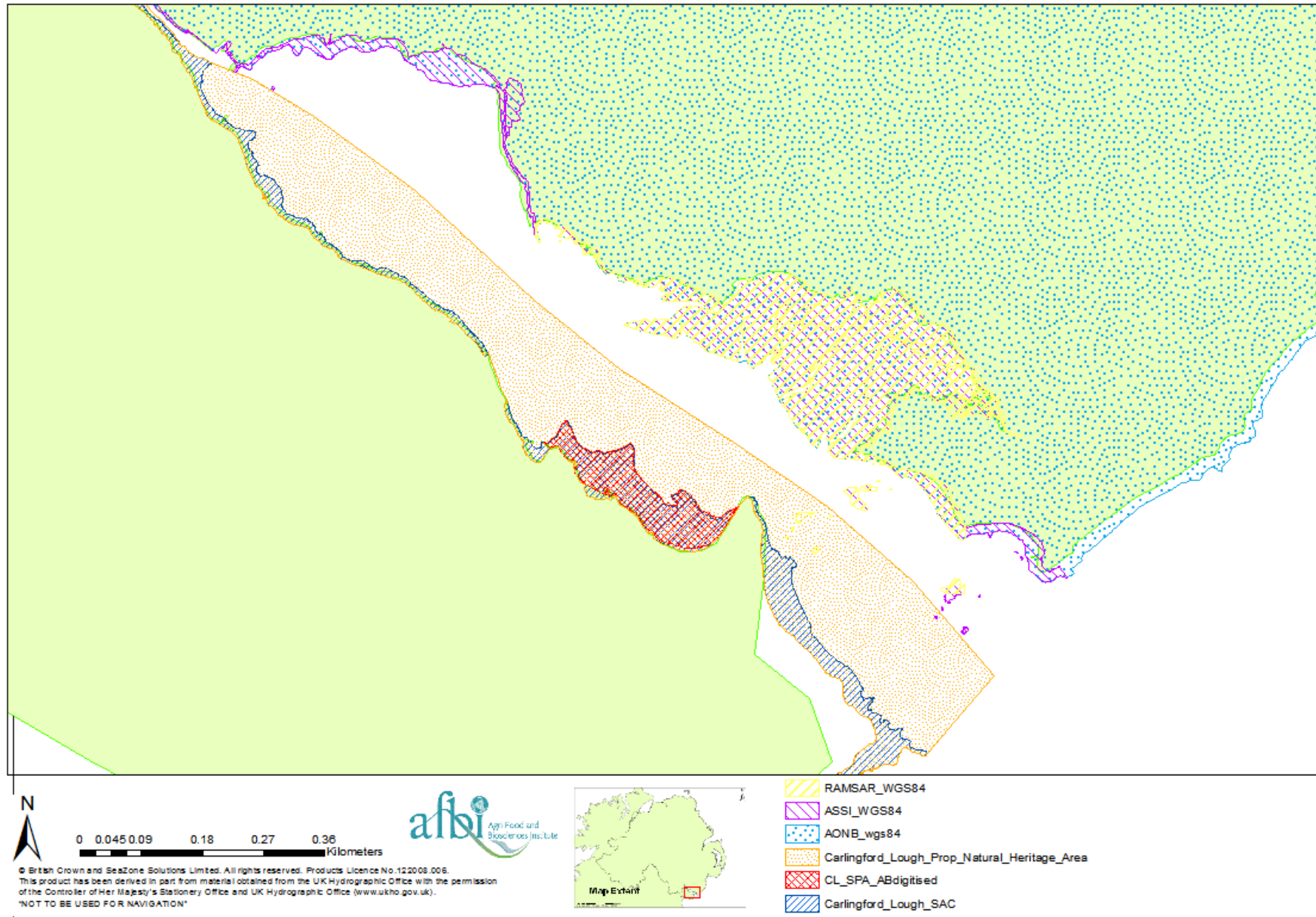


Figure 2: Map showing the boundaries of other designated sites within Carlingford Lough.

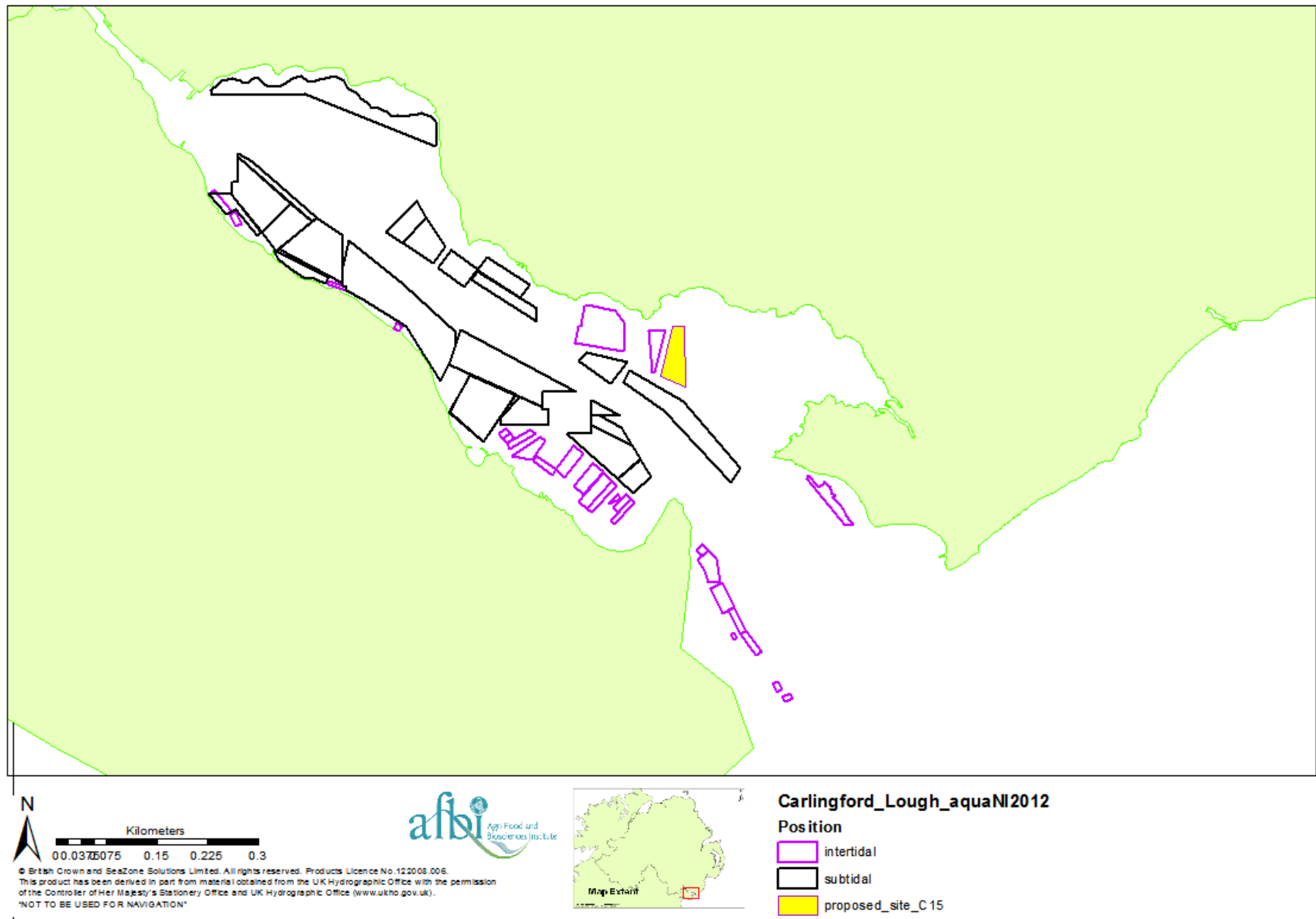


Figure 3: Map showing the location of the proposed new aquaculture site within Carlingford Lough.

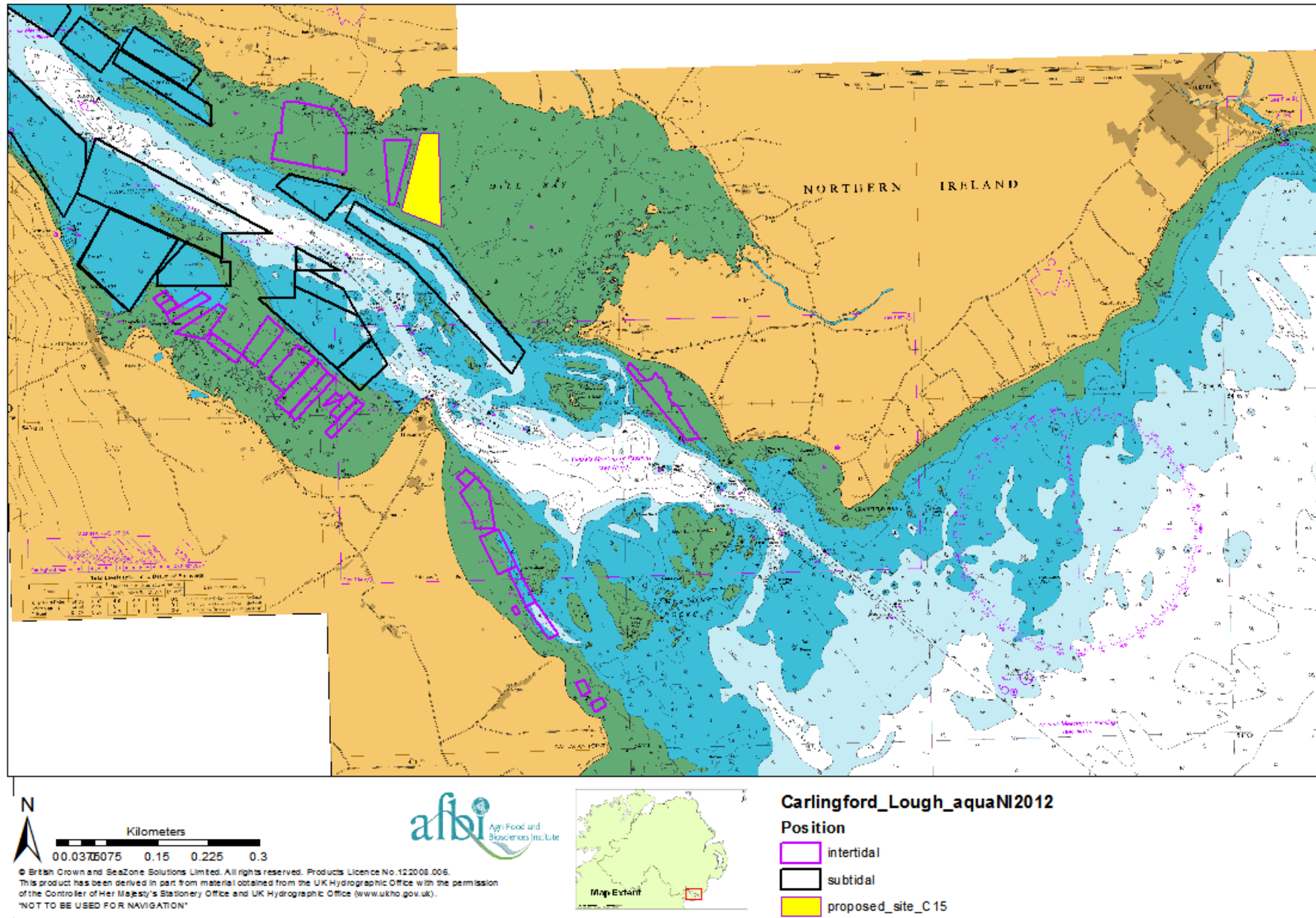


Figure 4: Map showing the location of the proposed new aquaculture site within the Mill Bay area of Carlingford Lough.

