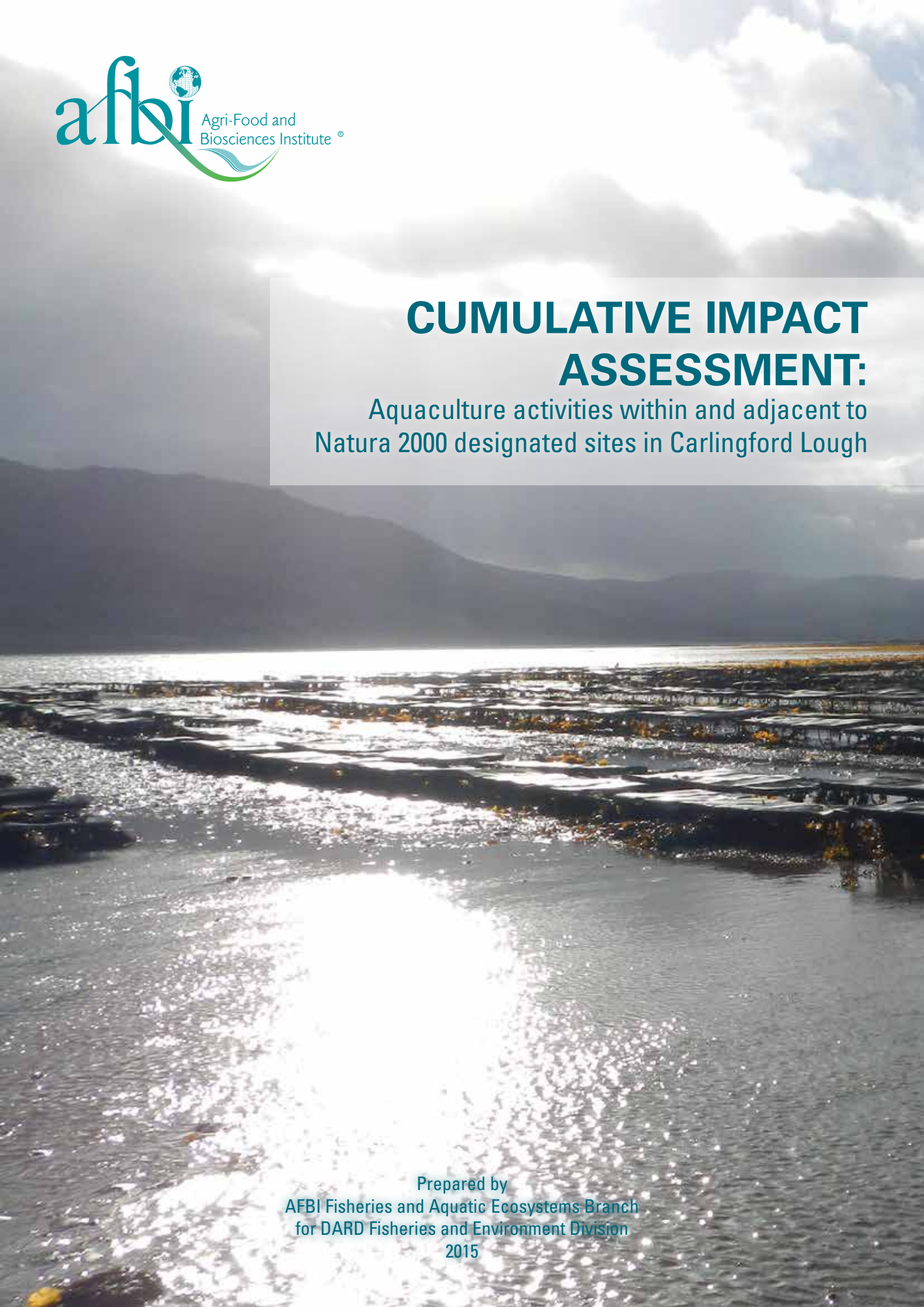

CUMULATIVE IMPACT ASSESSMENT:

Aquaculture activities within and adjacent to Natura 2000 designated sites in Carlingford Lough

Prepared by
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for DARD Fisheries and Environment Division
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Contents

Table of Figures

Executive summary

Introduction

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 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. The areas of Carlingford Lough on the Northern side of the dredged channel have been designated as a Special Protection Area (SPA) for breeding Sandwich and Common Terns and overwintering (non breeding) Light Bellied Brent Geese, 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 on the Southern side of the dredged channel have been designated as a Special Area of Conservation (SAC) for the Annex I habitats Annual vegetation of drift lines and Perennial vegetation of stony banks, a SPA for overwinter (non breeding) Light bellied Brent Geese and wetlands and also is a proposed Natural Heritage Area.

Impact Assessment

In order to undertake a comprehensive assessment of the impacts of aquaculture activities within the boundaries of and in the vicinity of the Natura 2000 designated sites within Carlingford Lough the GIS programme ArcGIS v10.0 was used to map the distribution of designated features (where available) in relation to licensed aquaculture sites.

Current aquaculture activities within Carlingford Lough

Aquaculture sites licensed for bottom culture of shellfish (predominantly mussels) cover approximately 931 hectares of the subtidal area of Carlingford Lough and approximately 240.1 hectares of the intertidal area of the Lough is licensed for the off bottom (trestle) culture of oysters. The total area of Carlingford Lough (both intertidal and subtidal) is estimated to be approximately 4,890 hectares (as calculated in ArcGIS v10.0). Therefore licensed aquaculture beds cover approximately 23.9% of the total area of the Lough. However not all of these sites are currently active and of

those sites that are active not all of the licensed area is utilised for shellfish cultivation.

1. 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 fourteen licensed aquaculture sites on the Northern side of Carlingford Lough. There are also at present two applications pending for amendments to currently licensed shellfish aquaculture sites. 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 show only *M. edulis* and *C. gigas* being produced within the Lough. These records also indicate that not all of the sites licensed for aquaculture are at present actively producing shellfish.

2. Southern area of Carlingford Lough

In the Southern side of Carlingford Lough the Aquaculture and Foreshore Management Division of the Department of Agriculture, Food and the Marine (DAFM) is responsible for aquaculture licensing under the Fisheries (Amendment) Act, 1997.

There are currently forty one sites licensed for shellfish aquaculture within the Southern side of Carlingford Lough. Records for 2009-2011 for shellfish production within the southern area of Carlingford Lough show only mussels and oysters being cultivated (BIM 2013).

The total area of the Carlingford Lough cSAC occupied by aquaculture is approximately 48.98 hectares which equates to approximately **9.31%** of the total designated area of the cSAC.

As the bird species for which the two SPAs are designated will utilise the whole of the Lough the total area of Carlingford Lough designated as a SPA was calculated. The total area of Carlingford Lough designated as a SPA that is currently occupied by aquaculture licences is approximately 209.73 hectares which equates to approximately **14.7%** of the total designated area.

GIS Assessment

1. Impacts of aquaculture activities on SPA designated features

- Breeding birds

Tern species breed on three islands near the mouth of Carlingford Lough which are monitored annually by the Royal Society for the Protection of Birds (RSPB).

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). It is not possible to determine an authoritative protective buffer distance for breeding Tern species within Carlingford Lough without first undertaking field investigations. However, no licensed aquaculture sites are within 500 m of the islands on which Terns are monitored in Carlingford Lough. Previous studies in America have listed Flushing Distances of Tern species to human disturbance which range from 100 m (Rodgers and Smith, 1997), 180 m (Rodgers and Smith, 1995) and 200 m (Erwin 1989). Using these as a guide in the absence of any site specific field data we can surmise that activities at an intertidal aquaculture site over 500 m from Tern nest sites are unlikely to cause significant negative impacts on this feature of the SPA.

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)). Intertidal aquaculture activities will therefore not impact on the feeding and foraging areas of the Tern species for which the Carlingford Lough SPA is designated.

Tern numbers within Carlingford Lough have been declining in recent years. This decline 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, 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).

- Overwintering (non breeding birds)

Light Bellied Brent Geese numbers within Carlingford Lough are counted annually through the Wetland Bird Survey (WeBS) Wildfowl and Wader Counts. These figures are collected at high tide. Analysis of monthly counts for Light Bellied Brent Geese

undertaken at both high and low tide at several locations within Carlingford Lough during 2012 indicated that the numbers counted at low tide were significantly higher than those counted at high tide. When investigating the potential impacts of intertidal aquaculture on this species it would therefore be preferable to use low tide counts if available.

Highest numbers of Light Bellied Brent Geese were recorded by the Loughs Agency in sectors N1 which covers the area between Cranfield Point and Soldiers Point within which there are not currently any licensed aquaculture sites. Sector S2, which had the second highest number of Brent Geese present covers an area within which there are numerous licensed intertidal aquaculture sites. Gittings and O'Donoghue (2012) found that Light Bellied Brent Geese showed a variable response to oyster trestles.

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. The intertidal eelgrass beds on the Southern shore of Carlingford Lough are confined to the area between Greenore Point and Carlingford Point. There are no licensed aquaculture sites within areas identified as intertidal eelgrass beds.

The feeding patterns of Brent Geese are related to tidal cycles, they can therefore be both diurnal and nocturnal feeders. In general operators of intertidal aquaculture sites can only access their trestles at low tide and would typically only be on site during daylight hours. However, during the darker winter months, low tides do not always coincide with daylight hours and therefore some limited access to aquaculture sites may be required during the hours of darkness. As there is no eelgrass on present on licensed aquaculture sites within Carlingford Lough, Light-bellied Brent Geese should be able to feed during night time low tides undisturbed by aquaculture operators.

2. Impacts of aquaculture activities on SAC designated features

- Annual vegetation of drift lines

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

- Perennial vegetation of stony banks

This Annex I habitat is found at the limit of high tide (JNCC 2007). As Intertidal shellfish aquaculture occurs on the lower intertidal zone there will therefore not be any spatial overlap between aquaculture and this feature of the SAC.

Aquatic Animal Health

The Aquatic Animal Health Regulations (Northern Ireland) 2009 implement Council Directive 2006/88/EC with regards to animal health requirements for aquaculture animals and products and on the prevention and if necessary control of certain diseases in aquatic animals. Under the 2009 Regulations, all fish and shellfish farms must be authorised as Aquaculture Production Businesses and operate in accordance with a documented bio-security plan in order to prevent and control the spread of disease.

Non native species

Seed mussels used the bottom culture of mussels in Carlingford Lough are obtained from naturally occurring seed beds (usually located within the UK and Ireland). Other bivalves for aquaculture, such as Pacific oysters (*Crassostrea gigas*), can be produced in purpose built authorised premises remote from the natural environment to remove exposure to aliens and disease.

Pacific oysters are a non native species within the UK and Ireland. They were introduced primarily to substitute declining native oyster stocks (Herbert *et al* 2012). It was previously believed that the Pacific oyster *Crassostrea gigas* 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 instances of feral populations of *Crassostrea gigas* present within Carlingford Lough.

Benthic impacts

Intertidal oyster culture is undertaken within the boundaries of all of the Natura 2000 designated sites in Carlingford Lough. It has the potential therefore to impact the benthic habitats within these sites. 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*, 1996; Forrest and Creese 2006; Forrest *et al,* 2009 and the literature reviewed within).

Oyster trestles within Carlingford Lough are generally around 50 cm above the ground. This ensures adequate circulation and reduces sedimentation (Nuges *et al* 1996). In order to ensure that any changes in benthic sediments and communities remain small and localised, a programme of monitoring has been established (in agreement with the Department of the Environment (DoE)) for all new intertidal aquaculture sites on the northern shore of Carlingford Lough granted licences since 2014.

Carrying capacity assessment

For the purpose of this assessment the SMILE model was applied to enable three scenarios, which simulated the impact on the ecosystem of increasing the abundance of filter-feeding organisms in Carlingford Lough, to be tested. Chlorophyll a (Chl a) was 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** 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). Those sites for which there was no production data for 2014 were activated at their rate of production as per data supplied during SMILE development. 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 – Aquaculture activities were increased to include the applications currently in progress on the Northern side of the Lough. The area of site C11 was reduced to that currently applied for (production levels at this site were kept as per Run 2). Production levels* within site C15 were increased to account for production of oysters and mussels on the proposed additional trestles. 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.

The results from these Runs show that aquaculture species reduce the overall ecosystem phytoplankton biomass and hence food availability for other organisms within Carlingford Lough by up to 70%.

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).

Results from SMILE Runs (Tables 2.2, 2.3 and 2.4) indicate that mussel production within all model boxes is currently at or above the ecological threshold whilst there is limited potential for the controlled expansion of intertidal oyster culture in certain areas.

It should be noted that for the purpose of this report (to represent the worst case scenario) within the model **ALL** currently licensed aquaculture sites within Carlingford Lough were activated which in reality is not the case. There is currently a moratorium in place within Northern Ireland on the granting of any further Fish Culture Licences for the bottom culture of mussels.

Conclusions

- Licensed aquaculture beds within Carlingford Lough occupy approximately 23.9% of total area of the Lough.

- Approximately 14.7% of the total area of Carlingford Lough designated as a SPA is licensed for aquaculture. Actual area under culture will be significantly less than this.

- Approximately 9.31% of the total area of the Carlingford Lough SAC is licensed for aquaculture. Actual area under culture will be significantly less than this.

- There are no licensed aquaculture sites within 500 m of the Islands within Carlingford Lough on which Tern populations breed.

- As Tern species feed mainly on fish, shellfish 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, 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). There is no evidence to suggest that aquaculture activities within Carlingford Lough are negatively impacting the conservation objectives for this designated feature.

- The preferred food of Light bellied Brent Geese is intertidal eelgrass (Owen and Black 1990, Hassall and Lane 2005, Inger *et al.* 2006). There are no licensed aquaculture sites within the areas identified as intertidal eelgrass beds within Carlingford Lough.

- Gittings and O'Donoghue (2012) found that Light Bellied Brent Geese 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 Carlingford Lough are negatively impacting the conservation objectives of this designated feature.

- There is no spatial overlap between licensed aquaculture sites and the designated features of the Carlingford Lough cSAC.

- Mussel production within Carlingford Lough is currently at or above the ecological carrying capacity however there is limited potential for the controlled expansion of intertidal oyster culture in certain areas.

It should be noted that for the purpose of this report (to represent the worst case scenario) within the model **ALL** currently licensed aquaculture sites within Carlingford Lough were activated which in reality is not the case. There is currently a moratorium in place within Northern Ireland on the granting of any further Fish Culture Licences for the bottom culture of mussels.

Recommendations

1. Care should continue to be taken to avoid areas of intertidal eelgrass when accessing sites.

2. Flushing distances (in response to different types of human disturbance, walking, vehicles, boats etc) for the Tern species which breed on islands within Carlingford Lough should be determined and used to set a minimum threshold distance to avoid disturbance.

3. Light Bellied Brent Geese populations within the Northern shores of Carlingford Lough should be counted at low tide in keeping with practices currently undertaken within other Northern Irish SPA sites.

4. Licences for new developments should only permit the cultivation of sterile Pacific oysters in order to reduce the risk of the establishment of feral populations.

5. The boundaries of aquaculture licences should reflect the culture area utilised.

6. The programme of benthic monitoring initiated in 2014 should continue and further monitoring within each intertidal aquaculture area should be undertaken.

7. The SMILE model should be run on a biannual basis to establish if shellfish production is within the ecological carrying capacity for the Lough.

It should be noted that this report has been prepared to enable DARD to assess licence applications submitted for aquaculture sites within areas on the Northern Shore of Carlingford Lough.

1. Introduction

European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, and Directive 2009/147/EC on the Conservation of wild birds (often referred to as the Habitats and Birds Directives respectively) were developed with the aims of protecting habitats and species considered to be of European interest. This is achieved through member states designating sites as Special Areas of Conservation (SAC) for the protection of habitats and species (as listed in Annex I and Annex II of the Habitats Directive respectively) and Special Protection Areas (SPA) for the protection wild birds and the habitats of listed species.

The Habitats and Birds Directives were brought into effect in Northern Ireland law by the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995, also known as the Habitats Regulations. SAC and SPA designated sites form the Natura 2000 network of sites (sometimes referred to as N2K).