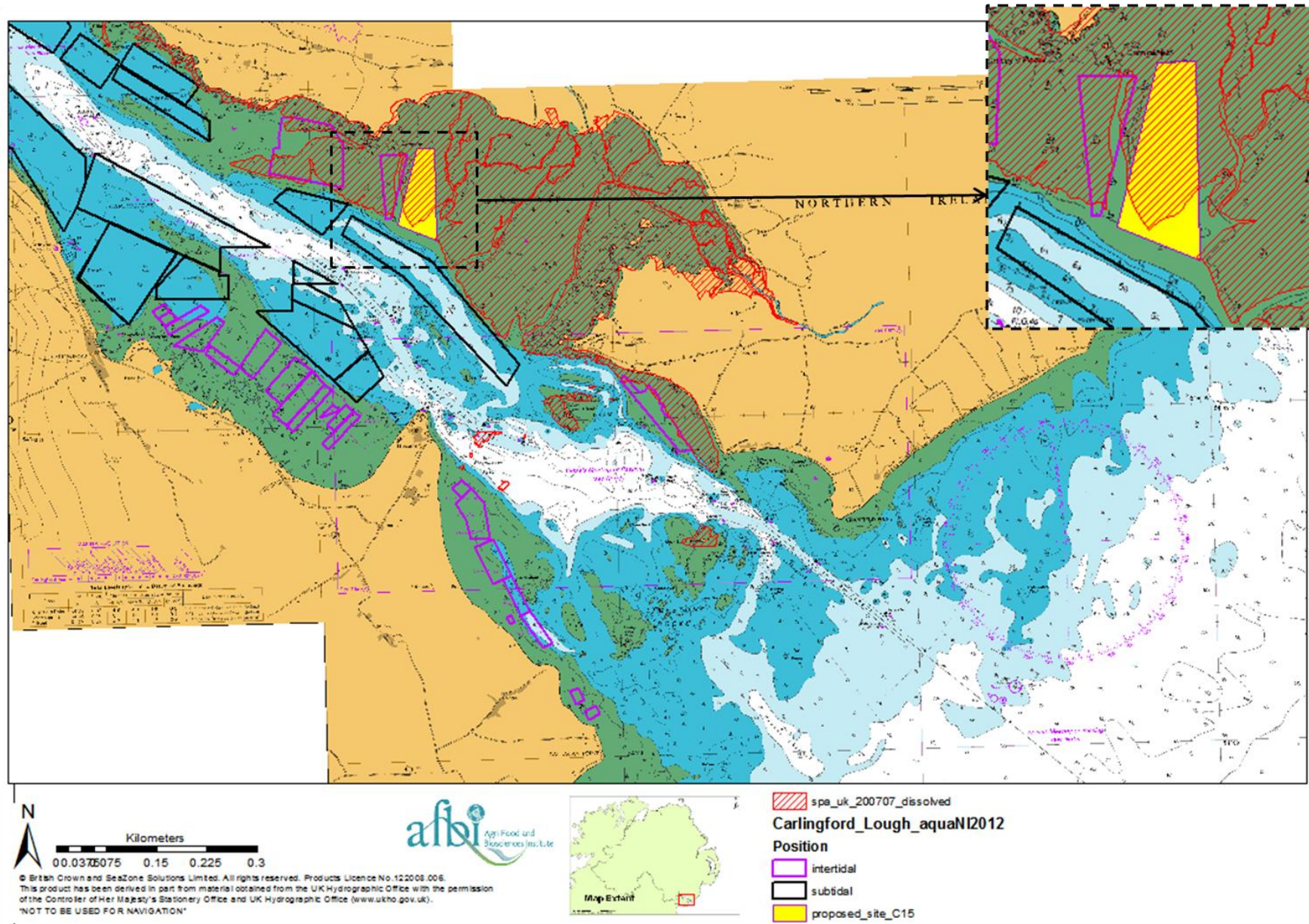


Figure 5: Map showing the location of the proposed new aquaculture site in relation to the boundary of the Carlingford Lough SPA.

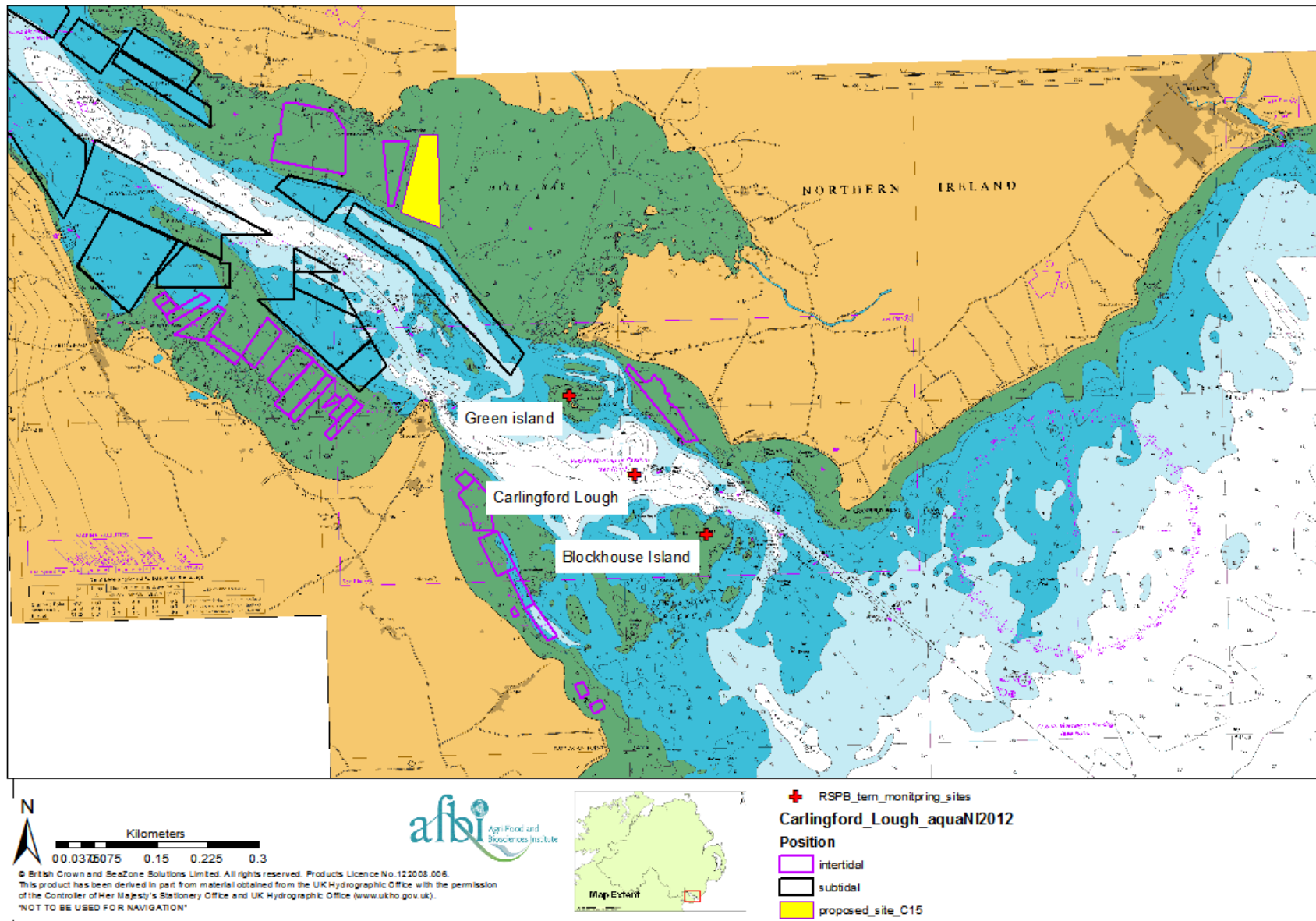


Figure 6: Map showing the location of the proposed new aquaculture site in relation to the islands within Carlingford Lough used as breeding sites by Tern species.

Common Tern numbers counted by RSPB in Carlingford Lough for the years 1980-2012 (data extracted from the SMP online database, no data available for 1986 and 1989).

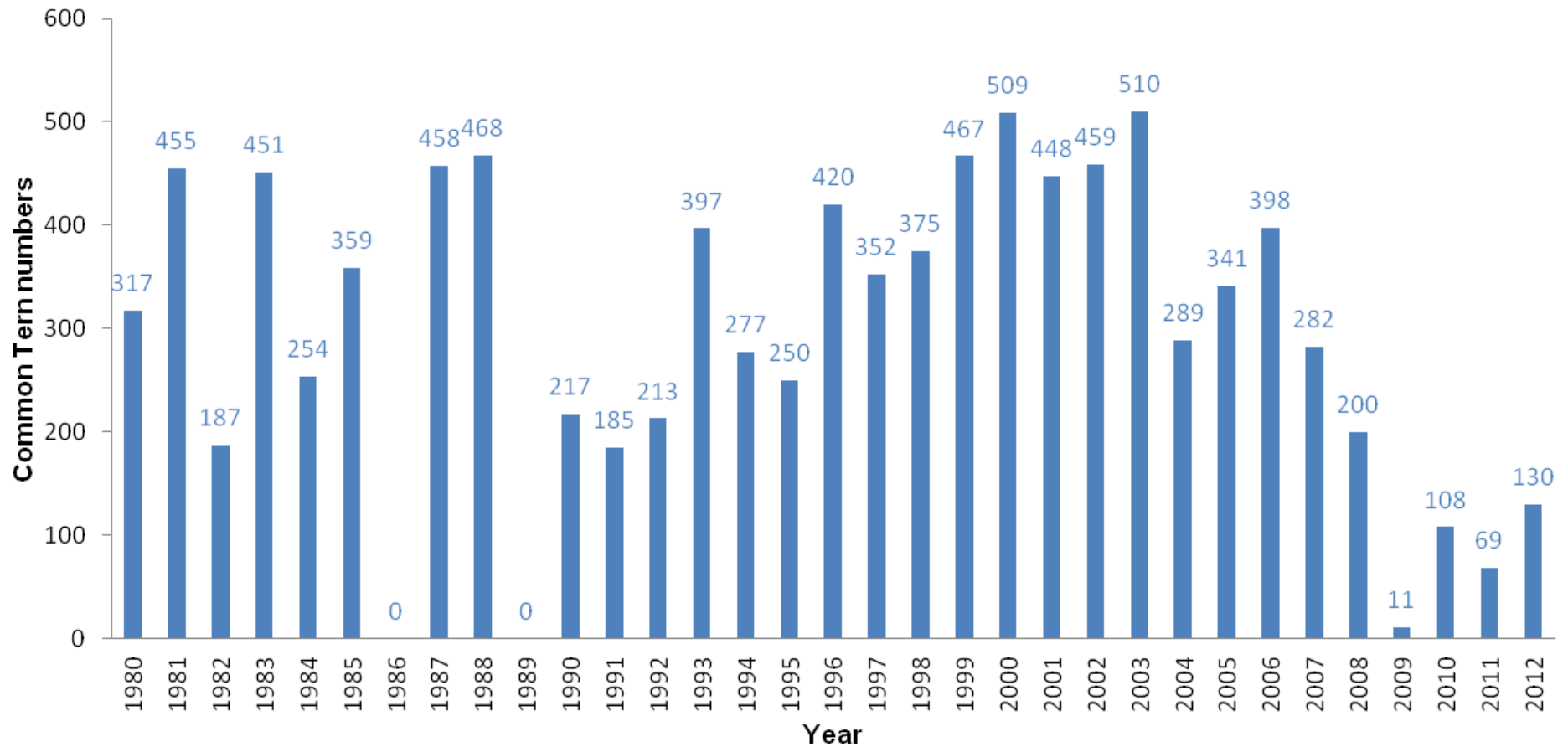


Figure 7: RSPB count numbers for Common Tern populations within Carlingford Lough.

Sandwich Tern numbers counted by RSPB in Carlingford Lough for the years 1969-2012 (data extracted from the SMP online database, no data available for 2010 and 2011).