The Fisheries and Environment Division of the Department of Agriculture and Rural Development (DARD) commissioned AFBI to produce an updated Cumulative Impact Assessment report for Aquaculture activities within and adjacent to Natura 2000 designated sites in Carlingford Lough to reflect the changes to the industry since the publication of the 2013 assessment report (AFBI 2013). This document therefore assesses the potential impacts of current aquaculture activities on the designated features and conservation objectives of the Natura 2000 designated sites detailed below. This assessment is based on information supplied by DARD, the Royal Society for the Protection of Birds (RSPB), the Wetlands Bird survey (WeBS), Bord Iascaigh Mhara (BIM, 2013), the Marine Institute, the National Parks and Wildlife Service (NPWS), the Loughs Agency, information collected by AFBI during interviews in 2013, with some of the aquaculture producers currently active in Carlingford Lough and through site visits.

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 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. The areas of Carlingford Lough on the Northern side of the dredged channel 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 on the Southern side of the dredged channel have been designated as a 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 features classified as either A, B, or C are considered as Natura 2000 features and need to be considered within impact assessments (Northern Ireland Environment Agency (NIEA) Competent Authority Habitat Regulations Assessment template (Annex I)).

1.1. Carlingford Lough SPA (site code UK9020161 - Northern Ireland)

Carlingford Lough SPA was classified in March 1998 and covers an area of approximately 830.51 hectares (see Figure 1.1 for a map of the site boundary).

This site qualifies under Article 4.1 of EC Directive 79/409 on the Conservation of Wild Birds by regularly supporting important numbers of the following species;

Breeding

- Common Tern (*Sterna hirundo*). For the period 1993-1997 the five year peak mean for Common Tern at this site constituted 10.9% of the all-Ireland breeding population.
- Sandwich Tern (*Sterna paradisaea*). For the period 1993-1997 the five year peak mean for Sandwich Tern at this site constituted 13.1% of the all-Ireland breeding population.

Up to date information regarding bird numbers and distribution for the above species were obtained from the Royal Society for the Protection of Birds (RSPB) and used within the GIS project accompanying this report to examine the potential impacts of aquaculture activities on these species.

This site was designated before the UK SPA review which was undertaken in 2001 (Stroud *et al* 2001). During this review an additional qualifying species (Light Bellied Brent Geese) was identified for this site.

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;

Over Winter (non breeding)

- Light-bellied Brent Goose (*Branta bernicla hrota*). For the period 1990-1995 the five year peak mean for Light-bellied Brent Geese at this site was 319 individuals which represented 1.6% of the wintering Canada/Ireland population.

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 Geese. 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.

Site Conservation Objectives

The conservation objectives for this site are "To maintain each feature in favourable condition" (NIEA 2015). A number of Selection Feature Objectives for each feature have also been identified. These are;

"To maintain or enhance the population of the qualifying species.

Fledgling success sufficient to maintain or enhance population,

To maintain or enhance the range of habitats utilised by the qualifying species,

To ensure that the integrity of the site is maintained,

To ensure there is no significant disturbance of the species and

To ensure that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species" (NIEA 2015)

The most recent condition assessment undertaken by NIEA in 2014 (NIEA 2015) states that the Light-bellied Brent Goose feature of this site is in favourable condition, whilst both the Common Tern and Sandwich Tern features are in unfavourable condition.

1.2. Carlingford Shore SAC (SAC) (site code IE002306 – Republic of Ireland)

Carlingford Shore SAC was first proposed as eligible as a Site of Community Importance (SCI) in June 2006. This site covers an area of approximately 526.28 hectares (see Figure 1.2 for a map of the site boundary).

This site has been proposed for designation due to the presence of the following Annex I Habitats;

- **Mudflats and sandflats not covered by seawater at low tide**.
  This feature is classified as D on the Natura 2000 data form (Annex III) and is therefore not considered further within this report.

- **Atlantic salt meadows**
  This feature is classified as D on the Natura 2000 data form for this site (Annex III) and is therefore not considered further within this report.

- **Annual vegetation of drift lines**
  This feature is classified as A on the Natura 2000 data form for this site (Annex III) and potential impacts on this feature are considered within section 2.2.2 of this document.

- **Perennial vegetation of stony banks**
  This feature is classified as A on the Nature 2000 data form for this site (Annex III) and potential impacts on this feature are considered within section 2.2.2 of this document.

Conservation Objectives (NPWS 2013a)

NPWS (2013a) state the conservation objectives for the Annual vegetation of drift lines, feature of this site as being "To maintain the favourable conservation condition of Annual vegetation of drift lines in Carlingford Shore SAC, which is defined by the following list of attributes and targets":

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession	Current area unknown, but thought to occur in a mosaic with perennial vegetation of stony banks (1220). Habitat is very difficult to measure in view of its dynamic nature, which means that it can appear and disappear within a site from year to year. See coastal habitats supporting document for further details.
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes	Current distribution unknown, but thought to occur in a mosaic with perennial vegetation of stony banks (1220). See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Accumulation of organic matter in tidal litter is essential for trapping sand. Rock armour is present at Ballagan Point and Greenore. These physical barriers will affect sediment supply. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Thought to occur in a mosaic with perennial vegetation of stony banks (1220). See coastal habitats supporting document for further details
Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities with typical species: sea rocket (Cakile maritima), sea sandwort (Honckenya peploides), prickly saltwort (Salsola kali) and orache (Atriplex spp.)	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009) and Gaynor (2008). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details

NPWS (2013a) state the conservation objectives for the Perennial vegetation of stony banks, feature of this site as being "To maintain the favourable conservation condition of Perennial vegetation of stony banks in Carlingford Shore SAC, which is defined by the following list of attributes and targets":

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession	Current area unknown. Habitat recorded during the National Shingle Beach Survey (NSBS) (Moore and Wilson, 1999) from three sub-sites: Whitestown to Cooley Point, Ballagan Point and Greenore. Although extent was not mapped, these contiguous sites extend for 3.5km along the coastline. Area of vegetated shingle is estimated to cover 130ha. NB Further unsurveyed areas maybe present within the SAC. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 3 for mapped locations	Based on data from Moore and Wilson (1999). Exact current distribution unknown, although the habitat has been recorded along a 3.5km stretch of coastline from Greenore, extending south to Cooley Point (Moore and Wilson, 1999). See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Based on data from Moore and Wilson (1999). West of Cooley Point there has been a lot of development at Templetown beach, including the installation of a car park. The NSBS noted two areas of coastal defences (rock armour), one in an area south of Ballagan Point and another in an area south of Greenore (approx. 200m in length). A number of tourism-related developments, including a promenade protected with rock armour, have been constructed at Greenore. Shingle features are relatively stable in the long term. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Moore and Wilson (1999). At Ballagan Point the shingle vegetation is backed by cobble-based grassland. Elsewhere along the Carlingford shore, gradations to inland habitats are disrupted by a road. Habitat is thought to occur in a mosaic with annual vegetation of drift lines (1210). See coastal habitats supporting document for further details
Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain the typical vegetated shingle flora including the range of subcommunities within the different zones	Based on data from Moore and Wilson (1999). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Moore and Wilson (1999). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. See coastal habitats supporting document for further details

1.3. Carlingford Lough SPA (site code IE004078 – Republic of Ireland)

Carlingford Lough SPA was classified in October 1996 (updated in September 2014) and covers an area of approximately 595.37 hectares (see Figure 1.3 for a map of the site boundary).

This site 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;

Over Winter (non breeding)

During the winter the site regularly supports 1% or more of the biogenic population of Light-bellied Brent Goose (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96-1999/00) was 253 individuals.

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

Conservation Objectives (NPWS 2013b)

NPWS (2013b) state the conservation objectives for Brent Goose *Branta bernicla hrota* populations as being "To maintain the favourable conservation condition of Light-bellied Brent Goose in Carlingford Lough SPA, which is defined by the following list of attributes and targets":

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document.
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by light-bellied Brent goose, other than that occurring from natural patterns of variation.	Waterbird distribution from survey work undertaken in 2010/2011 is discussed in part five of the conservation objectives supporting document.

NPWS (2013b) state the conservation objectives for Wetlands as being “To maintain the favourable conservation condition of the wetland habitat in Carlingford Lough SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following list of attribute and target”:

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

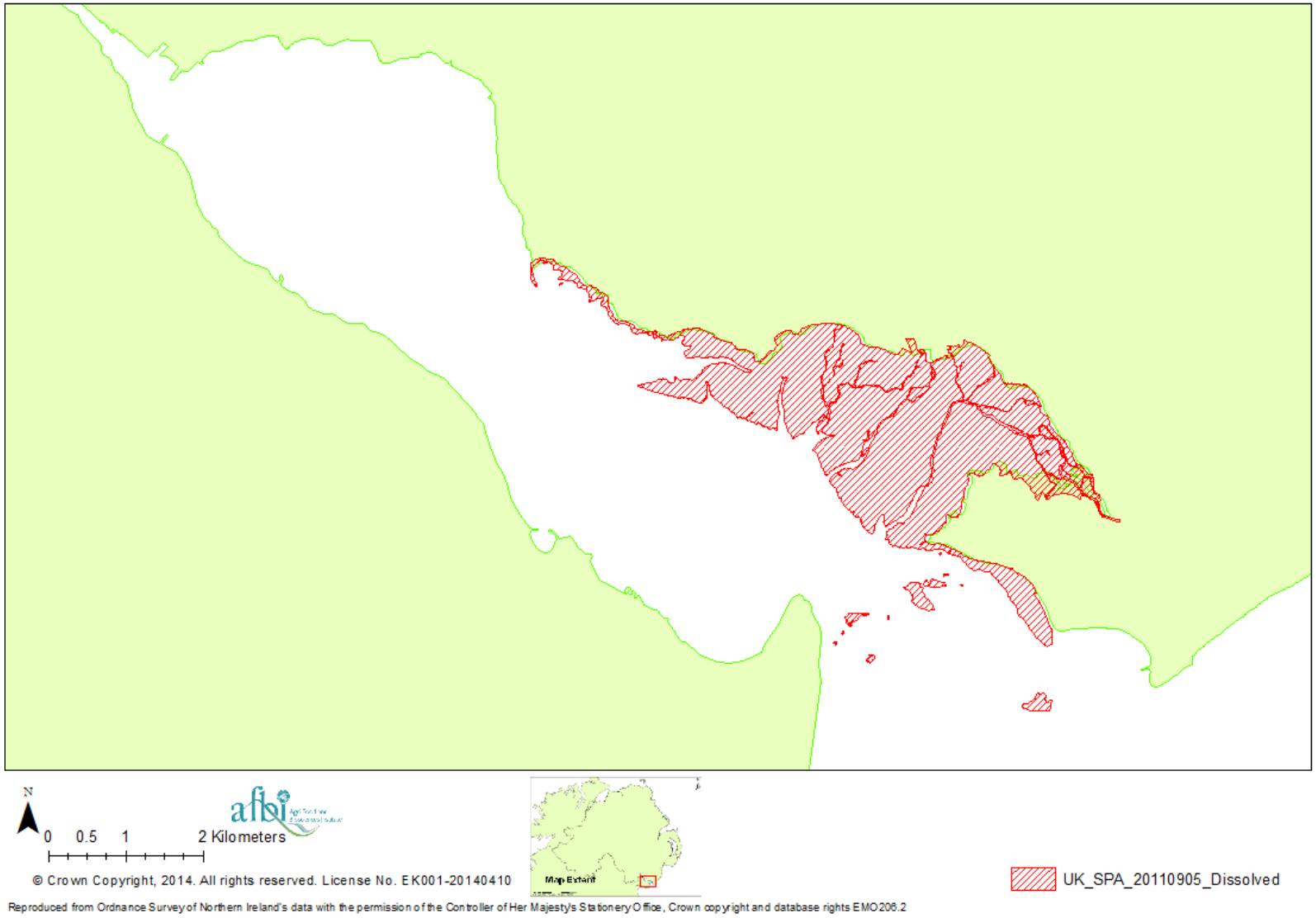


Figure 1.1: Map showing the boundary of the Carlingford Lough SPA – site code UK9020161

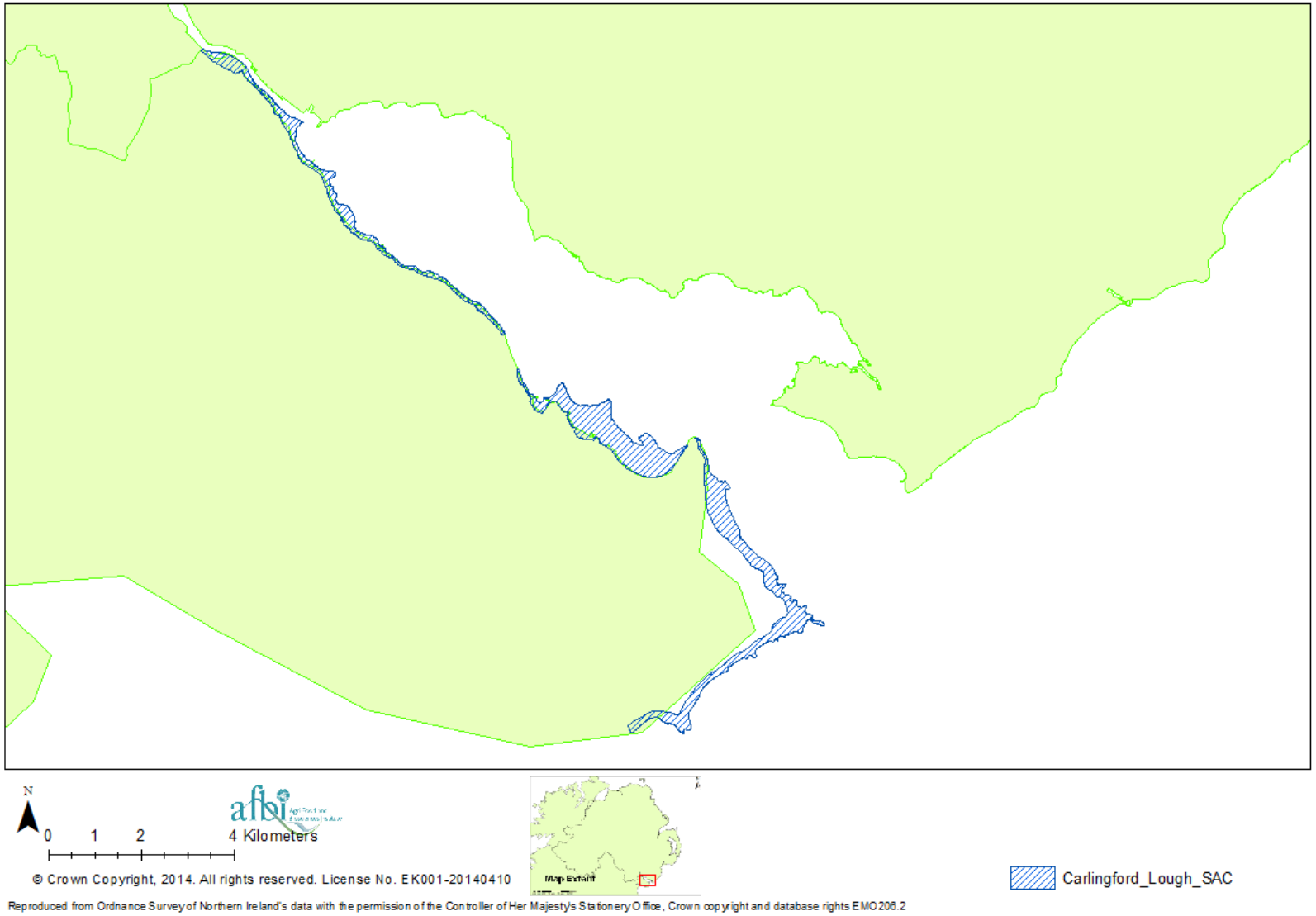


Figure 1.2: Map showing the boundary of the Carlingford Lough SAC – site code 002306