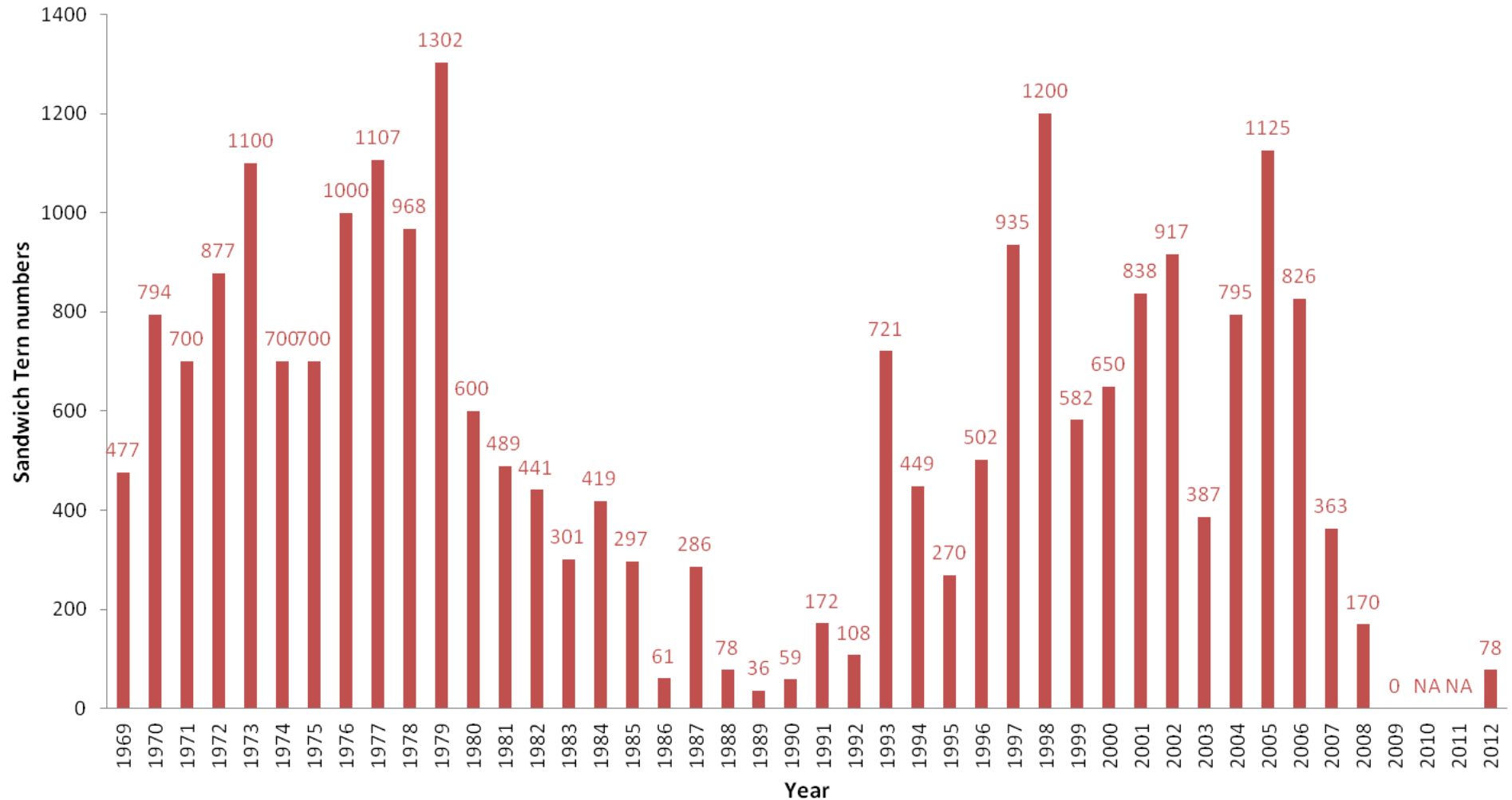


Figure 8: RSPB count numbers for Sandwich Tern populations within Carlingford Lough.

Arctic Tern numbers counted by RSPB in Carlingford Lough for the years 1980-2012 (data extracted from the SMP online database).

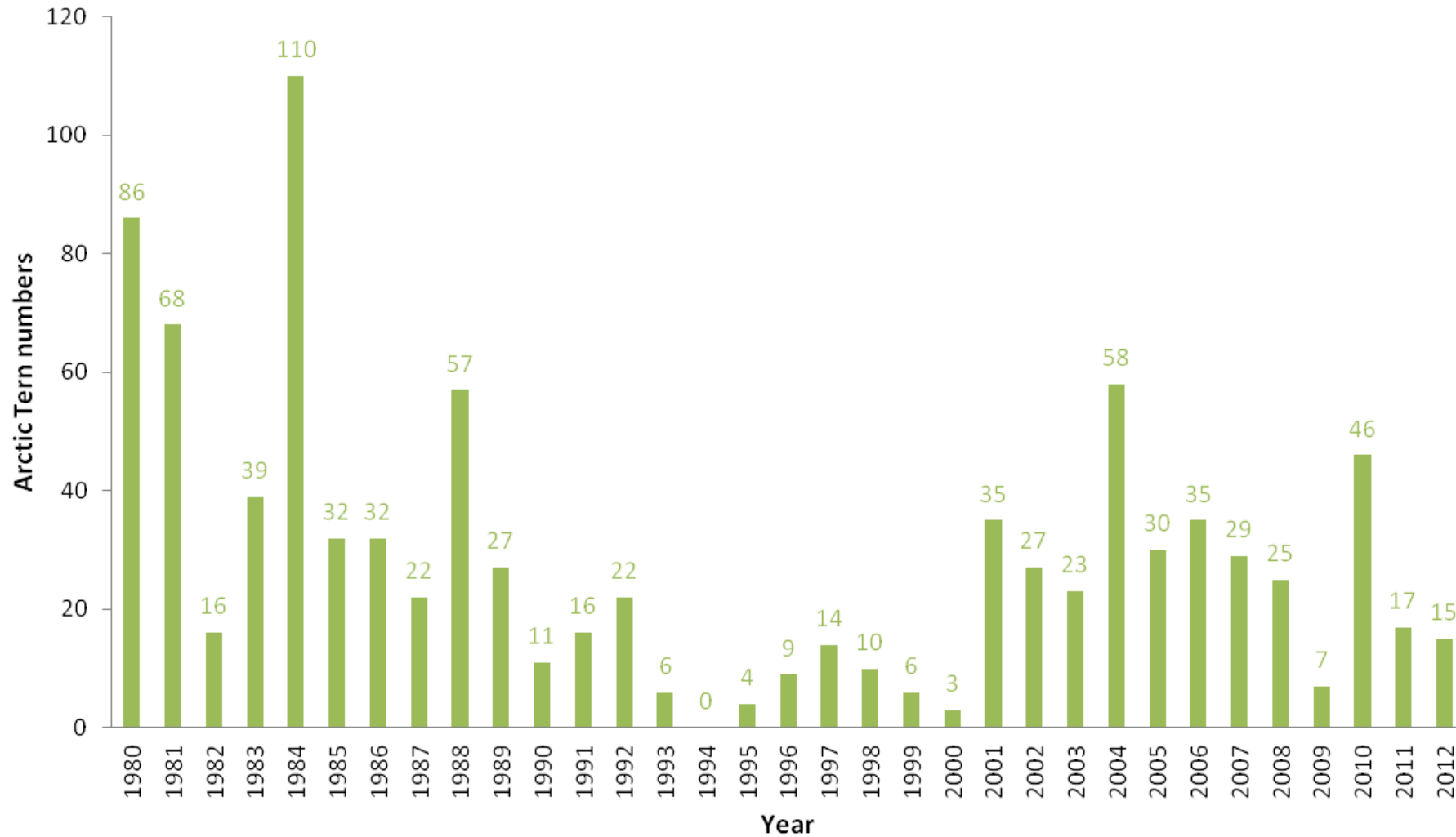


Figure 9: RSPB count numbers for Arctic Tern populations within Carlingford Lough.

Light Bellied Brent Goose numbers within Carlingford Lough for the winters of 1989/90 to 2010/11 as counted through WeBS Core count surveys (high tide counts).

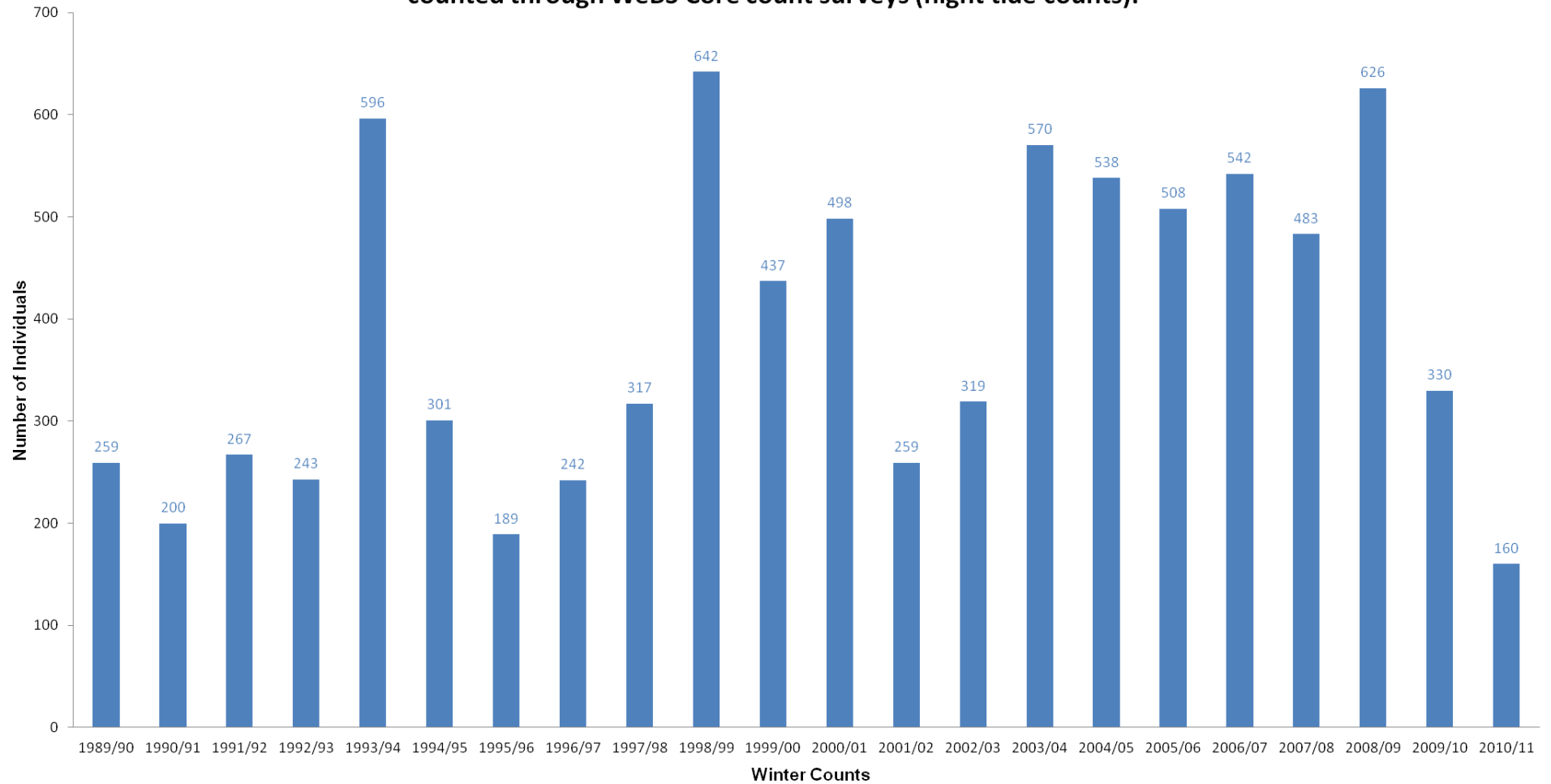


Figure 10: Graph showing the numbers of Light bellied Brent Goose counted within WeBS Core counts (high tide counts) in Carlingford Lough for the winters of 1989/90 to 2010/11.