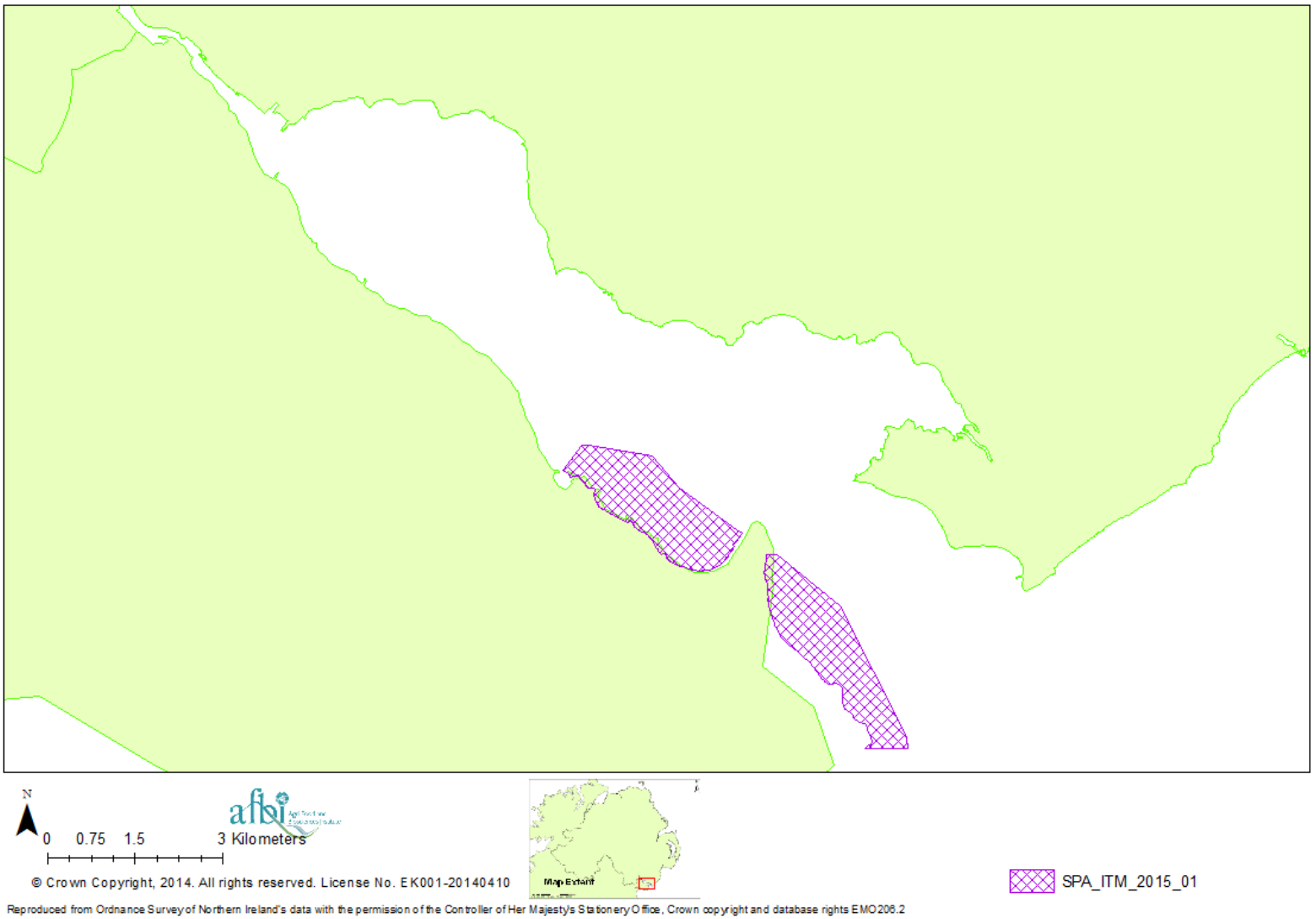


Figure 1.3: Map showing the boundary of the Carlingford Shore SPA – site code 004078

2. Impact Assessment

In order to undertake a comprehensive assessment of the impacts of aquaculture activities within the boundaries of and in the vicinity of the Natura 2000 designated sites within Carlingford Lough the GIS programme ArcGIS was used to map the distribution of designated features (where available) in relation to licensed aquaculture sites (see sections 1.1 to 1.3 for detailed descriptions of the designated features of these sites).

2.1. Current aquaculture activities within Carlingford Lough

Aquaculture within Carlingford Lough occurs on licensed sites within both the intertidal and subtidal areas of the Lough. Subtidal aquaculture involves the bottom culture of the blue mussel *Mytilus edulis*, whilst intertidal aquaculture occurs predominantly in the form of off-bottom (trestle) culture of the Pacific oyster *Crassostrea gigas*. *M. edulis* seed is dredged from naturally settled wild seed mussel beds (outside Carlingford Lough) then relaid onto licensed aquaculture beds within Carlingford Lough for on growing to harvestable size.

Aquaculture sites licensed for bottom culture of shellfish cover approximately 931 hectares of the subtidal area of Carlingford Lough and approximately 240.1 hectares of the intertidal area of the Lough is licensed for the off bottom (trestle) culture of oysters. The total area of Carlingford Lough (both intertidal and subtidal) is estimated to be approximately 4,890 hectares (as calculated in ArcGIS). Therefore approximately 23.9% of the total area of the Lough is licensed for aquaculture. However not all of these licensed sites are currently active and of those sites that are active, not all of the licensed area is utilised for shellfish cultivation.

2.1.1. Northern area of Carlingford Lough

In Northern Ireland the DARD Fisheries and Environment Division is responsible for the granting of fish culture licences, shellfish fishery licences or marine fish fishery licences under the Fisheries Act (Northern Ireland) 1966. Some of the conditions contained within these licences include the definition of the boundary of the licensed area, an outline the species to be cultured, and they also cover site decommissioning through the stipulation that all equipment “not in use for the cultivation of shellfish is removed from the Licensed area”. Additionally the Aquatic Animal Health Regulations

(NI) 2009 provides that aquaculture production businesses are required to be authorised by the DARD Fisheries and Environment Division.

GIS shapefiles outlining the locations of licensed aquaculture sites within the Northern area of Carlingford Lough have been supplied by DARD. There are currently fourteen licensed aquaculture sites on the Northern side of Carlingford Lough (Figure 2.1). Table 2.1 below outlines the information available for each of these sites. For ease of reference throughout this report the sites have been numbered as per the ID number assigned by DARD (Figure 2.1). Of these sites 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*) (see Figure 2.2). There are also at present two applications pending for amendments to currently licensed shellfish aquaculture sites within the area of DARD's jurisdiction (sites C11 and C15) (Figure 2.1). Although several sites are licensed for the bottom culture of native oysters (*Ostrea 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 show only *M. edulis* and *C. gigas* being produced within the Lough. These records also indicate that not all of the sites licensed for aquaculture within DARDs jurisdiction are at present actively producing shellfish.

From ArcGIS it is possible to ascertain the total area occupied by licensed aquaculture sites within the boundary of the Carlingford Lough SPA. The total area of the SPA occupied by currently licensed aquaculture sites is approximately 89.34 hectares (Figure 2.3). This equates to approximately 10.8% of the total designated area of the SPA. The proposed amendment to licensed site C15 will not result in a change in the site boundary, however if the proposed amendment to site C11 is granted then the area of the site within the SPA boundary will increase by 3.4 hectares. Resultantly the total area of the SPA occupied by aquaculture will increase to 92.74 hectares, approximately 11.2% of the total designated area of the SPA.

Table 2.1: Current licensed aquaculture sites within the Northern Irish jurisdiction of Carlingford Lough. DARD have given the sites specific codes which are also used within this document. The location of each of these sites is shown in Figure 2.1.

Site No.*	Species	Culture method	Approx area** (Ha)	Equipment***	Additional info****
C1	*Mytilus edulis*	Bottom culture	110.22	N/A	**This site is accessed by boat. Operators estimate that on average approximately 100 hours per month are spent onsite, but this seasonally dependant. No predator control is utilised at this site however predation by green crabs can be an issue.**
C2	*Mytilus edulis*	Bottom culture	20.37	N/A	**The operators of this site estimate that on average 50 hours per month are spent working on this site. Approximately 100 pots are deployed at this site to control predation by green crab.**
C3	*Mytilus edulis*	Bottom culture	26.70	N/A	**The operators of this site estimate that on average 80 hours per month are spent working on this site. The operators do not currently have any system of predator control in place at this site but have reported issues with green crabs and starfish.** **This site is not currently stocked.**
C4	*Mytilus edulis*	Bottom culture	19.31	N/A	**The operators do not currently have any system of predator control in place at this site but have reported issues with green crabs.** **This site is not currently stocked.**
C5	*Mytilus edulis* and *Ostrea edulis*	Bottom culture	22.36	N/A	**The operators do not currently have any system of predator control in place at this site but have reported issues with green crabs. Records show that oysters have not been cultured at this site in recent years (i.e. 2010-present).** **This site is not currently stocked.**
C6	*Mytilus edulis* and *Ostrea edulis*	Bottom culture	21.03	N/A	**The operators do not currently have any system of predator control in place at this site but have reported issues with green crabs. Records show that oysters have not been cultured at this site in recent years (i.e. 2010-present).**
C7	*Crassostrea gigas* and *Ostrea edulis*	Trestle culture	47.13	Approximately 2000 trestles on site	**Access to this site is outlined in AFBI 2013 Annex III. The operators at this site estimate that approximately 100 hours per month are spent by staff onsite.**

Site No.*	Species	Culture method	Approx area** (Ha)	Equipment***	Additional info****
C8	*Mytilus edulis*	Bottom culture	20.43	N/A	**The operators of this site estimate that on average 30 hours per month are spent working on this site. The operators do not currently have any system of predator control in place at this site but have reported issues with green crabs. The operators have stated that this site is only suitable for larger seed mussels.**
C9	*Crassostrea gigas*	Trestle culture	11.93	There are currently approximately 1000 trestles deployed in the lower section of the licensed area, and a further 190 (approximately) in the more northerly section of the license area.	**Access to this site is outlined in AFBI 2013 Annex IV. The operators at this site estimate that approximately 10 hours per month are spent by one part-time member of staff onsite.**
C10	*Mytilus edulis*	Bottom culture	71.07	N/A	**The operators do not currently have any system of predator control in place at this site.** **This site is not currently stocked.**
C11	*Crassostrea gigas*	Trestle culture	14.71	There are approximately 8000 trestles currently onsite.	**The operators at this site estimate that approximately 100 man hours per month are spent by staff onsite. The number of staff onsite at any one time ranges from four to eight.** **The operator of this site has applied to DARD to change the boundary of the licensed area of this site. The number of trestles deployed and the time spent onsite will not change as a result of the proposed licence amendment.**
C15	*Crassostrea gigas* and *Ostrea edulis*	Trestle culture	29	This site is licensed for 1,000 trestles, however there are currently only 400-500 trestles onsite. The operator of this site has applied to DARD to increase the number of trestles permitted at this site to 3,000.	**The operator estimates that approximately 30 hours per month are spent by 2 individuals onsite. Access to the site is at low tide via an existing pathway currently used to access other aquaculture sites in the area (AFBI 2013 Annex III).** **Time spent onsite and access routes will not change as a result of the proposed amendments to this site.**

Site No.*	Species	Culture method	Approx area** (Ha)	Equipment***	Additional info****
C16	*Mytilus edulis* *Crassostrea gigas* and *Ostrea edulis*	Trestle culture	3	This site is licensed for 2,000 trestles.	**The operators at this site estimate that approximately 50 man hours per month are spent by staff onsite.**
C17	*Crassostrea gigas* and *Ostrea edulis*	Trestle culture	18.25	This site is licensed for 6,000 trestles, however there are currently approximately 1,200 trestles onsite.	Activities on the site (husbandry, maintenance etc) are undertaken on approximately ten days per month and usually involve three to four workers on site.

*= Site no. refers to the numbers shown in Figure 2.1 as provided by DARD.

**= Approximate site area in hectares as determined from the GIS shapefiles supplied by DARD.
***= Equipment refers to the equipment on site as of November 2015, as supplied by DARD.
****= Additional Information supplied by DARD.
FCL= Fish Culture Licence

2.1.2. Southern area of Carlingford Lough

In Southern Ireland the Aquaculture and Foreshore Management Division of the Department of Agriculture, Food and the Marine (DAFM) is responsible for aquaculture licensing under the Fisheries (Amendment) Act, 1997.

GIS shapefiles outlining the locations of licensed aquaculture sites within the Southern area of Carlingford Lough were supplied by BIM. There are currently forty one sites licensed for shellfish aquaculture within the Southern Irish side of Carlingford Lough (Figure 2.4). Information regarding activities and production at these sites was obtained through interviews with the producers and through documents supplied by BIM, in 2013. Records for 2009-2011 for shellfish production within the southern Irish area of Carlingford Lough show only mussels and oysters being cultivated (BIM 2013).

From ArcGIS it is possible to ascertain the total area occupied by licensed aquaculture sites within the boundary of the Carlingford Shore SPA and Carlingford Lough SAC. The total area of the Carlingford Shore SPA occupied by aquaculture is approximately 120.39 hectares (Figure 2.5). This equates to approximately 20.22% of the total designated area of the SPA. The total area of the SAC occupied by aquaculture is approximately 48.98 hectares (Figure 2.5). This equates to approximately 9.31% of the total designated area of the SAC.

As the bird species for which the two SPAs are designated will utilise the whole of the Lough the total area of Carlingford Lough designated as a SPA was calculated. It is estimated that approximately 1,425.88 hectares of the Lough are currently designated as a SPA. The total area of Carlingford Lough designated as a SPA that is currently occupied by aquaculture licences is approximately 209.73 hectares. This equates to approximately **14.71%** of the total designated area.

2.2. GIS Assessment

All available information relating to the designated features of the Carlingford Lough SPA (Northern Ireland), the Carlingford Shore SPA (the Republic of Ireland) and the Carlingford Lough SAC (the Republic of Ireland) were converted into a format that was transferable to the GIS programme ArcGIS. This data was mapped alongside information relating to aquaculture activities within the Lough. Sections 2.2.1 and 2.2.2 below detail the potential impacts of aquaculture activities on the designated features of the Natura 2000 sites within Carlingford Lough.

2.2.1. Impacts of aquaculture activities on SPA designated features

Breeding Birds

Aquaculture activities within Carlingford Lough have the potential to negatively impact the breeding bird populations for which the Carlingford Lough SPA is designated (namely Common Tern and Sandwich Tern) through;

- Disturbance at nesting sites
- Damage to/disturbance within feeding areas
- Impacts on prey availability

Each of these potential impacts will be discussed in turn within the following paragraphs.

Tern species 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 2.6). The most recent figures for breeding Tern species within Carlingford Lough has been extracted from the Seabird Monitoring Programme (SMP) online database and is represented graphically in Figures 2.7-2.9. Although three sites are monitored for Tern numbers the data is presented as an annual figure for the Lough. Figure 2.7 shows a gradual increase in Common Tern numbers within Carlingford Lough between the years 2009 to 2014. From Figure 2.8 it can be seen that numbers of Sandwich Tern within Carlingford Lough between the years 2009 to 2014 still reminded low. This is similar to the trend observed between the years 1988 to 1992 when Sandwich Tern numbers within the Lough were greatly reduced (Figure 2.8). These figures show that Sandwich Tern numbers within Carlingford Lough have remained generally low in recent years. Common Tern numbers however have increased between 2011 (69) and 2014 (160).

- Disturbance at nesting sites

Terns are colonial breeding waterbirds (Gonzalez-Solis *et al* 2001). Their high density nesting habits make them particularly sensitive to human disturbance (Rodgers and Smith, 1995).

Using Flushing Distance ("the distance from the observer to the bird at the moment it actually began movement away from approaching disturbance" (Rodgers and Smith, 1997)) to determine protective buffer zones for bird species, Rodgers and Smith (1997) recommend a buffer of 100m to minimise human disturbance to foraging and loafing waterbirds (which included Terns). Rodgers and Smith (1995) recommended a setback distance of 180m for mixed Tern/Skimmer colonies and Erwin (1989) recommended a buffer zone of 200m for Common Terns. Erwin (1989) also states that "to protect colony sites early in the season before birds are established probably requires an additional 100m".

The protective buffer distances that exist for Common Terns were based on experiments undertaken on colonies in Florida (Erwin 1989 and, Rodgers and Smith 1995, 1997). Several factors can influence Flushing Distances of individuals within nesting colonies, these include; species sensitivity to disturbance, timing of disturbance, and habituation to the disturbance (Erwin, 1989).

In the absence of empirical data on the recommended protective buffer distance for Tern species in Carlingford Lough, a highly precautionary figure of 500 m has been used within this report to highlight the proximity of licensed aquaculture sites to the islands utilised by breeding Tern species (Figure 2.10). This distance is not intended as a definitive protective buffer zone for conservation purposes as it is not based on field investigations, **it is for illustrative purposes only**.

Figure 2.10 shows the location of the licensed aquaculture sites within Carlingford Lough in relation to the islands on which Tern numbers are monitored. As can be seen within Figure 2.10 no licensed aquaculture sites are within 500 m of the islands on which Terns are monitored in Carlingford Lough. The two closest licensed aquaculture sites are within approximately 650 m of the RSPB monitoring sites. One of these sites (C10) is licensed for bottom culture of mussels and the other (C11) for the intertidal trestle culture of oysters (Figure 2.11). If granted, the proposed amendment to aquaculture site C11 will result in the site boundary being moved further from the Tern monitoring sites (by approximately 100 m, see Figure 2.12).

Figure 2.13 shows the annual activity of vessels working on the subtidal aquaculture sites within Carlingford Lough in relation to the RSPB Tern monitoring sites. This Figure is derived from black box data (supplied by DARD) which has been filtered for vessel speed (<3.5 knots), location (licensed aquaculture sites) and date (year in this instance) and processed in ArcGIS v10.0 using Spatial Analysis tools. The vessel black box system is activity dependent and records a position from 10 seconds to 15 minutes depending on the vessel activity taking place e.g. fishing, steaming and mooring. This data has been processed to represent density (i.e. number of logged positions) per square kilometre. This gives a picture of the overall intensity of usage of the Lough by aquaculture servicing vessels. From Figure 2.13 it can be seen that there has not been any vessel activity on site C10 between the years 2010-2014. This is substantiated by shellfish production data from Carlingford Lough (supplied by DARD) which shows that there have not been any imports or exports of shellfish from this site for the years 2010-2014.

Site C11 is currently active. This site is generally accessed at low tides. The operators of this site estimate that approximately 100 hours per month are spent by staff on site throughout the year. The proposed changes to the site boundary will not result in a change to the activities undertaken on the site.

Previous studies in America have listed Flushing Distances of Tern species to human disturbance which range from 100m (Rodgers and Smith, 1997), 180m (Rodgers and Smith, 1995) and 200m (Erwin 1989). Using these as a guide in the absence of any site specific field data we can surmise that activities at an intertidal aquaculture site over 500 m from Tern nest sites will not result in significant negative impacts on this feature of the SPA.

- Damage to/disturbance within feeding areas

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 0.5 m. Intertidal aquaculture activities do therefore not impact upon the feeding and foraging areas of the Tern species for which the Carlingford Lough SPA is designated. The proposed amendments to intertidal aquaculture sites C11 (to change the site boundary) and C15 (to increase the number of trestles deployed and

add *Mytilus edulis* (blue mussel) to the species permitted to be cultured) will not impact feeding and foraging in fish eating Terns.

The main food source for Common Tern populations in the Wadden Sea has been identified as juvenile herring (Greenstreet *et al* 1999). Common Tern breeding success in the Wadden Sea has been strongly linked to the annual stocks of juvenile herring (Greenstreet *et al* 1999). An area within the Irish Sea just outside the mouth of Carlingford Lough has been identified as potential herring spawning grounds (Figure 2.14 AFBI unpublished data). Breeding Common Terns have a foraging range of approximately 7km (Greenstreet *et al* 1999). They could therefore potentially be feeding on juvenile herring within this area. The main prey species of Tern populations within Carlingford Lough is not presently known.

Mussel beds are not the preferred habitat for herring therefore it can be inferred that Tern species within Carlingford Lough are not feeding within the areas where bottom culture of mussels is undertaken. Resultantly vessel activity within bottom mussel cultivation areas will not disturb feeding terns. Wolsey (2011) has observed Common and Arctic Terns successfully foraging within the area of Carlingford Lough.

- Impacts on prey availability

The breeding Tern species for which Carlingford Lough is designated a SPA feed primarily on fish species (Greenstreet *et al*, 1999; Burger and Gochfeld 2003; Cramp and Simmons, 2004 (cited in Christel *et al* 2013); and Comeau *et al* 2009). Shellfish aquaculture will therefore not impact on the availability of prey species for these birds.

As can be seen from Figures 2.7 to 2.9 Tern numbers within Carlingford Lough have been declining in recent years. The populations of Sandwich Tern and Common Tern within Carlingford Lough at time of designation are stated as being 575 and 339 respectively. In 2014 RSPB recorded the population of Sandwich Tern as being 76 and the population of Common Tern as being 160. This decline is not in line with the general trend of Tern populations within other Northern Irish Tern monitoring sites (NIEA pers comm.). This decline had been attributed to; 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).

Overwintering (non breeding) Birds

Aquaculture activities within Carlingford Lough have the potential to negatively impact the overwintering (non breeding) bird populations for which the Carlingford Shore SPA and Carlingford Lough SPA are designated (namely Light-Bellied Brent Geese) through;

- Human presence within their preferred habitats
- Damage/disturbance to feeding areas/species

Light Bellied Brent Geese numbers within Carlingford Lough are counted annually through the Wetland Bird Survey (WeBS) Wildfowl and Wader Counts. Figure 2.15 shows the WeBS count data for the Light Bellied Brent Goose population within Carlingford for the winters of 1989/90 to 2013/14. These counts are undertaken at high tide and may not be representative of the populations utilising the site at low tide (when intertidal aquaculture operators are onsite). Analysis of monthly counts for Light Bellied Brent Geese undertaken at both high and low tide at several locations within Carlingford Lough (Figure 2.16) during 2012 (Loughs Agency data) indicated that the numbers counted at low tide were significantly higher than those counted at high tide. When investigating the potential impacts of intertidal aquaculture on this species it would therefore be preferable to use low tide counts if available.

- Human presence within their preferred habitats

Figure 2.17 shows the location of the Loughs Agency 2012 count sectors and Figure 2.18 shows the total low tide counts for Light Bellied Brent Geese within each sector during the 2012 survey (monthly counts were undertaken between January and December 2012). The highest numbers of Light Bellied Brent Geese were recorded in sectors N1 (a total of 704 birds were observed) and S2 (a total of 526 birds were observed). Sector N1 covers the area between Cranfield Point and Soldiers Point within which there are not currently any licensed aquaculture sites (Figure 2.17). Sector S2, which had the second highest number of Brent Geese present covers an area within which there are numerous licensed intertidal aquaculture sites. Gittings and O'Donoghue (2012) investigated the effects of intertidal oyster aquaculture on the distribution of waterbirds within six sites in the Republic of Ireland. In their investigations Gittings and O'Donoghue (2012) found that Light Bellied Brent Geese showed a variable response to oyster trestles. During their investigations 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.

The Light Bellied Brent Geese populations that feed within Carlingford Lough have been observed travelling approximately 23.4km along the coast to roost in Dundalk Bay (Martin 2013 unpublished data).

- Damage/disturbance to feeding areas/species

The preferred food of Brent Geese is intertidal eelgrass (Owen and Black 1990, Hassall and Lane 2005, Inger *et al.* 2006). The distribution of intertidal eelgrass within both the Northern (Beer and McQuaid 2011) and Southern (NPWS data 2012) shores of Carlingford Lough is shown in Figure 2.19. From Figure 2.19 it can be seen that on the Northern shores of Carlingford Lough the intertidal eelgrass beds are confined to a small portion of the Mill Bay area. The intertidal eelgrass beds on the Southern shore of Carlingford Lough are confined to the area between Greenore Point and Carlingford Point (Figure 2.19). Figure 2.20 shows an overlay of the current licensed aquaculture sites and the most recent eelgrass distribution maps for the whole of Carlingford Lough. From Figure 2.20 it can be seen that there are no licensed aquaculture sites within areas identified as intertidal eelgrass beds.

The intertidal oyster culture sites within Carlingford Lough have the potential to cause disturbance to Light Bellied Brent Geese populations through human presence in intertidal areas within which they feed on eelgrass. As can be seen in Figure 2.20 areas currently licensed for intertidal aquaculture do not overlap with identified eelgrass beds. Surveys of the access routes utilised by the operators of the licensed intertidal aquaculture sites within Carlingford Lough were undertaken by AFBI and DARD staff (AFBI 2013, Annex IV to Annex VIII). Eelgrass was not observed during any of these surveys. Small patches of green algae (*Ulva* and *Enteromorpha* sp) were noted at the top of the shore beside and along the access routes during some of the surveys (AFBI 2013, Annex IV to Annex VIII). Inger *et al.* (2006) investigated prey choice in the Light Bellied Brent Goose population within Strangford Lough and stated that the "further 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, Inger *et al.* 2006).

The proposed amendments to sites C11 and C15 will not result in any changes to the current site access routes. The proposed new boundary area of C11 that is outwith the currently licensed site was surveyed by AFBI scientific staff in December 2014 and was determined to be free from eelgrass (AFBI, 2015).

Operators of intertidal oyster aquaculture sites access their trestles at low tide. In general operators of intertidal aquaculture sites can only access their trestles at low tide and would typically only be on site during daylight hours. However, during the darker winter months, low tides do not always coincide with daylight hours and therefore some limited access to aquaculture sites may be required during the hours of darkness. As there is no eelgrass on present on licensed aquaculture sites within Carlingford Lough, Light-bellied Brent Geese should be able to feed during night time low tides undisturbed by aquaculture operators.

Owen and Black (1990) and Hughes and Green (2005) observed that the feeding patterns of Brent Geese are related to tidal cycles. Brent Geese can therefore be both diurnal and nocturnal feeders. As a result of this during the darker winter months these birds will be able to feed on intertidal eelgrass during night time low tides undisturbed by aquaculture operators who cannot access their sites at this time. When looking at feeding preferences in dark-bellied Brent geese (*Branta bernicla bernicla*) feeding on salt marshes at high tide, Hassall and Lane (2005) found that 22% of the time the birds were observed feeding occurred at night.

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).

2.2.2. Impacts of aquaculture activities on SAC designated features

Annual vegetation of drift lines

This Annex I habitat occurs primarily on deposits of shingle found lying at or above mean high-water spring tides (JNCC, 2007). Intertidal shellfish aquaculture occurs on the lower intertidal zone and there therefore will not be any spatial overlap between aquaculture and this feature of the SAC. There is however, the potential for aquaculture operations to indirectly impact upon this feature through vehicle/pedestrian access to the licensed aquaculture areas. The access routes for the main areas of aquaculture activity on the southern shores of Carlingford Lough

were surveyed by AFBI staff in early 2013 (AFBI 2013, Annex IV and Annex V). As can be seen from these reports operators access the shore solely via existing slipways or manmade paths and therefore do not impact upon this feature of the SAC.

Perennial vegetation of stony banks

This Annex I habitat is found at the limit of high tide (JNCC 2007). As Intertidal shellfish aquaculture occurs on the lower intertidal zone there will therefore not be any spatial overlap between aquaculture and this feature of the SAC. As was the case with the Annual vegetation of drift lines feature there is however the potential for aquaculture operations to indirectly impact upon this feature through vehicle/pedestrian access to the licensed aquaculture areas. The reports in AFBI 2013, Annex IV and Annex V show that aquaculture operators access the shore exclusively via existing slipways or manmade paths and therefore do not impact upon this feature of the SAC.

2.3. Aquatic Animal Health

The Aquatic Animal Health Regulations (Northern Ireland) 2009 implement Council Directive 2006/88/EC with regards to animal health requirements for aquaculture animals and products and on the prevention and control of certain diseases in aquatic animals. Under the 2009 Regulations, all fish and shellfish farms must be authorised as Aquaculture Production Businesses and operate in accordance with a documented bio-security plan in order to prevent and control the spread of disease.

Northern Ireland is free from the listed exotic shellfish diseases and the non-exotic disease *Marteilia refringens* which affects Native oysters (*Ostrea edulis*) and mussels (*Mytilus edulis*).

Commission Regulation (EC) 1251/2008 sets out the movement and health certification requirements for importing or exporting aquaculture animals into or out of Northern Ireland. Movements of aquatic animals are recorded on the EU TRACES system (TRAde Control and Expert System). TRACES is a trans-European network for veterinary health which notifies, certifies and monitors imports, exports and trade in animals and animal products. DARD use this web based network to monitor fish and shellfish movements and ensure compliance with EU legislation.

Imports, exports and internal movements of shellfish are routinely monitored and subject to inspection by the DARD Fish Health Inspectorate.

2.4. Non native species

The Molluscan Shellfish (Control of Deposit) Order (Northern Ireland) 1972 prohibits the introduction into Northern Ireland waters of molluscan shellfish taken from outside Northern Ireland waters except under the authority of a permit granted by DARD. Only imports of shellfish originating from areas known to be free from non native species are permitted.

Seed mussel used for bottom culture in Carlingford Lough are sourced from naturally occurring seed bed. Other bivalves for aquaculture, such as Pacific oysters (*Crassostrea gigas*) can be produced in purpose built authorised premises remote from the natural environment to remove exposure to aliens and disease. Consignments are packed dry before transport and are inspected by the local competent veterinary authority before despatch (CEFAS in England and Wales) and are accompanied by certification. All movements are recorded on TRACES by the competent authority.

The movement of Pacific oysters (*Crassostrea gigas*), which is a non native species, is also regulated under the Alien and Locally Absent Species in Aquaculture Regulations (Northern Ireland) 2012, which implement Council Regulation (EC) No 708/2007 on the use of alien and locally absent species in aquaculture.

Pacific oysters were introduced primarily to substitute declining native oyster stocks (Herbert *et al* 2012). It was previously believed that the Pacific oyster *Crassostrea gigas* 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.

2.5. Benthic impacts of aquaculture

Intertidal oyster culture is undertaken within the boundaries of all of the Natura 2000 designated sites in Carlingford Lough. It has the potential therefore to impact the benthic habitats within these sites.

Pseudofaeces and faeces bioaccumulation beneath intertidal oyster trestles has the potential to impact benthic community structures. These impacts are generally considered to the small scale and localised (Nuges *et al*, 1996; Forrest and Creese 2006; Forrest *et al,* 2009 and the literature reviewed within). Nuges *et al* (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. De Grave *et al* (1998) investigated the impacts of large scale oyster culture in Dungarvan Bay and did not observe any evidence of organic enrichment underneath the trestles. 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".

Oyster trestles within Carlingford Lough are generally around 50 cm above the ground. This ensures adequate circulation and reduces sedimentation (Nuges *et al* 1996). In order to ensure that any changes in benthic sediments and communities remain small and localised, a programme of monitoring has been established (in agreement with the Department of the Environment (DoE)) for all new intertidal aquaculture sites within Carlingford Lough granted in recent years. Baseline core samples and samples for Particle Size Analysis (PSA) are collected before the installation of trestles onsite (to be used as a baseline for future comparisons). PSA samples are collected monthly for analysis. If changes in sediments are detected then further Infaunal samples are collected for baseline comparison and management options explored.

2.6. Carrying Capacity Assessment - SMILE

In order to assess the ecological carrying capacity of aquaculture activities within Carlingford Lough the Sustainable Mariculture in northern Irish Lough ecosystems

(SMILE) model has been utilised. The SMILE model is used for the collation and processing of scientific information. The SMILE model was developed in 2007 and it enables the application of an integrated framework for the determination of sustainable carrying capacity within 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 refer to Ferreira *et al* (2007).

For the purpose of this assessment the SMILE model was applied to enable three scenarios, which simulated the impact on the ecosystem of increasing the abundance of filter-feeding organisms in Carlingford Lough. Chlorophyll a (Chl a) was used as a proxy for phytoplankton biomass within Carlingford Lough. The three 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 – **All** 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). Those sites for which there was no production data for 2014 were activated at their rate of production as per data supplied during SMILE development. 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).
f) Run 3 – Aquaculture activities were increased to include the applications currently in progress on the Northern side of the Lough. The area of site C11 was reduced to that currently applied for (production levels at this site were kept as per Run 2). Production levels* within site C15 were increased to account for production of oysters and mussels on the proposed additional trestles. 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 (taken from Taylor *et al* 1999) shows up to -62% annual variation within chlorophyll a values (using 90th percentile figures) recorded between sampling years. 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 > 30% Chl a reduction are highlighted in Tables 2.2, 2.3 and 2.4. The location of licensed aquaculture sites in relation to SMILE model Boxes is shown within Figure 2.21.