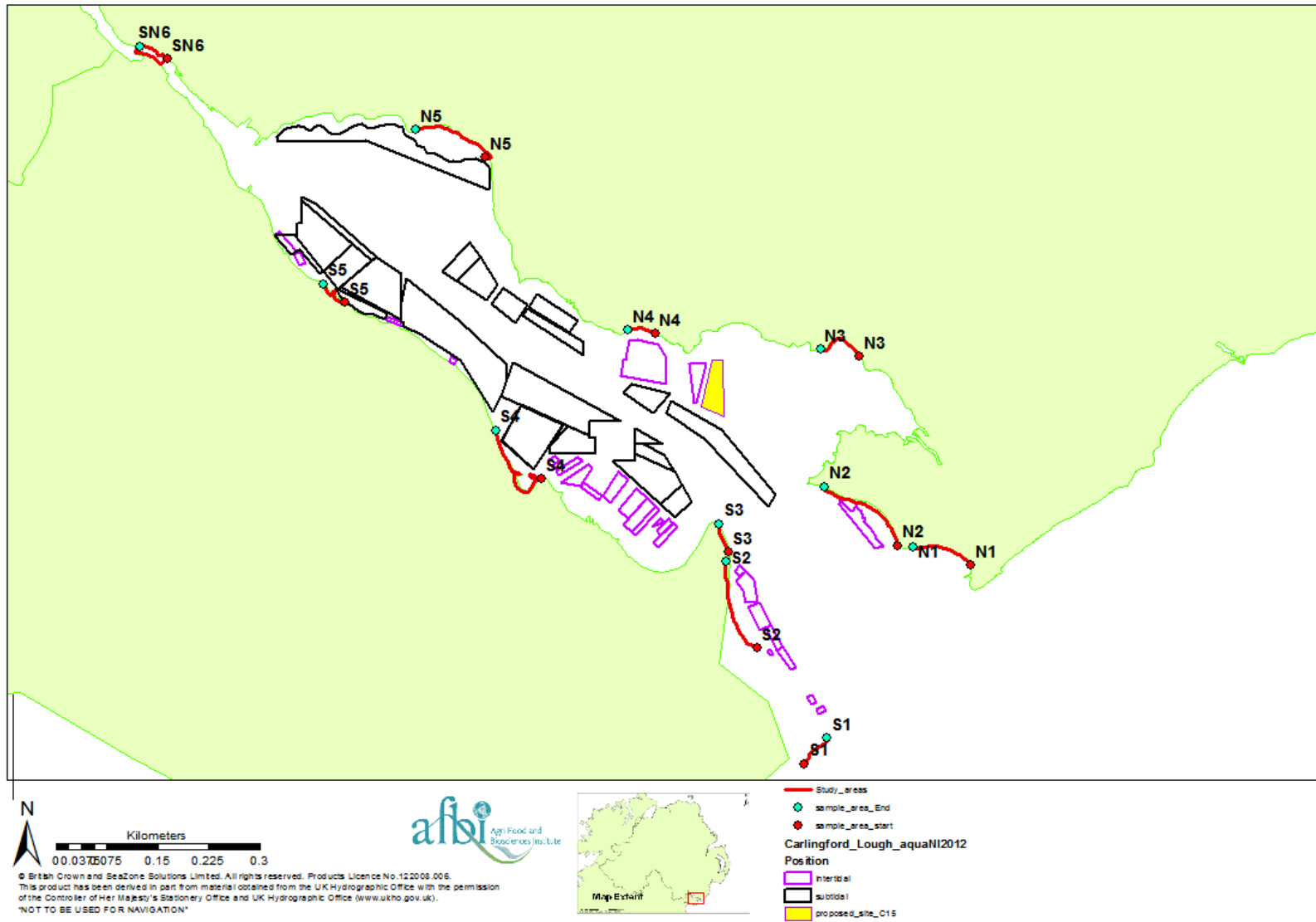


Figure 11: Map showing the location of the count areas within which the Loughs Agency (LA) undertook monthly bird counts from Jan to Dec 2012. Only the start (red dot on map) and end (turquoise dot on map) were supplied to AFBI. Boundaries of the survey areas were not drawn out to sea (LA pers comm.) however red lines along the shore have been added to the map in order to illustrate the distance along the shore included within each survey sector.

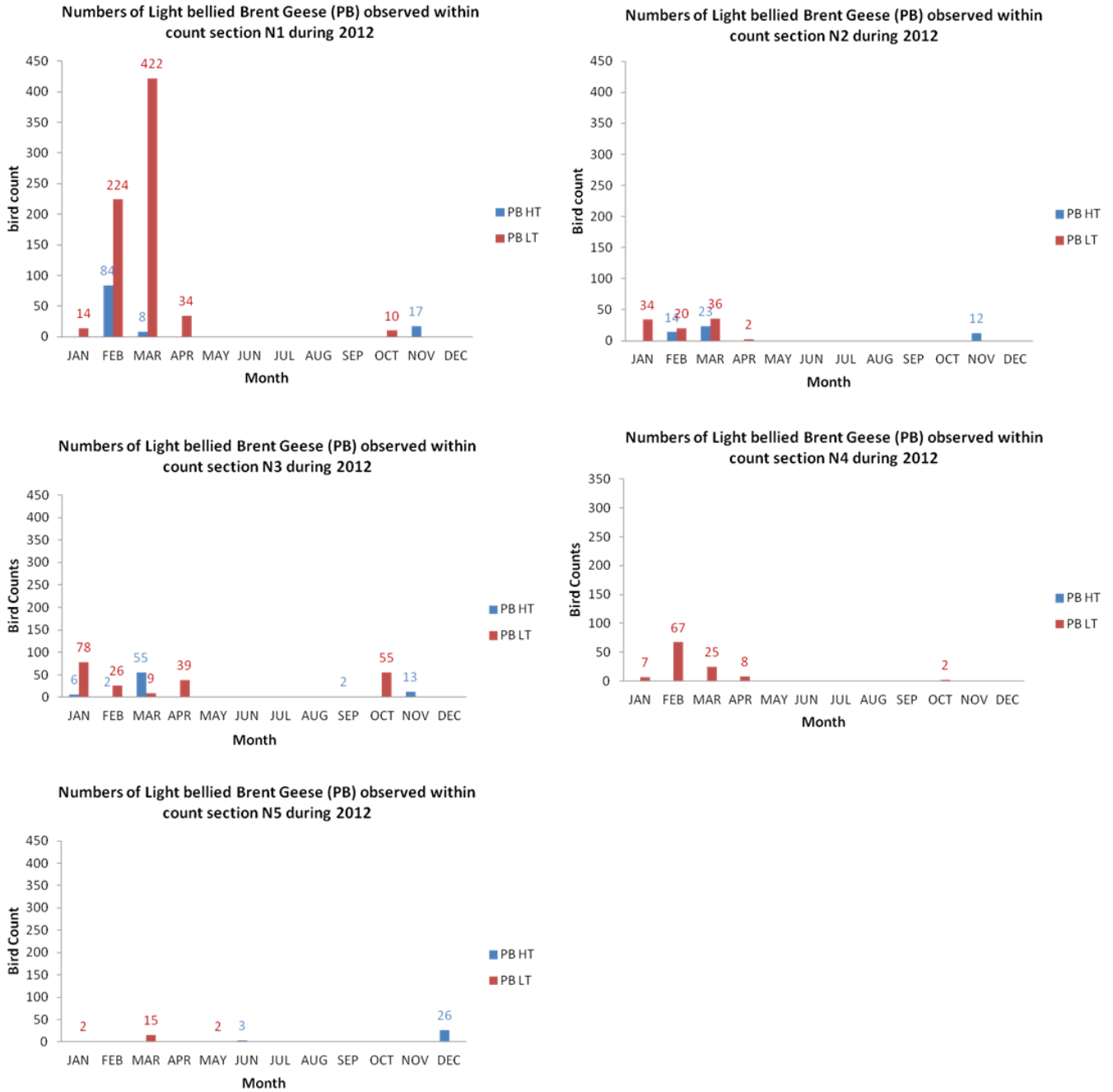


Figure 12: Graphs showing the numbers of Light Bellied Brent Goose counted by the Loughs Agency from Jan to Dec 2012 within the survey sites on the northern shore of Carlingford Lough (N1 to N5). Red bars represent low tide counts and blue bars represent high tide counts.

Total numbers of Light Bellied Brent Goose observed by the Loughs Agency from Jan-Dec 2012 at survey sites within Carlingford Lough

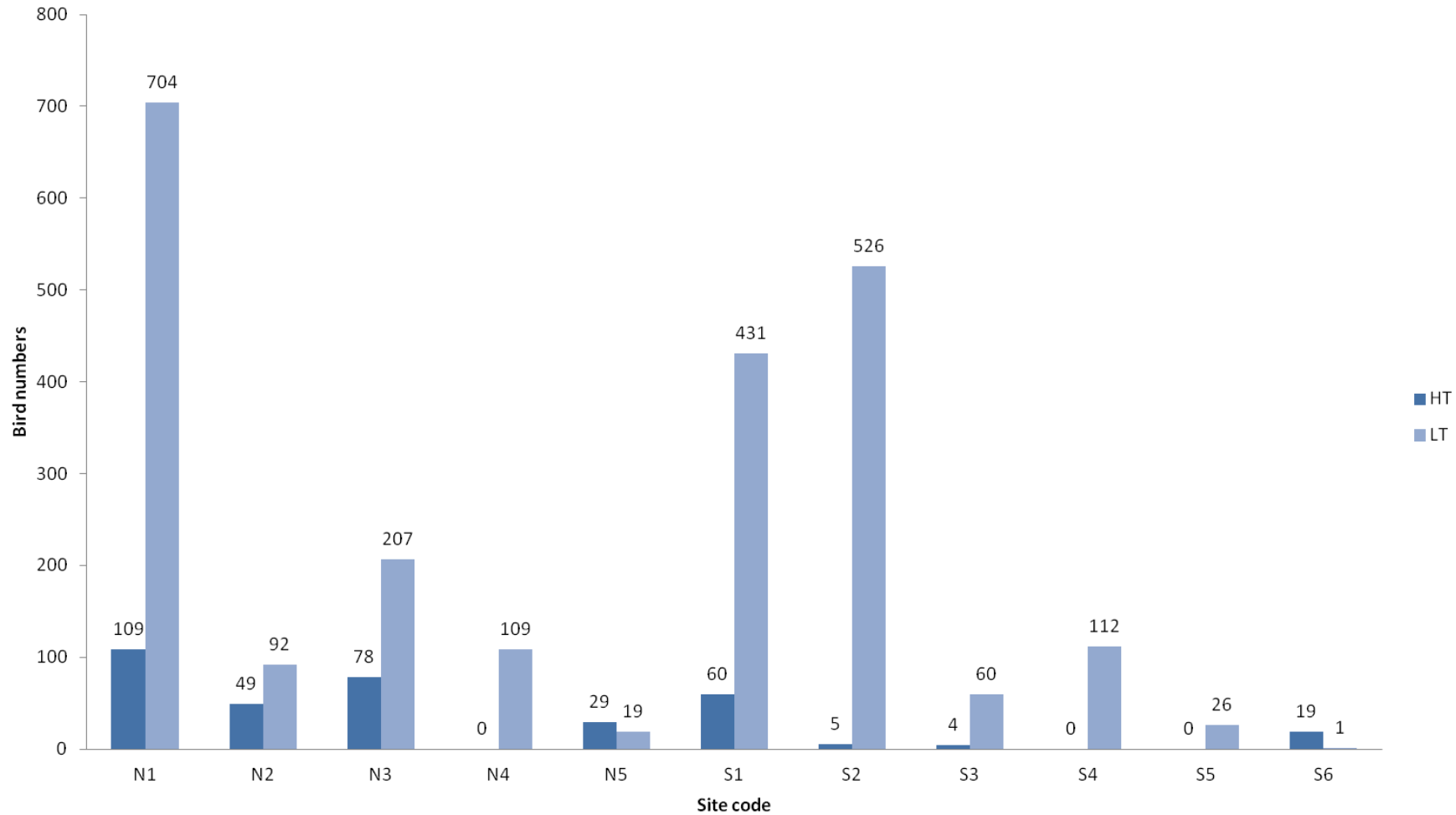


Figure 13: Total numbers of Light bellied Brent Geese observed by the Loughs agency from Jan – Dec 2012 at survey sites within Carlingford Lough. Dark blue bars indicate high tide counts and light blue bars represent low tide counts.