From Tables 2.2, 2.3 and 2.4 below it can be seen that aquaculture species reduce the overall ecosystem phytoplankton biomass and hence food availability for other organisms within Carlingford Lough by up to a maximum of 70%. 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. This data indicates that using 2014 stocking data mussel production within all model boxes is currently at the ecological threshold (or above in the case of boxes 36, 38 and 25) whilst there is limited potential for the controlled expansion of intertidal oyster culture in certain areas. 2014 data was used within these model runs as this was the most recent data available. It should be noted that for the purpose of this exercise, to demonstrate the "worst case scenario" all aquaculture sites were activated simultaneously, which as can be seen from Figure 2.13 is not the case in reality.

In light of the high Chl a reduction values observed within boxes 36 and 38 AFBI would recommend running the SMILE model for Carlingford Lough more frequently (i.e. biannually). Should this pattern continue following two further model runs (i.e. over the course of 12 months) then we could recommend DARD meet with the operators of the aquaculture sites within these boxes to consider management options. SMILE model box 25 is within the Southern area of Carlingford Lough and therefore not within DARD jurisdiction.

Increasing the amount of licensed aquaculture sites within the Lough to include the proposed amendments to sites C11 and C15 results in a minimal increase in the reduction in Chl a in all model boxes (Tables 2.3 and 2.4). The change in Chl a reduction resulting for amendments to sites C11 and C15 within the model boxes within which they reside is **< 0.5%** in both incidences. The proposed amendments to sites C11 and C15 will therefore not negatively impact the ecological carrying capacity of Carlingford Lough (in terms of food available for wild species).

Table 2.2: 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 is taken into account (Run 2). The location of licensed aquaculture sites in relation to SMILE model boxes are shown in Figure 2.21.

SMILE Box	Species	Run 1	Run 2	% reduction
Box 38	mussel	11.38	3.38	70.343
Box 36	mussel	10.59	4.78	54.878
Box 25	mussel	6.56	3.43	47.789
Box 29	mussel	9.09	5.28	41.933
Box 35	mussel	9.58	5.75	39.974
Box 28	mussel	6.90	4.24	38.575
Box 34	mussel	9.11	5.61	38.464
Box 33	mussel	8.05	4.96	38.456
Box 32	mussel	7.03	4.62	34.275
Box 23	mussel	5.82	3.98	31.731
Box 30	no	10.95	7.59	30.704
Box 27	no	5.71	3.96	30.549
Box 22	Oys_mus	4.99	3.56	28.730
Box 26	no	4.40	3.39	22.910
Box 31	Oys	4.10	3.31	19.186
Box 24	Oys	3.44	2.87	16.670
Box 37	no	2.05	1.77	13.659

Table 2.3: 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 is taken into account (Run 3). The location of licensed aquaculture sites in relation to SMILE model boxes are shown in Figure 2.21.

SMILE Box	Species	Run 1	Run 3	% reduction
Box 38	mussel	11.38	3.38	70.342
Box 36	mussel	10.59	4.78	54.894
Box 25	mussel	6.56	3.43	47.807
Box 29	mussel	9.09	5.27	41.969
Box 35	mussel	9.58	5.75	39.982
Box 28	mussel	6.90	4.23	38.606
Box 34	mussel	9.11	5.60	38.491
Box 33	mussel	8.05	4.95	38.479
Box 32	mussel	7.03	4.62	34.348
Box 23	mussel	5.82	3.97	31.782
Box 30	no	10.95	7.59	30.715
Box 27	no	5.71	3.96	30.592
Box 22	Oys_mus	4.99	3.55	28.803
Box 26	no	4.40	3.38	23.013
Box 31	Oys	4.10	3.30	19.491
Box 24	Oys	3.44	2.86	16.797
Box 37	no	2.05	1.77	13.797

Table 2.4: 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). The location of licensed aquaculture sites in relation to SMILE model boxes are shown in Figure 2.21.

SMILE Box	Species	R2 % reduction from R1	R3 % reduction from R1	difference
Box 38	mussel	70.343	70.342	-0.002
Box 36	mussel	54.878	54.894	0.015
Box 25	mussel	47.789	47.807	0.018
Box 29	mussel	41.933	41.969	0.036
Box 35	mussel	39.974	39.982	0.008
Box 28	mussel	38.575	38.606	0.031
Box 34	mussel	38.464	38.491	0.028
Box 33	mussel	38.456	38.479	0.023
Box 32	mussel	34.275	34.348	0.074
Box 23	mussel	31.731	31.782	0.051
Box 30	no	30.704	30.715	0.010
Box 27	no	30.549	30.592	0.043
Box 22	Oys_mus	28.730	28.803	0.073
Box 26	no	22.910	23.013	0.102
Box 31	Oys	19.186	19.491	0.305
Box 24	Oys	16.670	16.797	0.127
Box 37	no	13.659	13.797	0.138

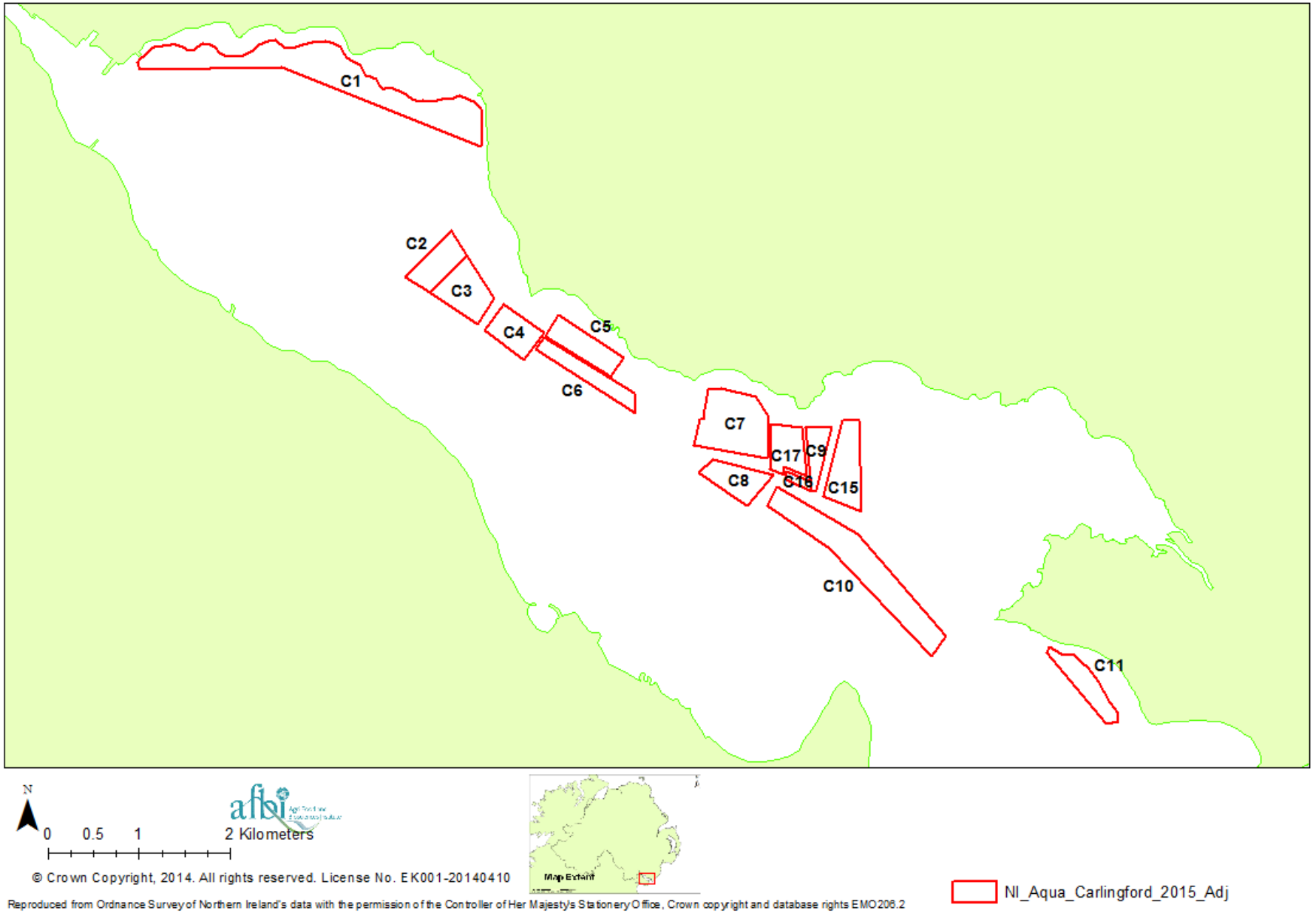


Figure 2.1:Map showing DARD, licensed aquaculture sites.

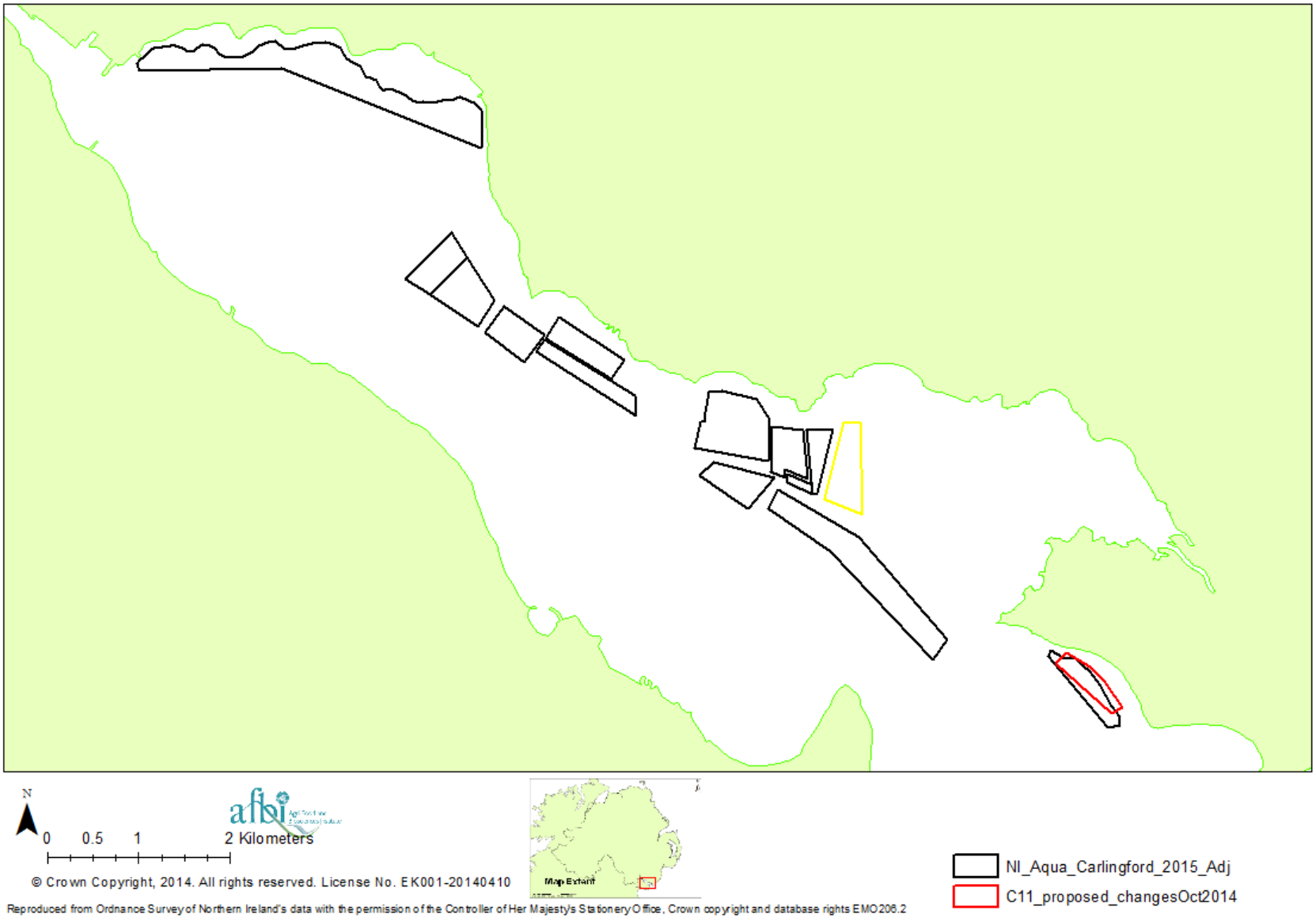


Figure 2.2: Map showing DARD licensed aquaculture sites highlighting the sites with active amendment applications pending. Site C15 is shown in yellow and the proposed amended location of site C11 is shown in red.

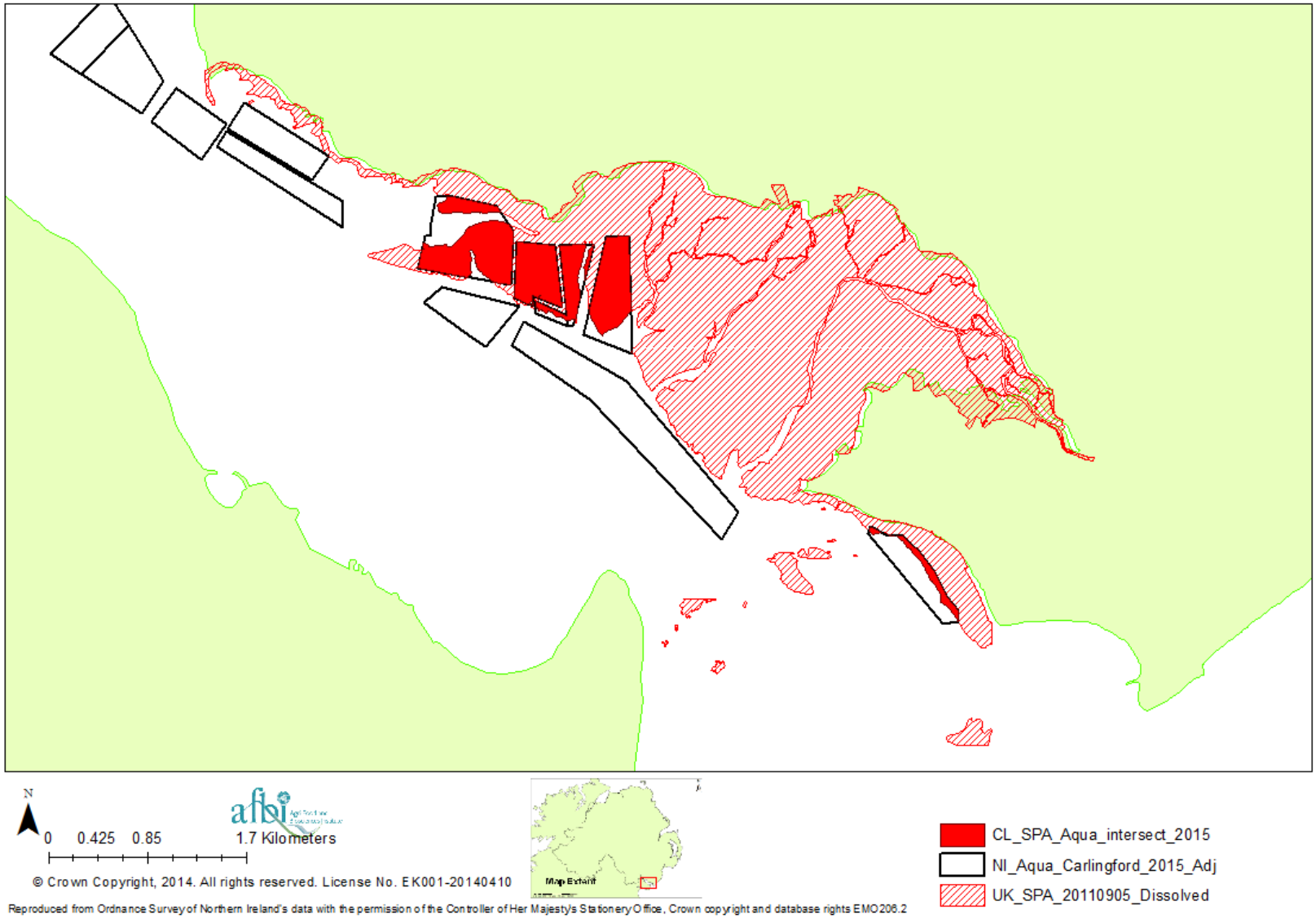


Figure 2.3: Map showing licensed aquaculture sites within the boundary of the Carlingford Lough SPA. The area of the SPA is shown as the hashed red polygon and the portions of licensed aquaculture sites within the boundary of the SPA are shown as the solid red polygons on the map).

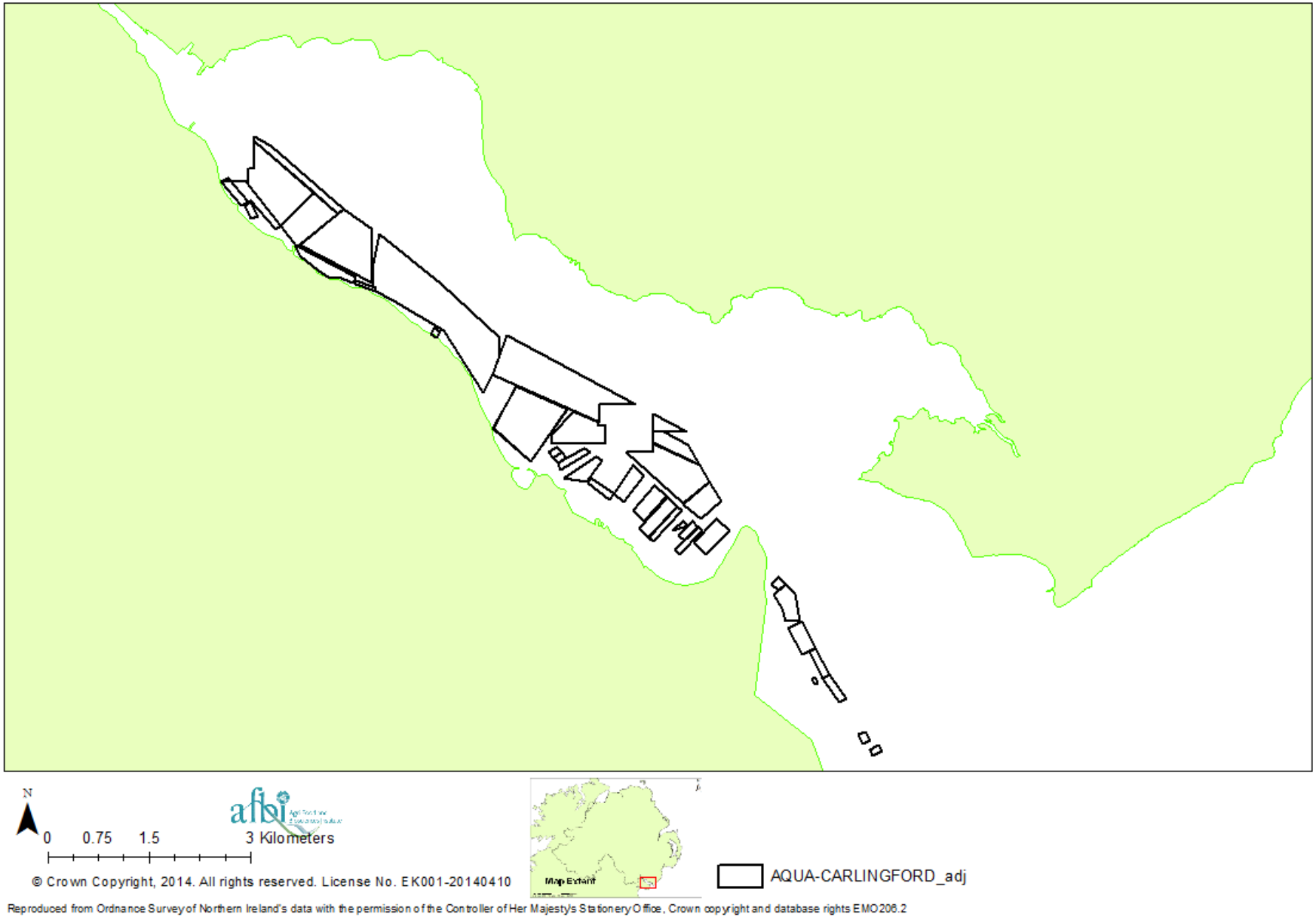
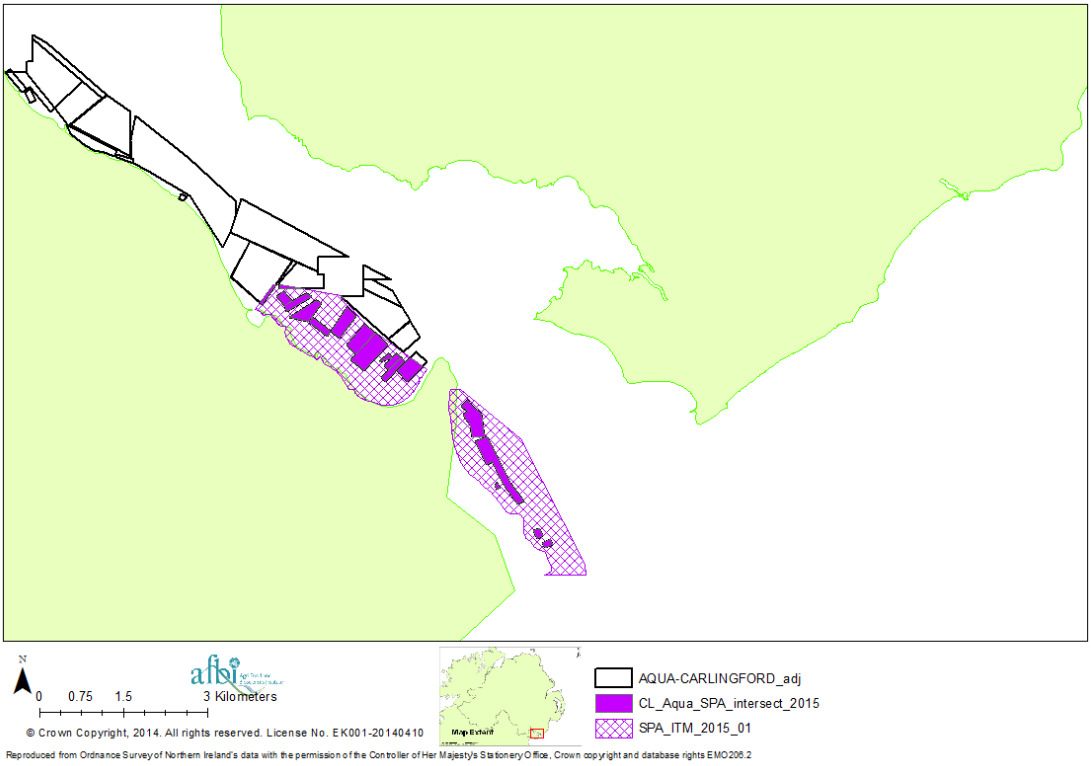


Figure 2.4: Map showing DAFM licensed aquaculture sites.

A)



B)

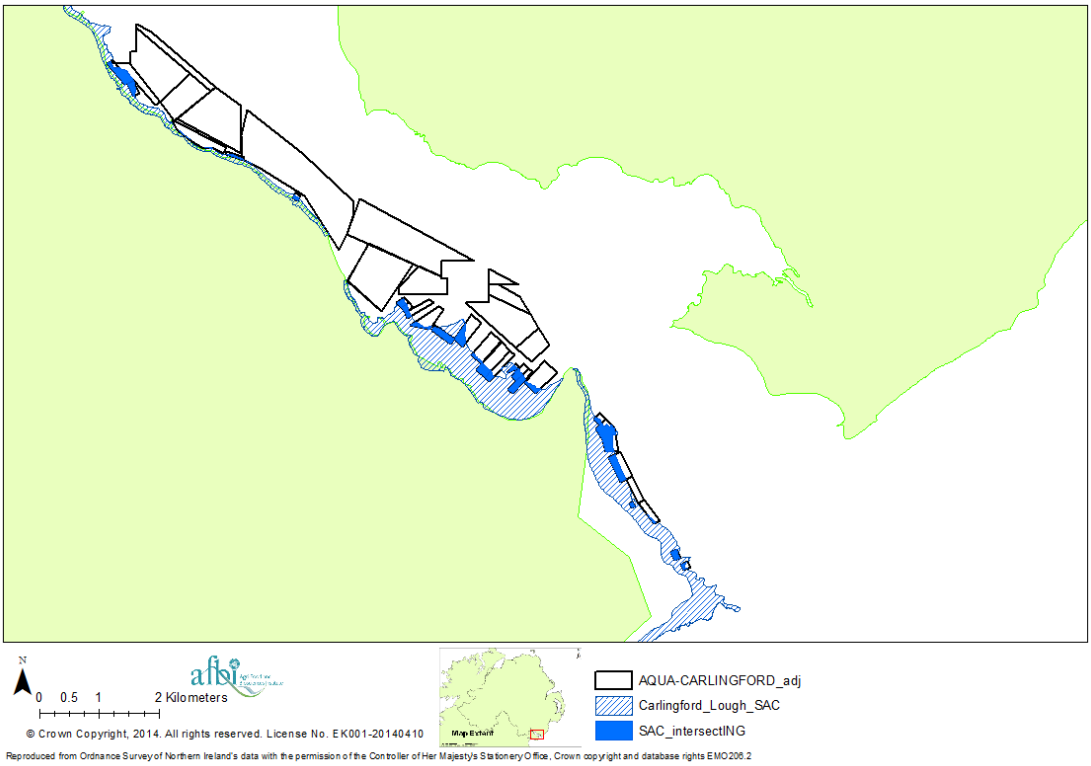


Figure 2.5: A) Map showing the areas within the boundary of the Carlingford Shore SPA occupied by licensed aquaculture sites (solid purple on map). B) Map showing the areas within the boundary of the Carlingford Lough SAC occupied by licensed aquaculture (solid blue on map).

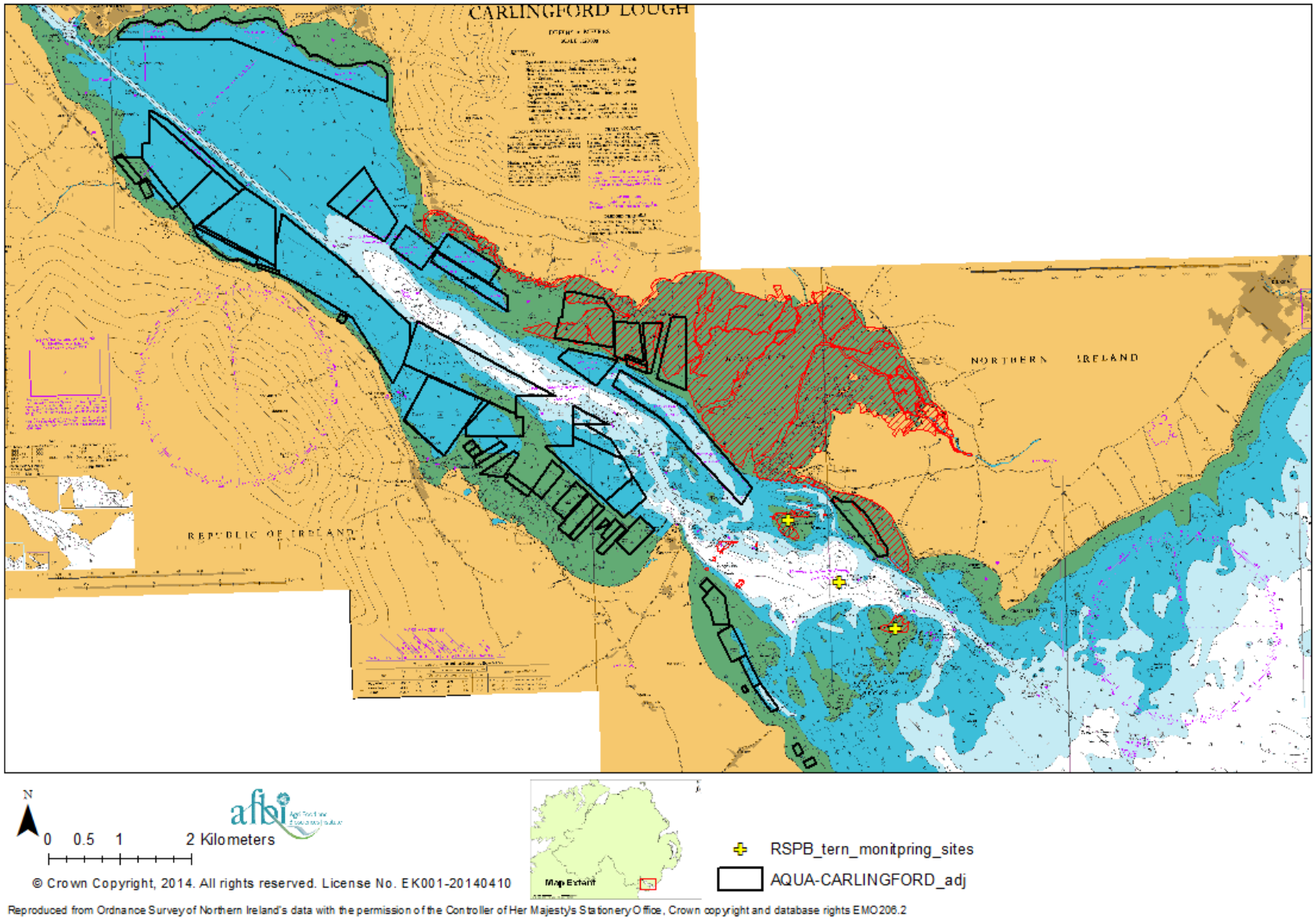


Figure 2.6: Map showing the islands monitored by RSPB for Breeding Tern species within Carlingford Lough.

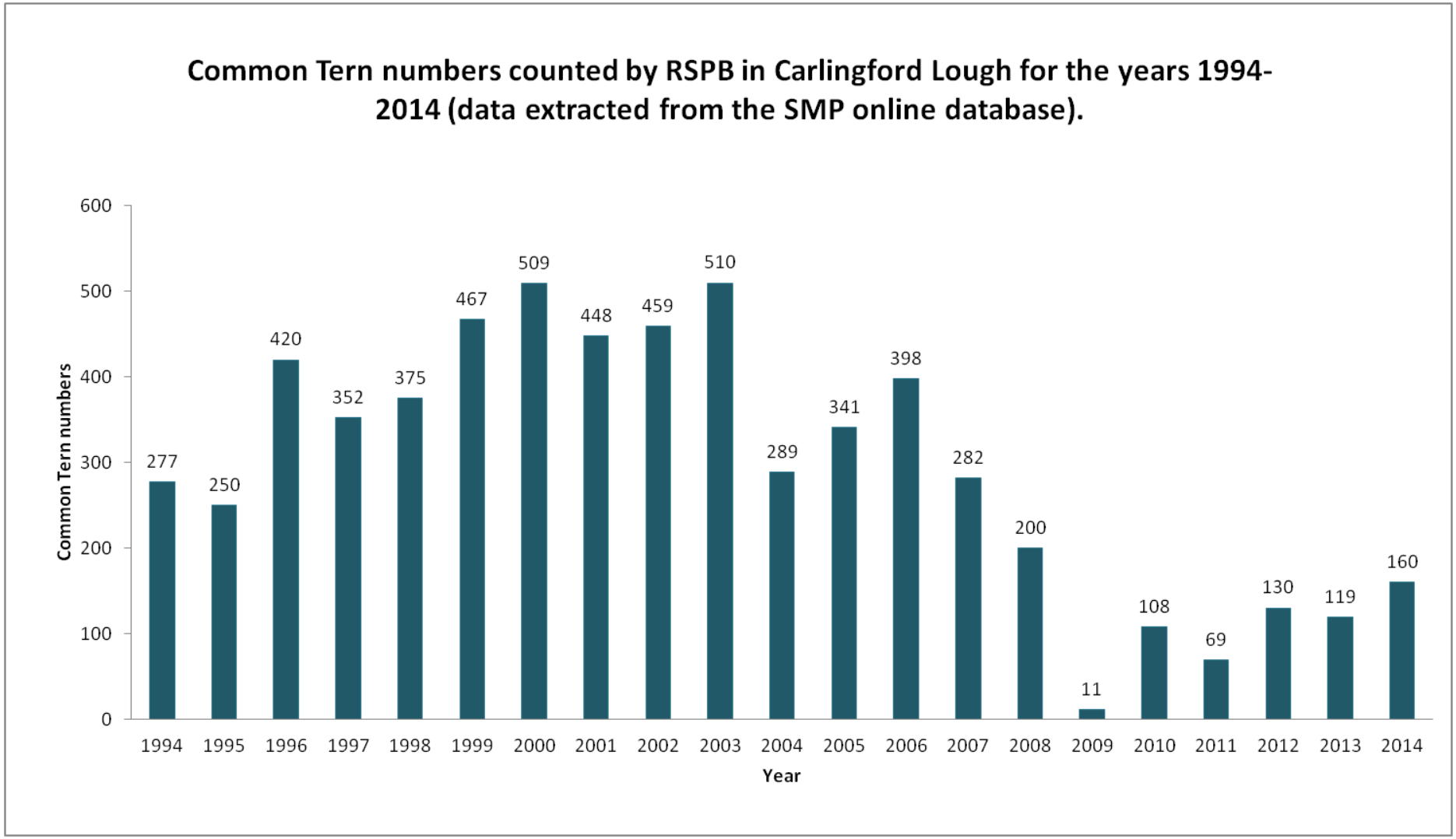


Figure 2.7: RSPB count numbers for Common Tern populations within Carlingford Lough.