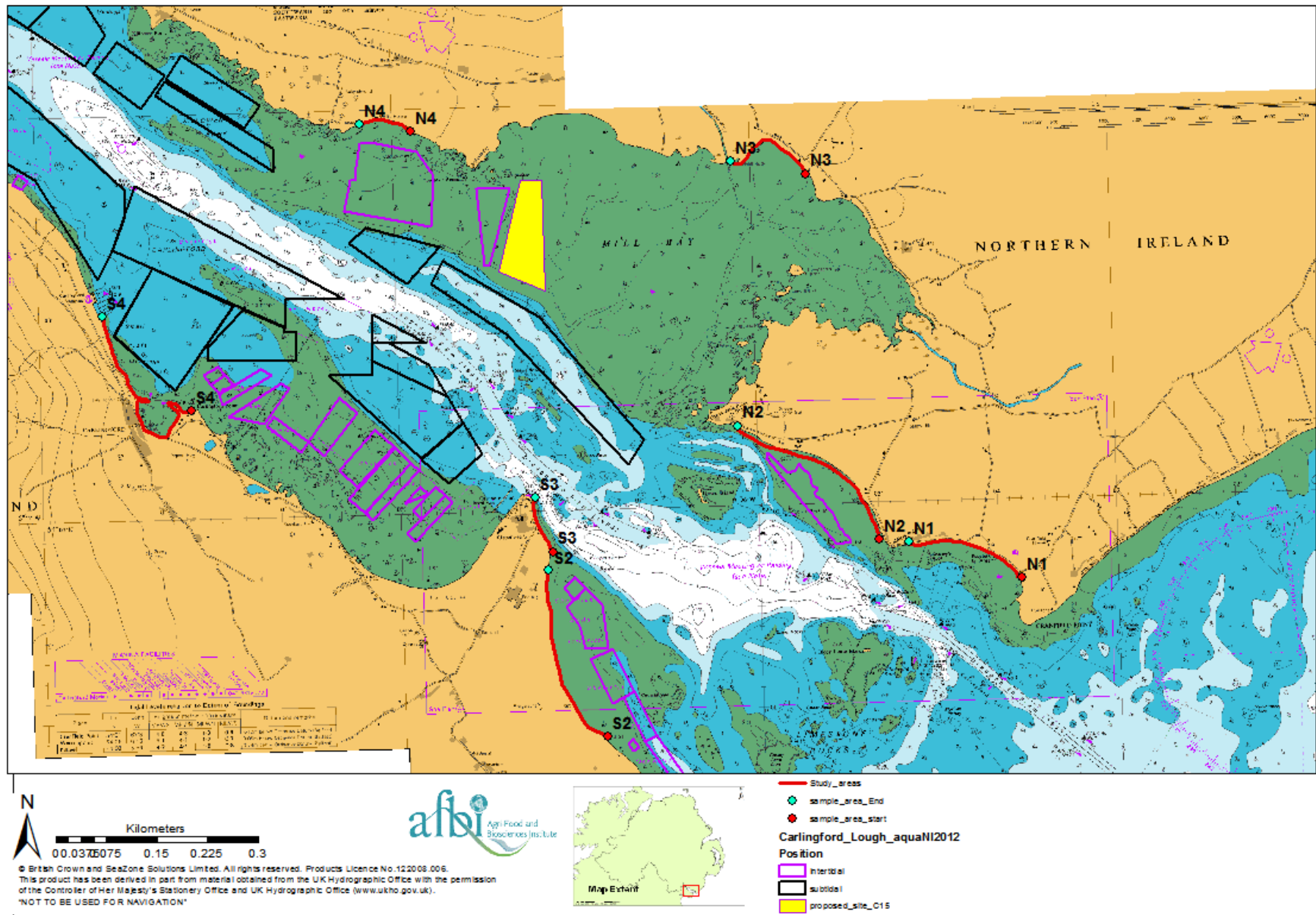


Figure 14: Map showing the location of the proposed new aquaculture site in relation to the Loughs Agency survey areas.

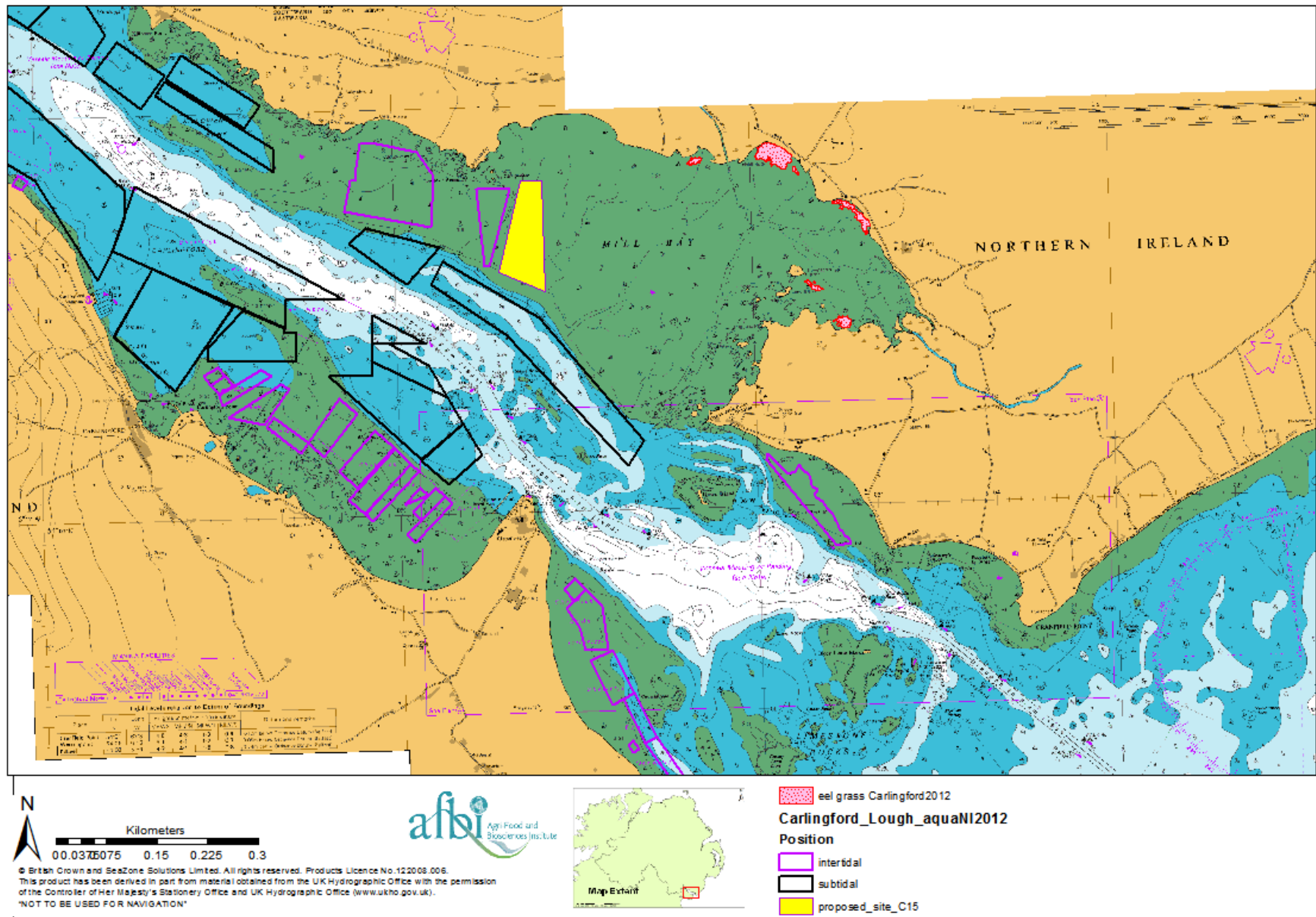


Figure 15: Map showing distribution of intertidal eelgrass on the Northern shores of Carlingford Lough as mapped by NIEA.

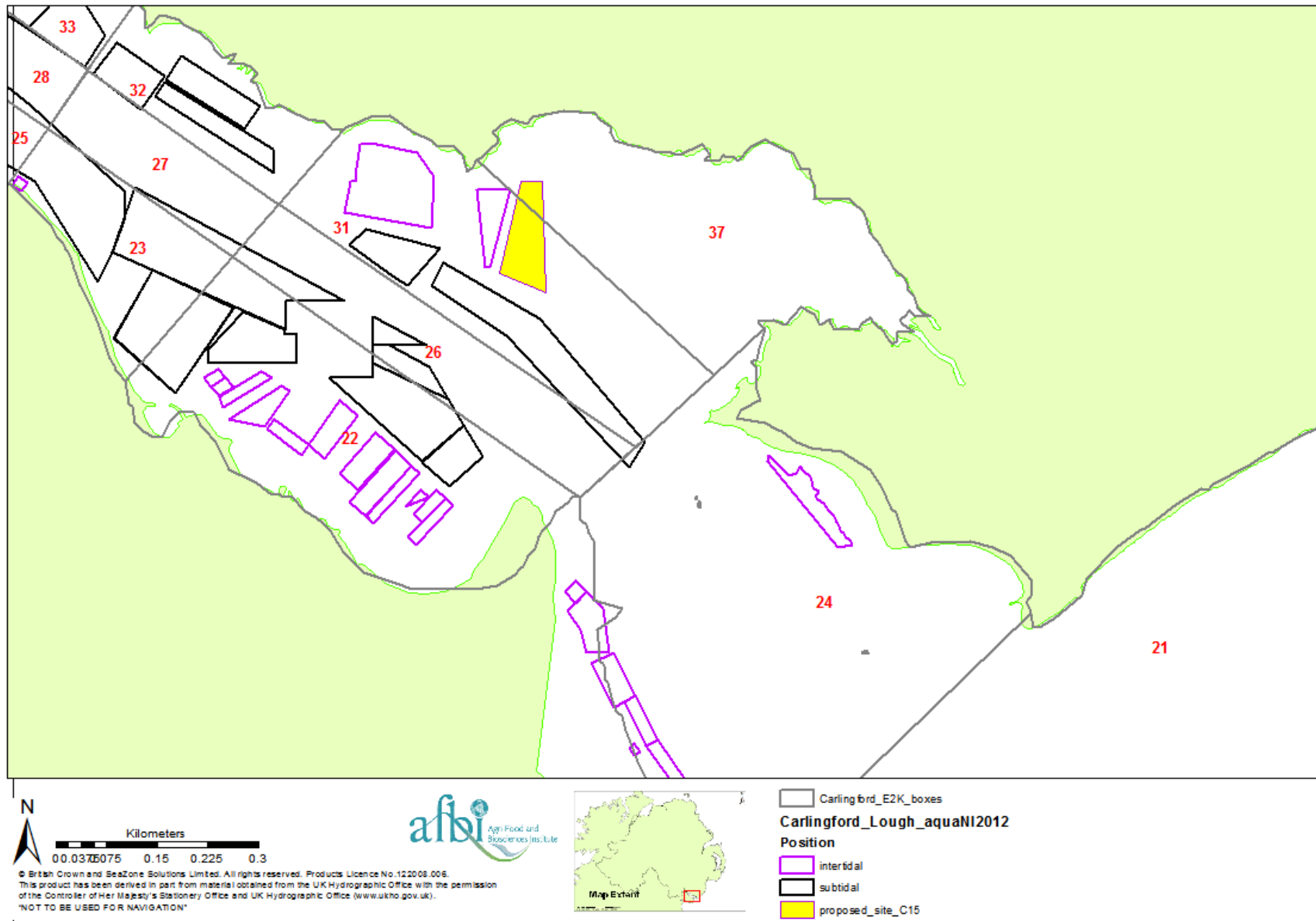


Figure 16: Map showing the location of the proposed new aquaculture site in relation to the SMILE model E2K Boxes.

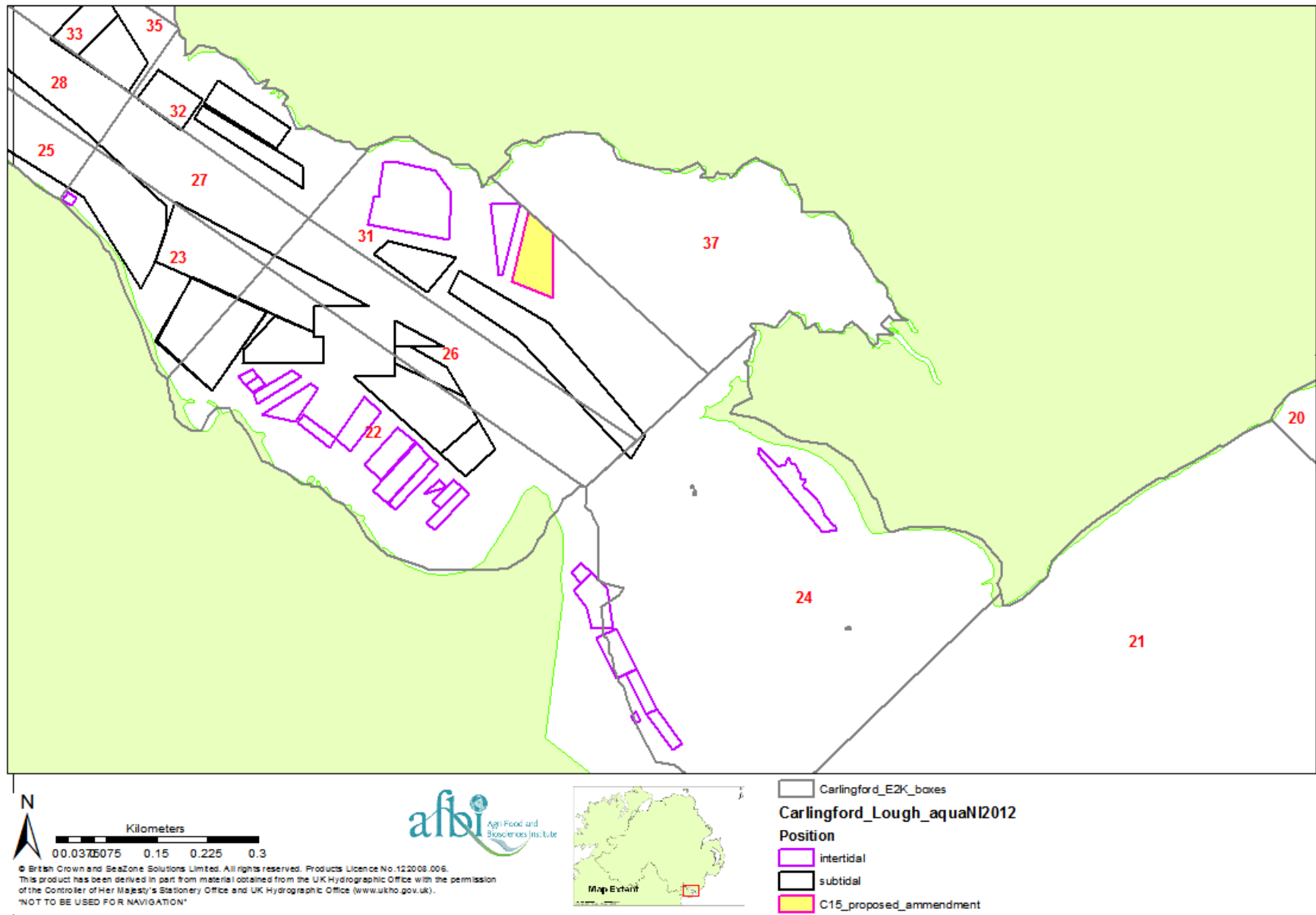


Figure 17: Map showing the recommended amendments to the proposed new aquaculture site.

Annex I: Natura 2000 standard Data form – Carlingford Lough SPA

UK SPA data form

NATURA 2000
STANDARD DATA FORM
 FOR SPECIAL PROTECTION AREAS (SPA)
 FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)
 AND
 FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type 1.2 Site code
 1.3 Compilation date 1.4 Update
 1.5 Relationship with other Natura 2000 sites

 1.6 Respondent(s)
 1.7 Site name

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	
date confirmed as SCI	
date site classified as SPA	199803
date site designated as SAC	

2. Site location:

2.1 Site centre location
 longitude latitude
 2.2 Site area (ha) 2.3 Site length (km)

2.5 Administrative region

NUTS code	Region name	% cover
UKB	Northern Ireland	99.59%

2.6 Biogeographic region
 Alpine Atlantic Boreal Continental Macaronesia Mediterranean

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representati vity	Relative surface	Conservation status	Global assessment

UK SPA data form

3.2 Annex I birds and regularly occurring migratory birds not listed on Annex I

Code	Species name	Population			Site assessment				
		Resident	Migratory		Population	Conservation	Isolation	Global	
			Breed	Winter					Stage
A193	<i>Sterna hirundo</i>		339 P			B		C	
A191	<i>Sterna sandvicensis</i>		575 P			B		C	

4. Site description:

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	96.0
Salt marshes. Salt pastures. Salt steppes	3.0
Coastal sand dunes. Sand beaches. Machair	
Shingle. Sea cliffs. Islets	1.0
Inland water bodies (standing water, running water)	
Bogs. Marshes. Water fringed vegetation. Fens	
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	
Alpine and sub-alpine grassland	
Improved grassland	
Other arable land	
Broad-leaved deciduous woodland	
Coniferous woodland	
Evergreen woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	
Inland rocks. Scree. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	
Total habitat cover	100%

4.1 Other site characteristics

Soil & geology: Limestone/chalk
Geomorphology & landscape: Enclosed coast (including embayment), Estuary, Intertidal rock, Intertidal sediments (including sandflat/mudflat), Islands, Ob (fiard)

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC)	
During the breeding season the area regularly supports:	
<i>Sterna hirundo</i> (Northern/Eastern Europe - breeding)	10.9% of the all-Ireland breeding population 5 year mean, 1993-1997
<i>Sterna sandvicensis</i> (Western Europe/Western Africa)	13.1% of the all-Ireland breeding population 5 year mean, 1993-1997

UK SPA data form

ARTICLE 4.2 QUALIFICATION (79/409/EEC)

4.3 Vulnerability

Breeding terns could be affected by factors such as disturbance, predation, reduction in limited suitable breeding sites within the site. The populations could also be affected by changes in food availability, winter mortality and shifts in breeding populations outside of the site.
An existing Conservation Plan for Carlingford Lough is now under review. This review will up-date existing management prescriptions and refine existing conservation objectives.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK04 (SSSI/ASSI)	100.0

Annex II: Carlingford Lough SPA (site code UK9020161)
selection feature objectives, as taken from Annex I of the NIEA
Conservation Objectives report for Carlingford Lough SPA.

Attribute	Measure	Targets	Comments
* Sandwich Tern breeding population	Apparently occupied nests	No significant decrease in Sandwich Tern breeding population against national trends, caused by on-site factors	Requirement that annual data is collected, then apply 5 year mean criteria. Ideally the population will be maintained above 1% of the national population. Decline to a level below the Common Standards Monitoring baseline over a five year period may indicate unfavourable condition of the site.
# Sandwich Tern fledging success	Annual survey (as per Gilbert <i>et al.</i> 1998). Determine number of fledglings raised and add to total number of fledglings raised over previous four years and divide by five to obtain average. This should remove variation from season to season, e.g. in response to bad weather.	>1 fledgling per pair successfully raised per year over five year period	Appropriate level of fledgling survival to be determined
* Common Tern breeding population	Apparently occupied nests	No significant decrease in Common Tern breeding population against national trends, caused by on-site factors	Requirement that annual data is collected, then apply 5 year mean criteria. Ideally the population will be maintained above 1% of the national population. Decline to a level below the Common Standards Monitoring baseline over a five year period may indicate unfavourable condition of the site.
# Common Tern fledging success	Annual survey (as per Gilbert <i>et al.</i> 1998). Determine number of fledglings raised and add to total number of fledglings raised over previous four years and divide by five to obtain average. This should remove variation from season to season, e.g. in response to bad weather.	>1 fledgling per pair successfully raised per year over five year period	Appropriate level of fledgling survival to be determined
* Light-bellied Brent Goose wintering population	Bird numbers	No significant decrease in population against national trends, caused by on-site factors	Five year running averages will be used to monitor population trends through WeBS data. Decline to a level below the Common Standards Monitoring baseline over a five year period may indicate unfavourable condition of the site.

* = primary attribute. One failure among primary attribute = unfavourable condition

= optional factors. These can be in unfavourable condition without the site being in unfavourable condition.

Annex III: DARD and AFBI site survey of the proposed new aquaculture site and access routes to be utilised.

Fisheries & Aquatic Ecosystems Branch
Marine Inshore Monitoring



Survey Title: Carlingford Lough Aquaculture Site Access Assessment
Proposed new Site C15

Survey date: 30.07.09

Location: Mill Bay area of the Northern shore of Carlingford Lough

Purpose: Carry out a site assessment of proposed access routes for new aquaculture site C15 and document the substrates within the proposed site area.

Client: Department of Agriculture and Rural Development
(Fisheries Division)

Equipment used: Garmin GPS device, waterproof digital camera, waterproof site aerial photographs/OS maps and waterproof notebook and pencil.

Types of sample collected: Photographs accompanied by; GPS waypoints (coordinates) and observational notes

AFBI Staff Involved: G. McNeil (SO) **DARD Staff Involved:** S. Craig

Additional Info:

Waypoint 1 = 54 03.915N 06 07.207W

Photos 1 and 2 were taken at the top of the shore and show the proposed site access point at the top of the shore looking landward. This is an existing lane already in use by other aquaculture operators within the area. Photos 3 and 4 were also taken from this position but show the existing track looking seaward. It is proposed that this track will be utilised as far as possible until a point of divergence is necessary to access the new site.

Waypoint 2 = 54 03.342N 05 07.663W

Photos 5 to 10 show the substrates within the area of the proposed new aquaculture site and the location of the site in relation to the shore. Photos show a mixed furoid habitat consisting of *Fucus vesiculosus* and *Fucus serratus*, interspersed with areas of rippled muddy sand dominated by *Arenicola marina*.

Whilst small patches of *Enteromorpha* sp were identified no *Zostera* was observed during this site visit.



Carlingford Lough 30.07.09 photo 1



Carlingford Lough 30.07.09 photo 2



Carlingford Lough 30.07.09 photo 3



Carlingford Lough 30.07.09 photo 4



Carlingford Lough 30.07.09 photo 5



Carlingford Lough 30.07.09 photo 6



Carlingford Lough 30.07.09 photo 7



Carlingford Lough 30.07.09 photo 8



Carlingford Lough 30.07.09 photo 9



Carlingford Lough 30.07.09 photo 10

Annex IV: Consultation responses received on original application for fish culture and shellfishery licences and initial Test of Likely Significance (table supplied to AFBI by DARD).

The majority of the issues raised below have been addressed in subsequent drafts of the test of likely significance and, at the time of this final version, there are no outstanding objections to the proposed development.

Agency/ Individual	Comment
RSPB	<p>They state that AFBI's original assessment failed to identify the correct SPA features, the most likely receptors, and the likely potential impacts. As a consequence the assessment is inadequate.</p> <ul style="list-style-type: none"> • Brent Geese were not considered in relation to direct and indirect impacts on the SPA • Feeding terns, benefit rather than a threat to terns. • Want the assessment to investigate whether the proposed site is used by feeding Brent geese and other wintering species, in order to determine the level of impact due to the loss of feeding habitat or disturbance. • Changes in geomorphology and hydrology – scouring, deposition effects, and nutrient conditions should be considered. • In combination and cumulative effects need to be considered in relation to oyster cultivation areas restricting the availability of mudflats to foraging birds. • Want to have mitigation measures relevant to the identified impacts on brent geese. • Pacific Oysters- concerns about breeding naturally. <p>Would like a strategic plan for the lough – rather than a specific assessment.</p>
Council for Nature, Conservation & Countryside	<ul style="list-style-type: none"> • Significant concerns and objections to the introduction of Pacific Oysters into an ASSI/SAC particularly on the basis that they are now spawning in Strangford Lough • Would like Fisheries division to review and strengthen their methods for screening introduced seed shellfish of all types before introduction.

<p>Ulster Wildlife Trust</p>	<p>Strongly object to the cultivation of the pacific oyster- they advocate precautionary principle should be followed.</p> <p>Support native oysters</p> <p>Concern in relation to the sea pen communities at the head of the lough, sand and rock reefs in the middle of the lough, and fast water communities at the entrance.</p> <p>Keen to recover the marine benthos and promote recovery of site, and better preservation of benthic communities.</p>
<p>NIEA Conservation Designations and Protection</p>	<p>For the following reasons they recommend against permitting the operation of a shellfish farm</p> <ul style="list-style-type: none"> • Destruction/disturbance to the ASSI/SPA selection feeding grounds caused by 5000m2 of trestles • Means of access to the site, type of vehicle to be used etc is not clear. • Underestimation of man power required to install and manage site • Impacts on the mud flat ecosystem due to shading and sediment flow etc caused by an additional 5000m2 of trestles • Pacific oysters are an alien species – may impact on biodiversity • As there are a number of shellfish farms in the area, the combined impact must be considered. <p>If Article 6 is robust and defensible then appropriate conditions below must be imposed –</p> <ul style="list-style-type: none"> • A limit on the number of personal and man hours (2 people, 6 hours a month) • Access to site at low tide, using existing pathway, by a way that negates disturbance to • Trestles should be placed in areas which do not contain food sources for the selection features of Terns and Brent Geese • All pacific oysters should be of triploid variety •
<p>Birdwatch Ireland</p>	<p>Fully supports and re-iterates the submission made by the RSPB.</p>
<p>NIEA Water Management Unit</p>	<p>NIEA expressed concerns over-</p>

	<ul style="list-style-type: none">• Scale of the proposed development• Effect on ecological status under the Water Framework Directive• Original assessment is incomplete – needs to include other SPA features
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Annex II: Natura 2000 standard Data form – Carlingford Lough SPA

UK SPA data form

NATURA 2000
STANDARD DATA FORM
 FOR SPECIAL PROTECTION AREAS (SPA)
 FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)
 AND
 FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type 1.2 Site code
 1.3 Compilation date 1.4 Update
 1.5 Relationship with other Natura 2000 sites

 1.6 Respondent(s)
 1.7 Site name

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	
date confirmed as SCI	
date site classified as SPA	199803
date site designated as SAC	