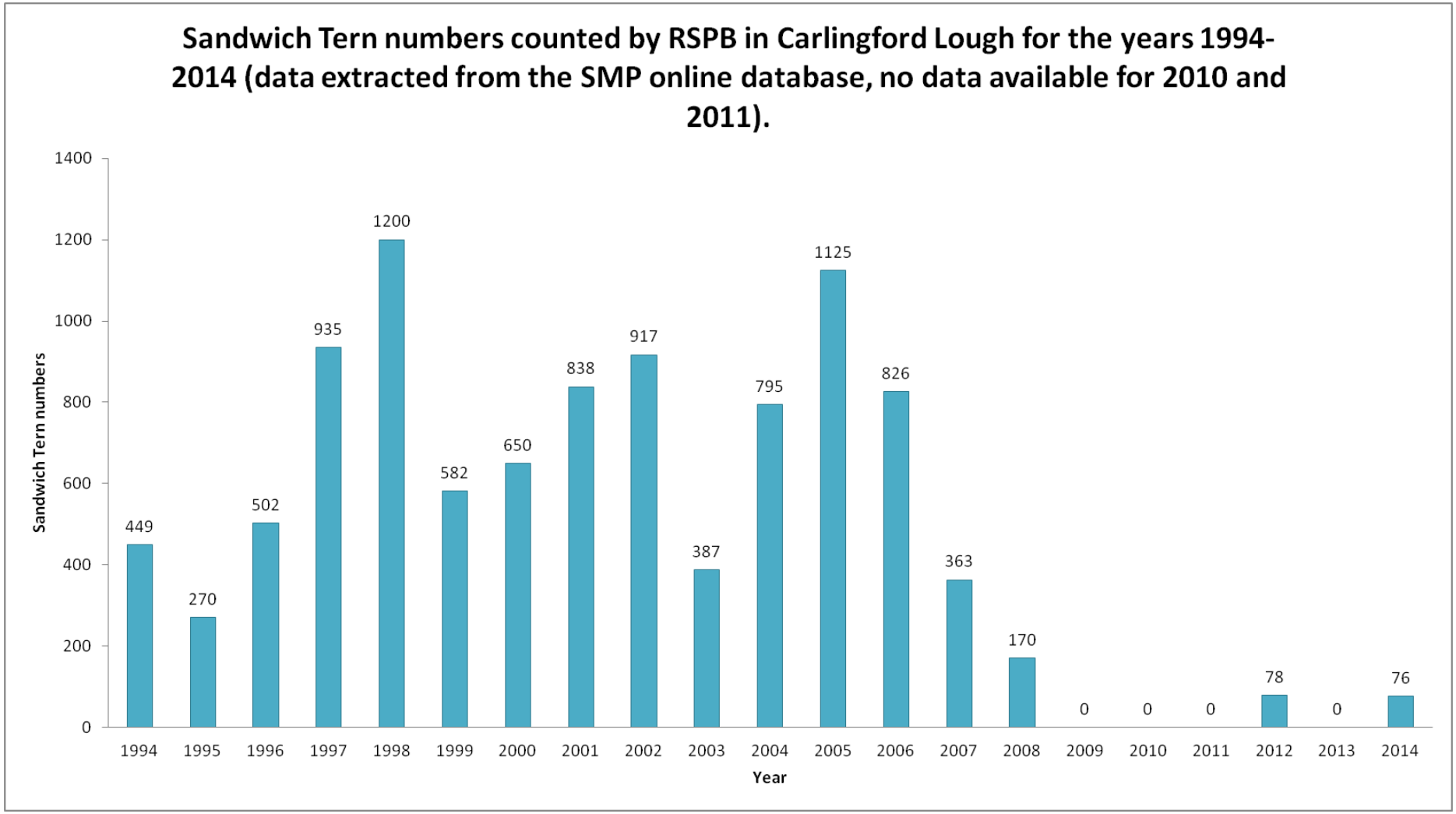


Figure 2.8: RSPB count numbers for Sandwich Tern populations within Carlingford Lough.

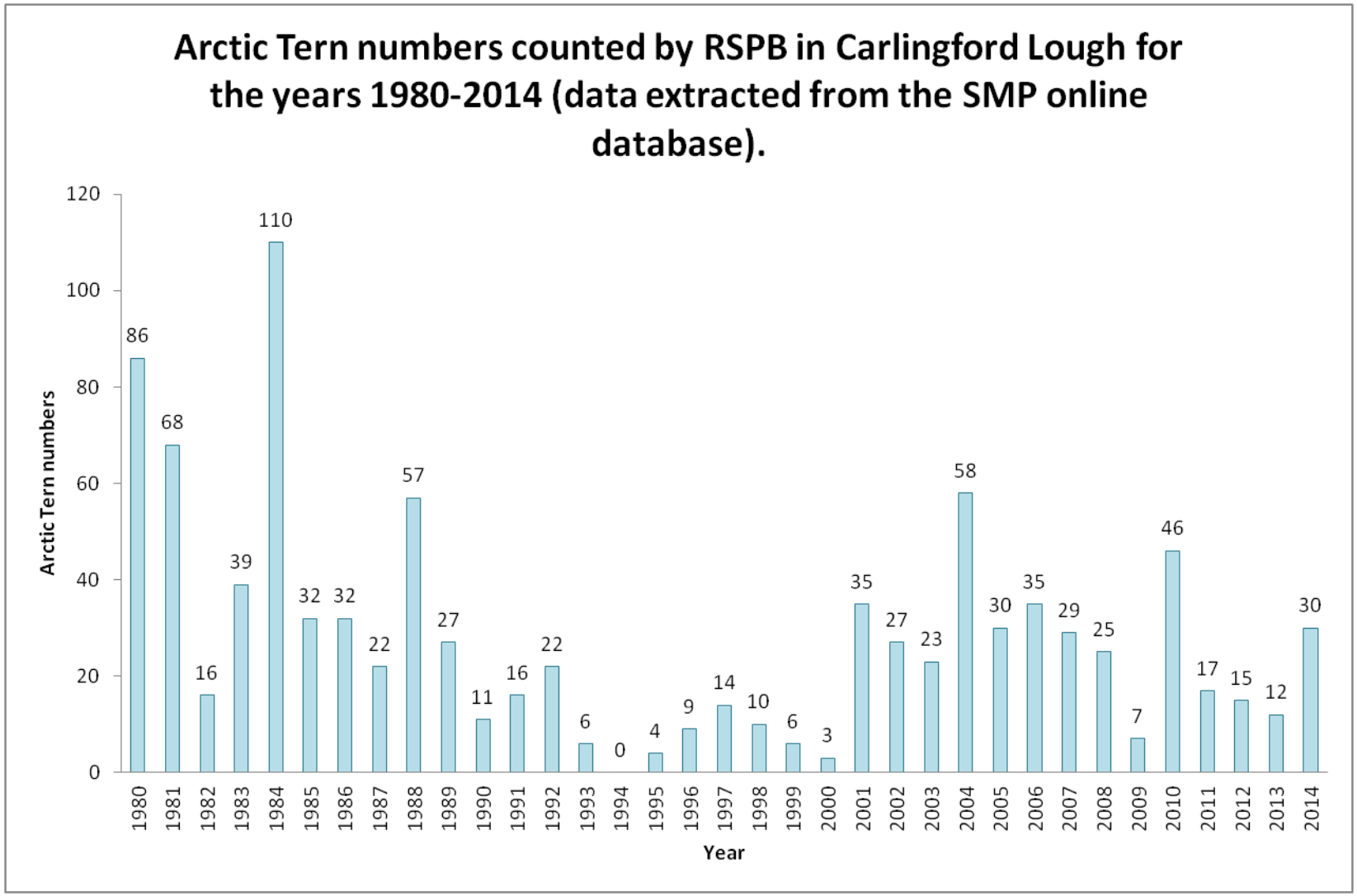


Figure 2.9: RSPB count numbers for Arctic Tern populations within Carlingford Lough.

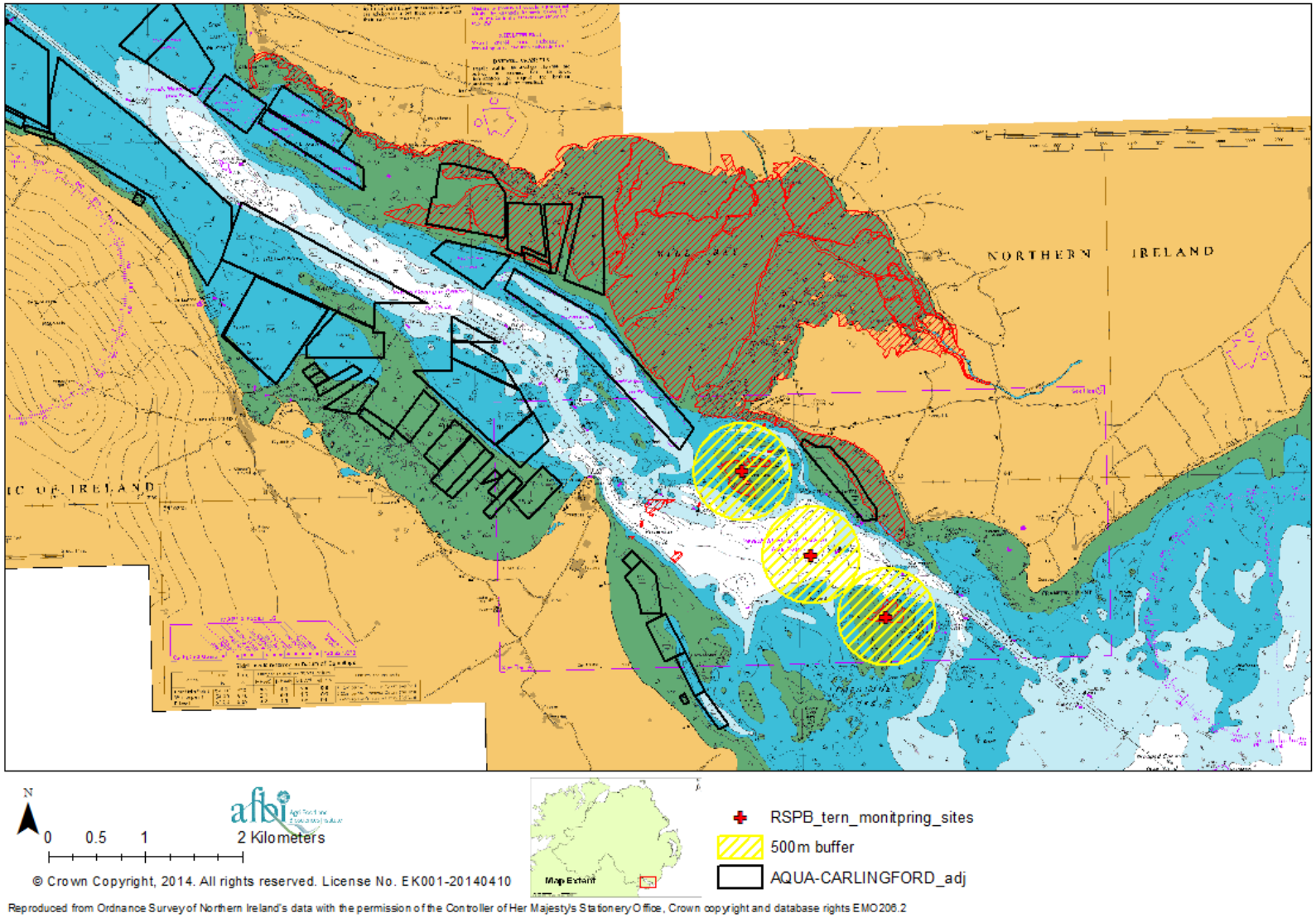


Figure 2.10: Map showing the licensed aquaculture sites within Carlingford Lough and the Islands within Carlingford Lough on which Tern species breed to which a 500 m buffer has been applied (yellow hashed area).

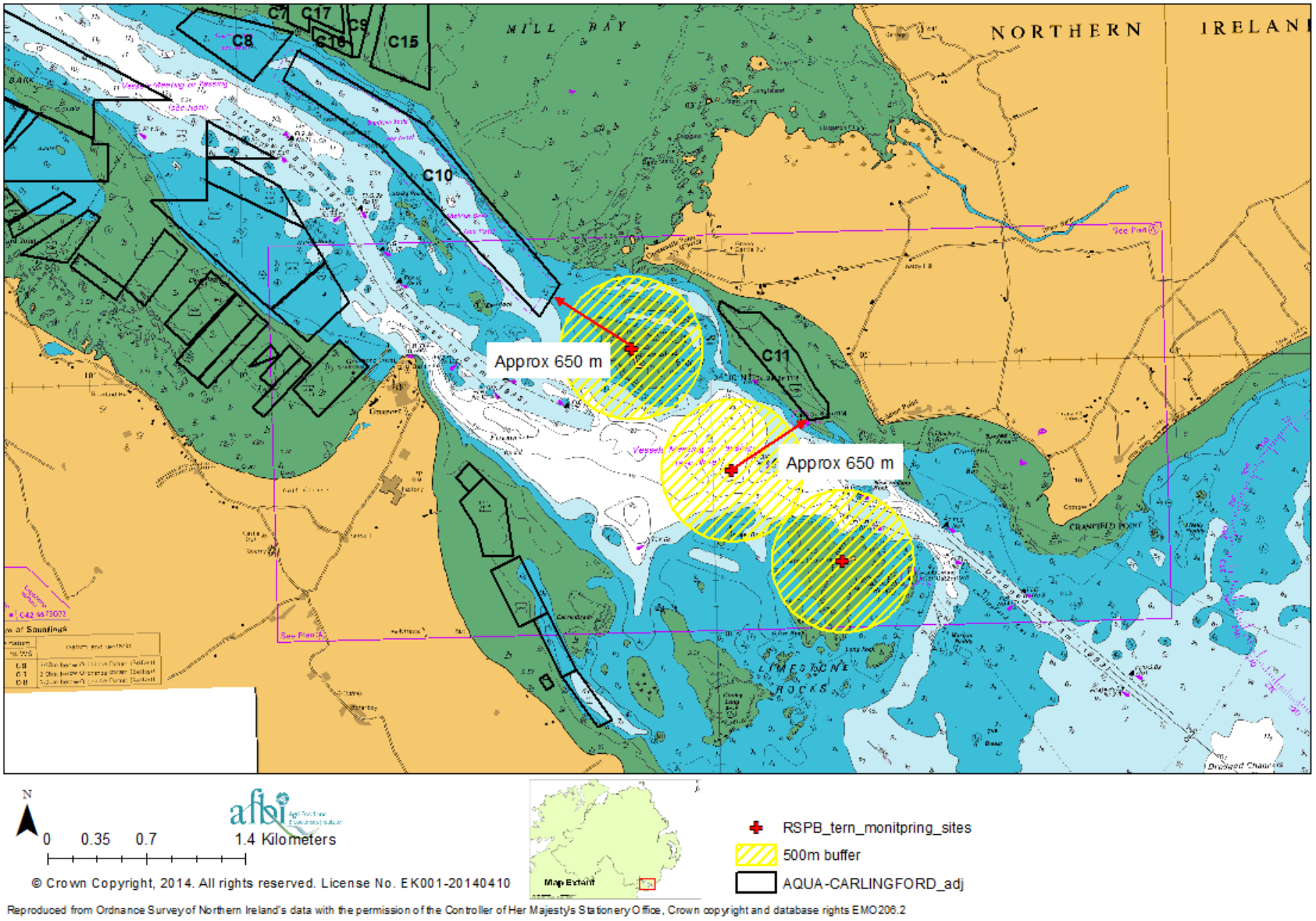


Figure 2.11: Map of Carlingford Lough showing the two licensed aquaculture sites in the vicinity of the Tern breeding islands.