2. Site location:

2.1 Site centre location
 longitude latitude
 2.2 Site area (ha) 2.3 Site length (km)

2.5 Administrative region

NUTS code	Region name	% cover
UKB	Northern Ireland	99.59%

2.6 Biogeographic region

Alpine
 Atlantic
 Boreal
 Continental
 Macaronesia
 Mediterranean

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representati vity	Relative surface	Conservation status	Global assessment

UK SPA data form

3.2 Annex I birds and regularly occurring migratory birds not listed on Annex I

Code	Species name	Population			Site assessment				
		Resident	Migratory		Population	Conservation	Isolation	Global	
			Breed	Winter					Stage
A193	<i>Sterna hirundo</i>		339 P			B		C	
A191	<i>Sterna sandvicensis</i>		575 P			B		C	

4. Site description:

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	96.0
Salt marshes. Salt pastures. Salt steppes	3.0
Coastal sand dunes. Sand beaches. Machair	
Shingle. Sea cliffs. Islets	1.0
Inland water bodies (standing water, running water)	
Bogs. Marshes. Water fringed vegetation. Fens	
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	
Alpine and sub-alpine grassland	
Improved grassland	
Other arable land	
Broad-leaved deciduous woodland	
Coniferous woodland	
Evergreen woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	
Inland rocks. Scree. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	
Total habitat cover	100%

4.1 Other site characteristics

Soil & geology: Limestone/chalk
Geomorphology & landscape: Enclosed coast (including embayment), Estuary, Intertidal rock, Intertidal sediments (including sandflat/mudflat), Islands, Ob (fiard)

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC)	
During the breeding season the area regularly supports:	
<i>Sterna hirundo</i> (Northern/Eastern Europe - breeding)	10.9% of the all-Ireland breeding population 5 year mean, 1993-1997
<i>Sterna sandvicensis</i> (Western Europe/Western Africa)	13.1% of the all-Ireland breeding population 5 year mean, 1993-1997

UK SPA data form

ARTICLE 4.2 QUALIFICATION (79/409/EEC)

4.3 Vulnerability

Breeding terns could be affected by factors such as disturbance, predation, reduction in limited suitable breeding sites within the site. The populations could also be affected by changes in food availability, winter mortality and shifts in breeding populations outside of the site.
An existing Conservation Plan for Carlingford Lough is now under review. This review will up-date existing management prescriptions and refine existing conservation objectives.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK04 (SSSI/ASSI)	100.0

Annex III: AFBI site survey January 2015.

Fisheries & Aquatic Ecosystems Branch
Marine Inshore Monitoring



Survey Title: Aquaculture Site Access Assessment at
Site C15

Survey date: 23.01.2015

Location: Mill Bay, Carlingford Lough, Co. Down

Purpose: To carry out a site assessment within the boundary of licensed site C15 to
inform the HRA for a licence amendment application.

Client: Department of Agriculture and Rural Development
(Fisheries and Environment Division)

Equipment used: Garmin GPS device (GPSmap 62), waterproof digital
camera, waterproof site aerial photographs/OS maps and
waterproof notebook and pencil.

Types of sample collected: Photographs accompanied by; GPS
waypoints (coordinates), and observational notes

AFBI Staff Involved: Gavin McNeill (SO) and Yaiza Ontoria Gomez (TASO)

Additional Information:

Introduction

The Fisheries and Environment Division of the Department of Agriculture and Rural Development (DARD) commissioned AFBI to undertake a Habitats Regulations Assessment report for proposed amendments to the Fish Culture Licence of licensed aquaculture site C15 within Carlingford Lough Special Protection Area (SPA) in Northern Ireland. Part of this assessment involved a site visit by AFBI Scientific staff to investigate the area within which the applicant intends to deploy the proposed additional trestles. This brief report outlines the initial findings of the AFBI site survey undertaken on the 23rd of January 2015 within the boundary of aquaculture site C15.

Methods

The applicant accompanied AFBI scientific staff and identified the areas within which the proposed additional trestles would be deployed. Sampling stations were placed at the corners of each of the two proposed trestle locations. In order to investigate the benthic composition of these areas sediment samples were collected for Particle size Analysis (PSA) and a quadrat was randomly placed on the seabed and photographs and notes on benthic habitats and conspicuous epifauna recorded at each sample station.

Results

Field notes and positional information from each sample station are presented within Table 1. The location of the route taken across site C15 and the position of each of the waypoints described within Table 1 are shown within Figure 1. The location of each sample station is shown in Figure 2. The areas within which the applicant wishes to deploy the additional trestles (if granted) are shown by the blue outlined areas within Figure 3. The photographic quadrats are shown in Figure 4 and overview photographs taken at additional waypoints are shown in Figure 5.

No species of conservation significance were observed within or adjacent to the survey area.

Table 1: Sample station locations and brief description of the benthos.

Latitude (decimal degrees)	Longitude	WP	Photo quadrat + PSA	Photo no.	Notes
54.05348	-6.12978	566	No		Corner 1 of the 1 st block of existing trestles currently in use on site.
54.05353	-6.12992	567	No		Corner 2 of the 1 st block of existing trestles currently in use on site.
54.05392	-6.12937	568	No	1656 - 1658	Corner 3 of the 1 st block of existing trestles currently in use on site. Photographs showing extent of Block 1 taken at this point.
54.05388	-6.1293	569	No		Corner 4 of the 1 st block of existing trestles currently in use on site.
54.05355	-6.1289	570	Yes	1635 - 1639	Waypoint marking 1 st corner of proposed area of expansion; Area 1. Shore comprised of compact rippled sand.
54.05228	-6.12993	571	Yes	1640 - 1645	Waypoint marking 2 nd corner of proposed area of expansion; Area 1. Shore comprised of compact rippled sand.
54.05245	-6.13108	572	Yes	1646 - 1651	Waypoint marking 3 rd corner of proposed area of expansion; Area 1. Shore comprised of compact rippled sand. Area of shore containing medium to small sized rocks covered with fucoids to the outside of the proposed area of expansion at this point.
54.05407	-6.12927	573	Yes	1652 - 1655	Waypoint marking 4 th corner of proposed area of expansion; Area 1. Shore comprised of compact rippled sand.
54.0541	-6.12942	574	No	1659 - 1660	Waypoint along a route used to access existing area of trestles; Block 1. Photo 1659 taken in a southerly direction from this point. Photo 1660 taken in a northerly direction from this point shows a clearing through the rock covered shoreline.
54.05507	-6.1291	575	No	1661 - 1663	Waypoint along a route used to access existing area of trestles; Block 1. Photo 1661 - 1663 taken in a southerly direction from this point shows the upper end of the cleared route through the rock covered shoreline.
54.05478	-6.13373	576	Yes	1664 - 1669	Waypoint marking 1 st corner of proposed area of expansion; Area 2. Shore comprised of compact rippled sand. Area of shore containing medium to small sized rocks covered with fucoids to the outside of the proposed area of expansion at this point. Photos 1668 & 1669 show the 2 nd area of trestles currently in use on this site to the south of this point.
54.05585	-6.13352	581	Yes	1670 - 1675	Waypoint marking 2 nd corner of proposed area of expansion; Area 2. Shore comprised of compact rippled sand containing worm casts and medium to small sized rocks covered with fucoids. Photos 1674 & 1675 show the 2 nd area of trestles currently in use on this site to the south of this point.
54.05545	-6.13207	577	No		Corner 1 of the 3 rd block of existing trestles currently in use on site.
54.0553	-6.13208	578	No	1676 - 1677	Corner 2 of the 3 rd block of existing trestles currently in use on site. Photographs showing extent of Block 3 taken at this point.
54.05532	-6.1314	579	No		Corner 3 of the 3 rd block of existing trestles currently in use on site.

54.05543	-6.13138	580	No		Corner 4 of the 3 rd block of existing trestles currently in use on site.
54.05553	-6.12988	582	Yes	1678 - 1682	Waypoint marking 3 rd corner of proposed area of expansion; Area 2. Shore comprised of compact rippled sand containing worm casts. Area of shore containing medium to small sized rocks covered with fucoids to the outside of the proposed area of expansion at this point.
54.0548	-6.12953	583	Yes	1683 - 1686	Waypoint marking 4 th corner of proposed area of expansion; Area 2. Shore comprised of compact rippled sand containing worm casts and medium to small sized rocks covered with fucoids.
54.05585	-6.12972	584	No	1687	Waypoint at a divergence point along a route used to access either the existing area of trestles at Block 1 or Blocks 2 & 3. Photo 1687 taken in a northerly direction at this point.
54.0575	-6.12997	585	No		Waypoint marking a point along the route towards the shoreline access point.
54.05873	-6.12985	586	No		Waypoint marking a point along the route towards the shoreline access point.
54.06048	-6.12943	587	No	1688	Waypoint at a divergence point between the route used to access the O'Hare site and a main communal route. Photo 1688 taken in a south westerly direction at this point.
54.0614	-6.1272	588	No		Waypoint marking a point along the main communal route towards the shoreline access point.
54.06298	-6.12455	589	No		Waypoint marking a point along the main communal route towards the shoreline access point.
54.06532	-6.12003	590	No	1689	Waypoint marking the shoreline access point at the beginning of the communal route. Photo 1689 taken in a south westerly direction at this point.

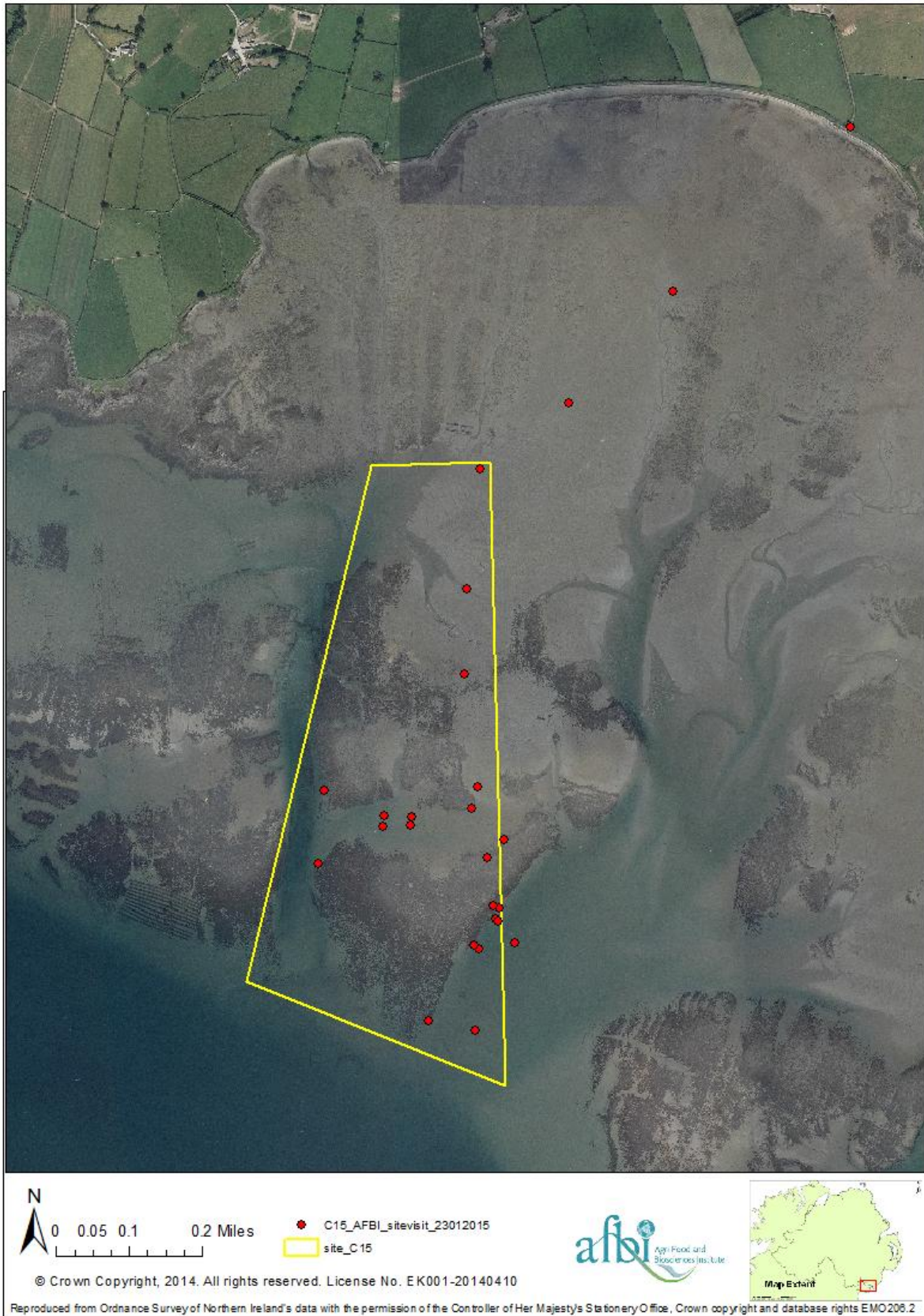


Figure 1: C15 boundary showing all AFBI waypoints.

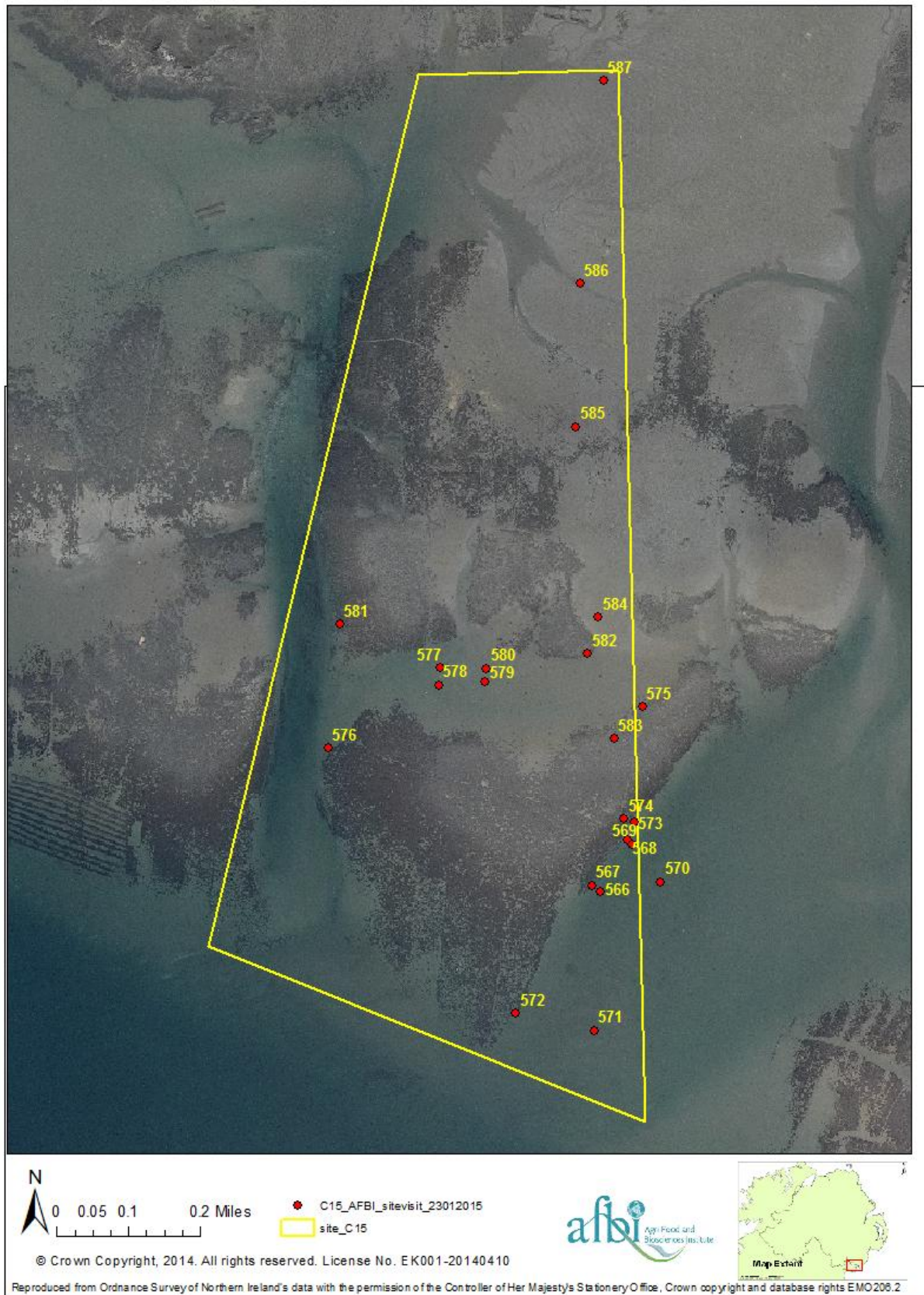


Figure 2: C15 boundary showing the labelled waypoints within this area.

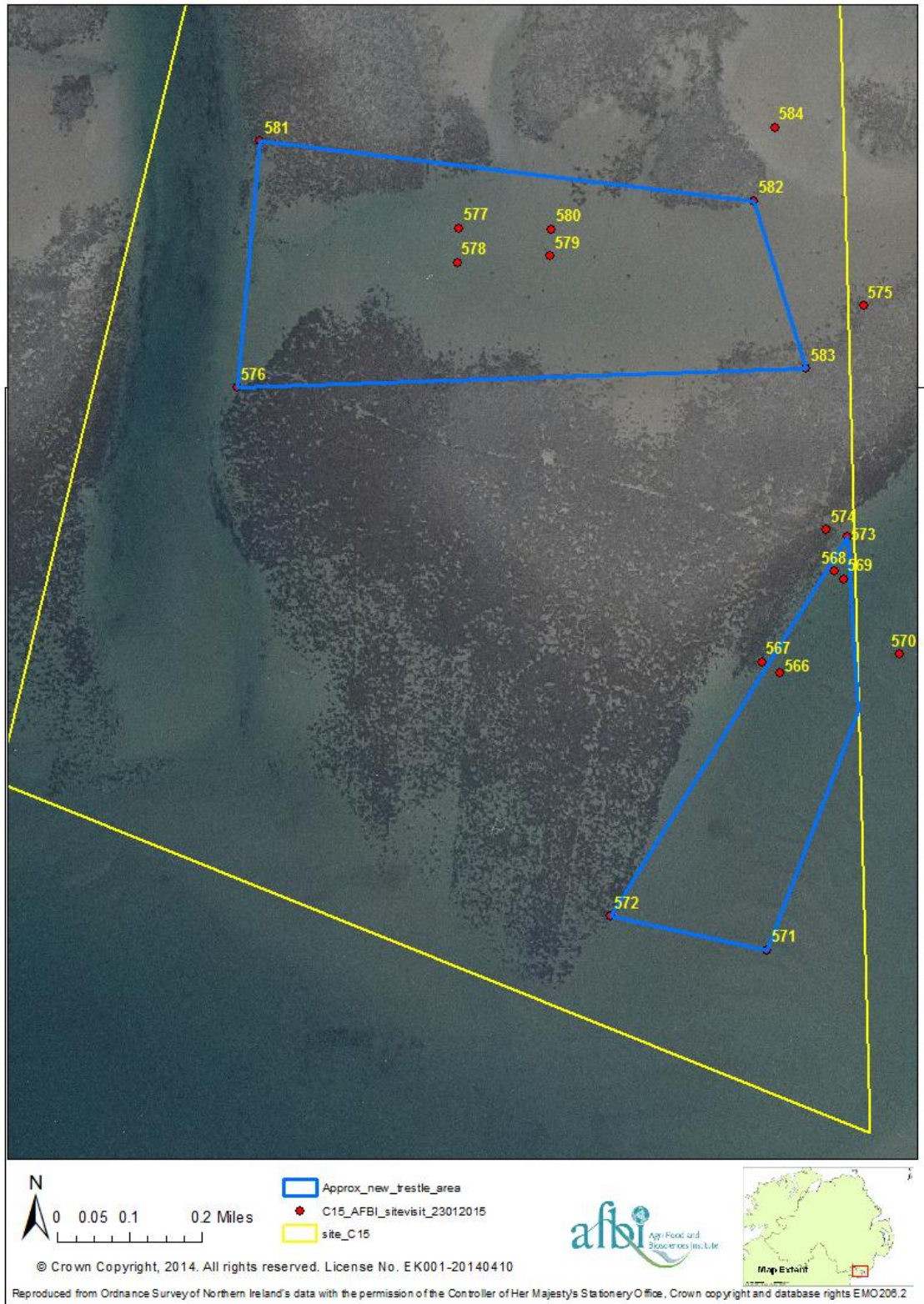


Figure 3: C15 boundary showing the proposed location of the additional trestles applied for (blue areas outlined on the map).

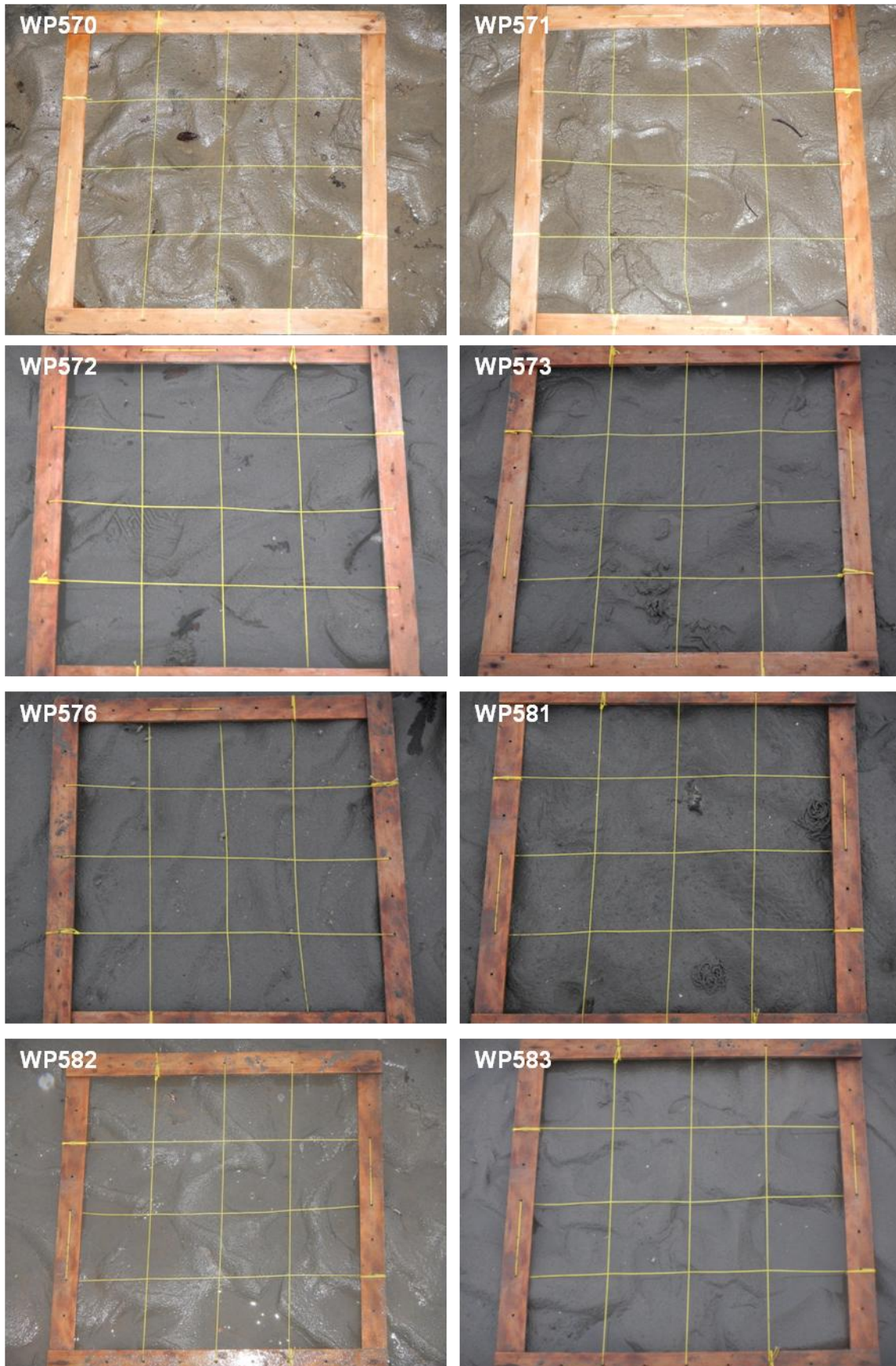


Figure 4: Photographic quadrats with associated waypoint number.



Figure 5: Overview photographs taken during the survey, with associated waypoint numbers.