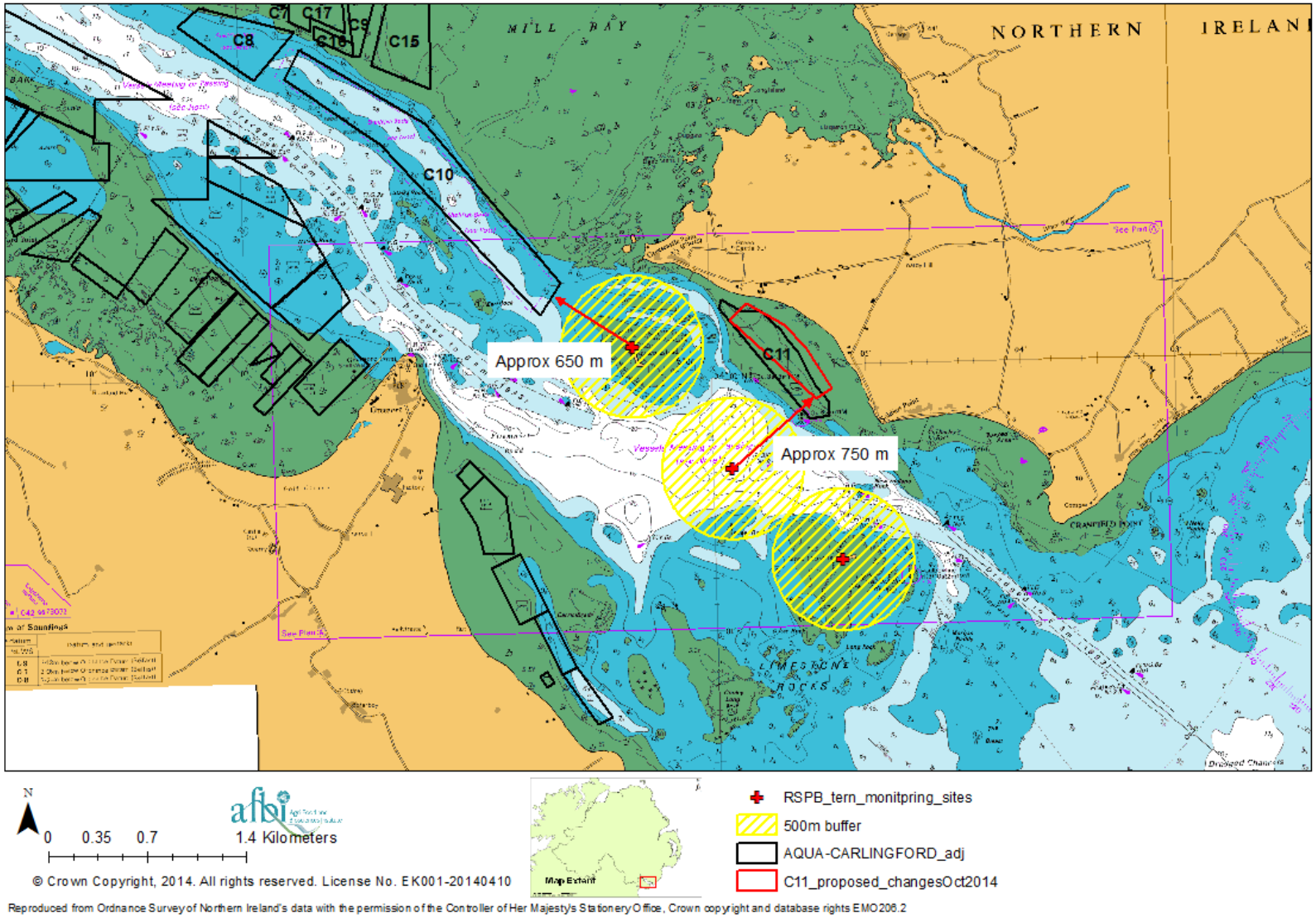


Figure 2.12: Map of Carlingford Lough showing the proposed amendment to the boundary of aquaculture site C11 in relation to the Tern breeding islands.

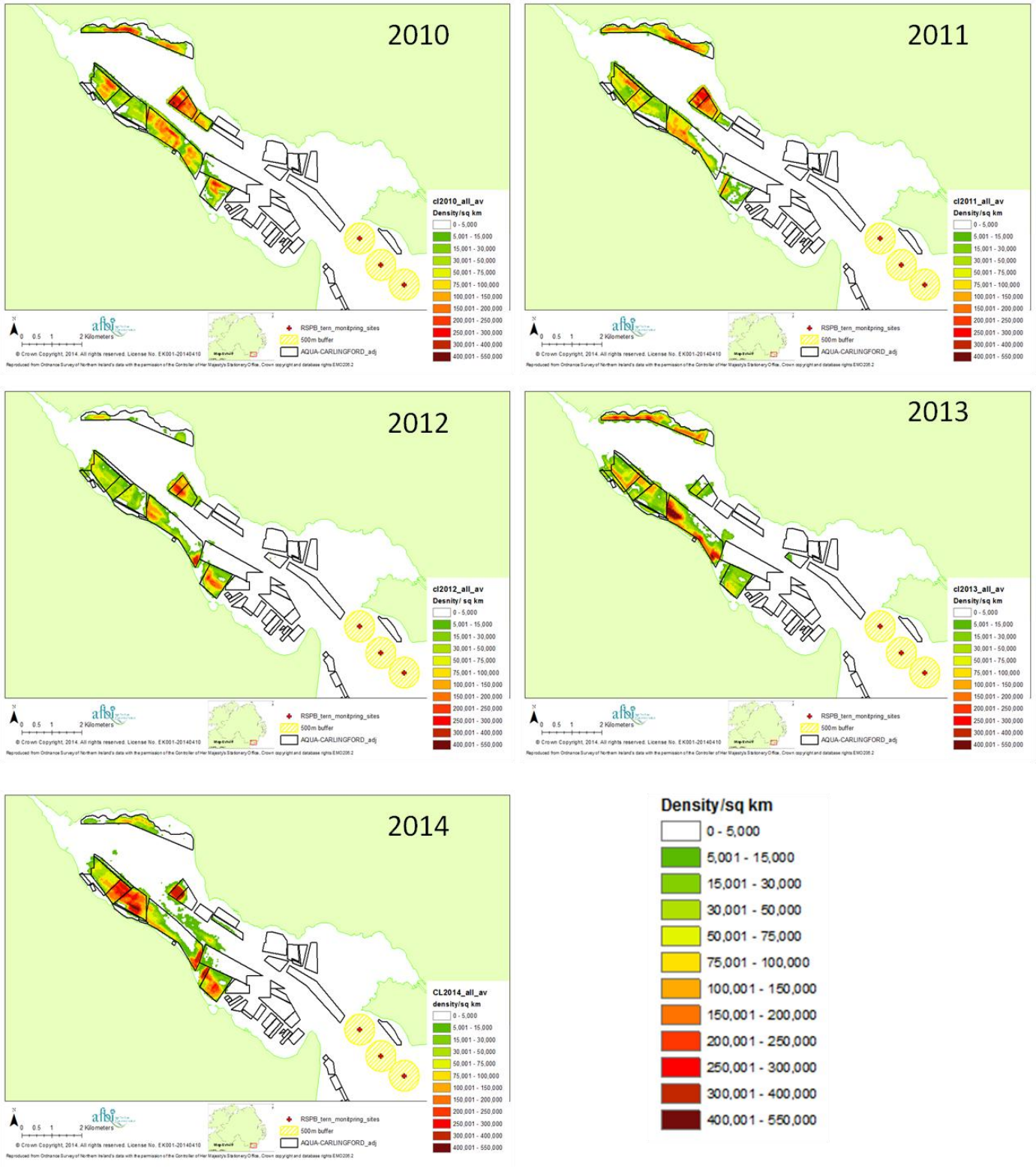


Figure 2.123: Maps showing annual vessel activity within licensed subtidal aquaculture areas in Carlingford Lough for the years 2010, 2011, 2012, 2013 and 2014. These maps were produced from black box data (supplied by DARD) processed in ArcGIS v10.0.

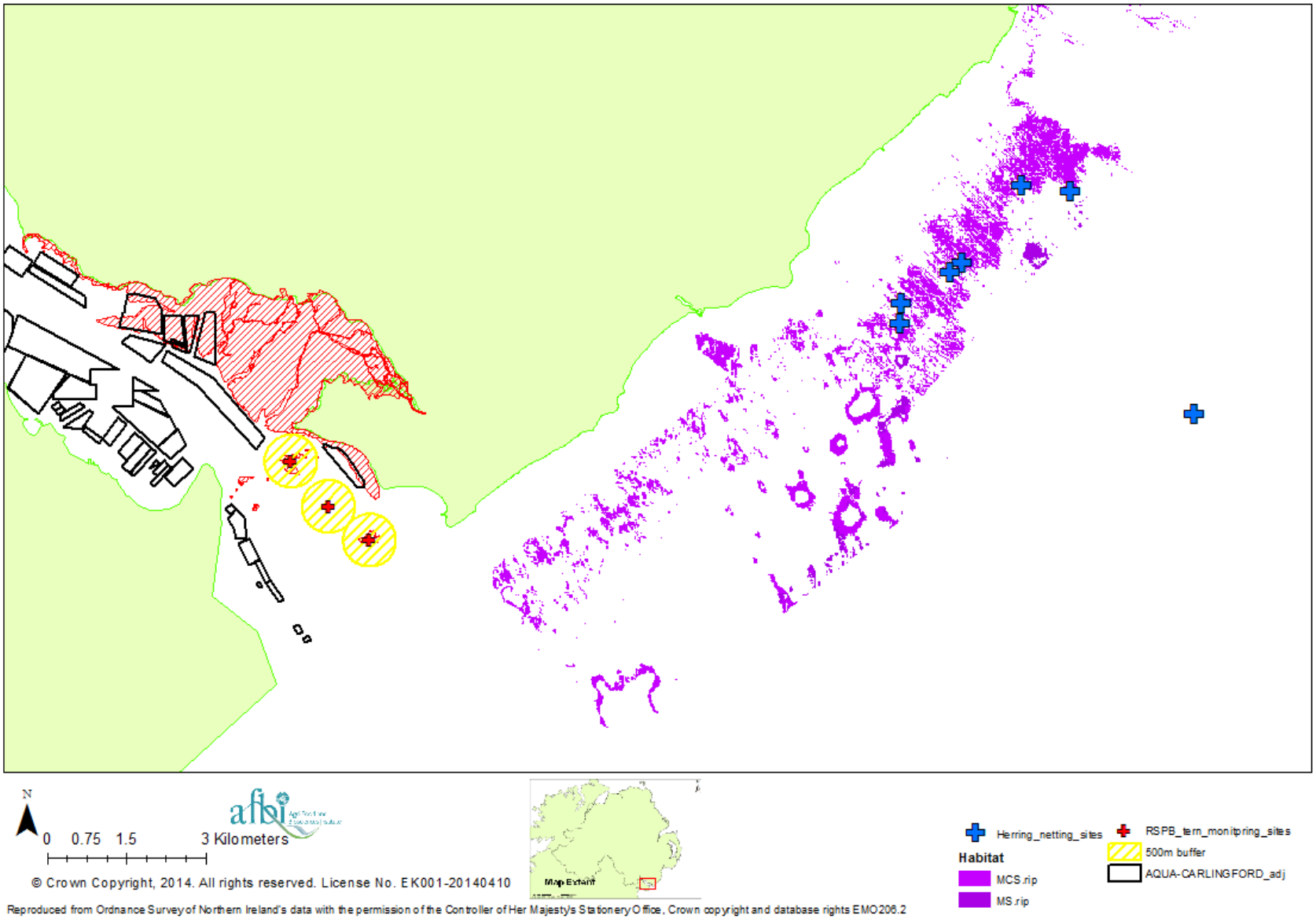


Figure 2.134: Map showing areas outside Carlingford Lough identified as potential herring spawning grounds.

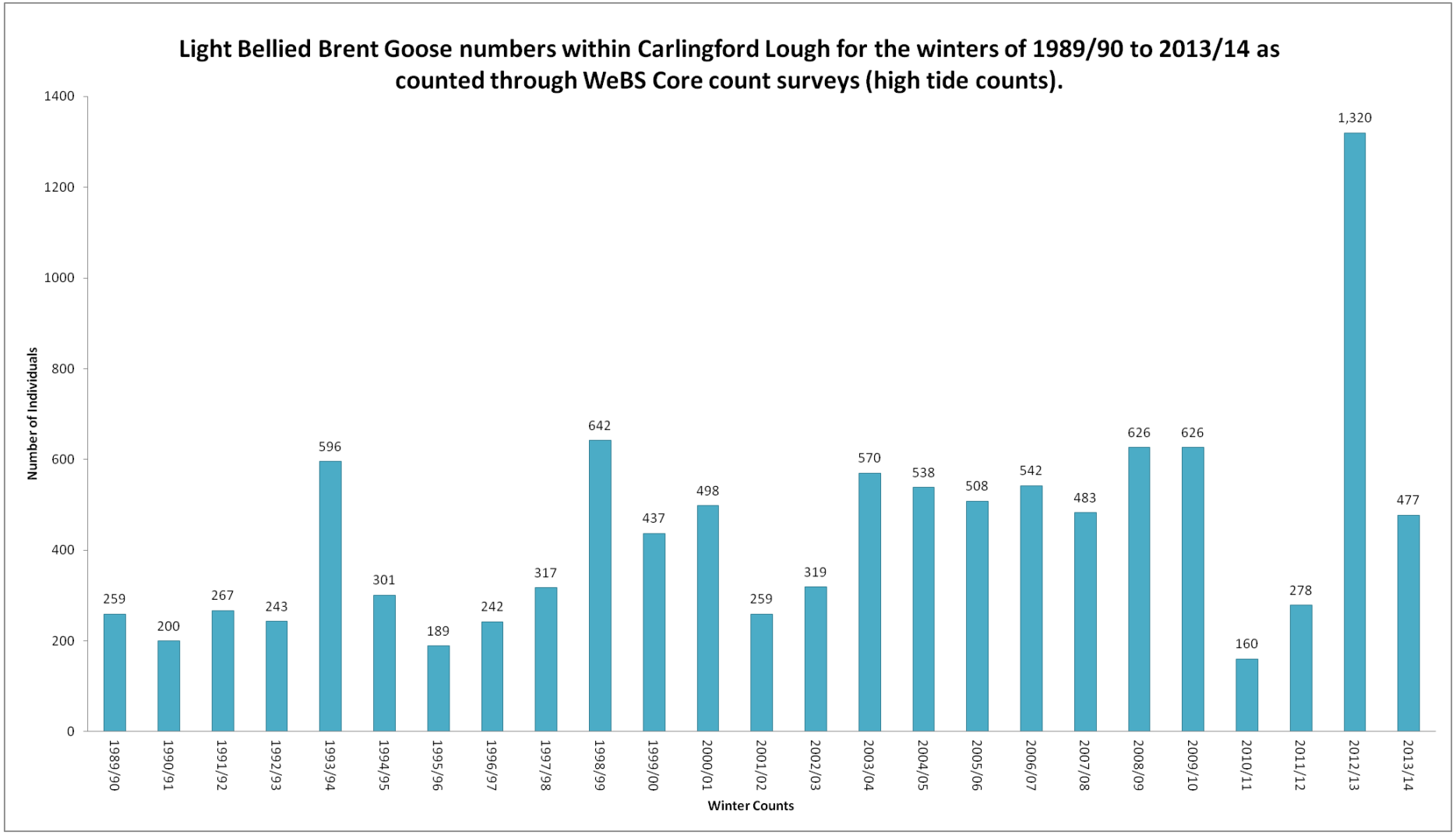


Figure 2.145: Graph showing the numbers of Light bellied Brent Geese counted within WeBS Core counts (high tide counts) in Carlingford Lough for the winters of 1989/90 to 2013/14.

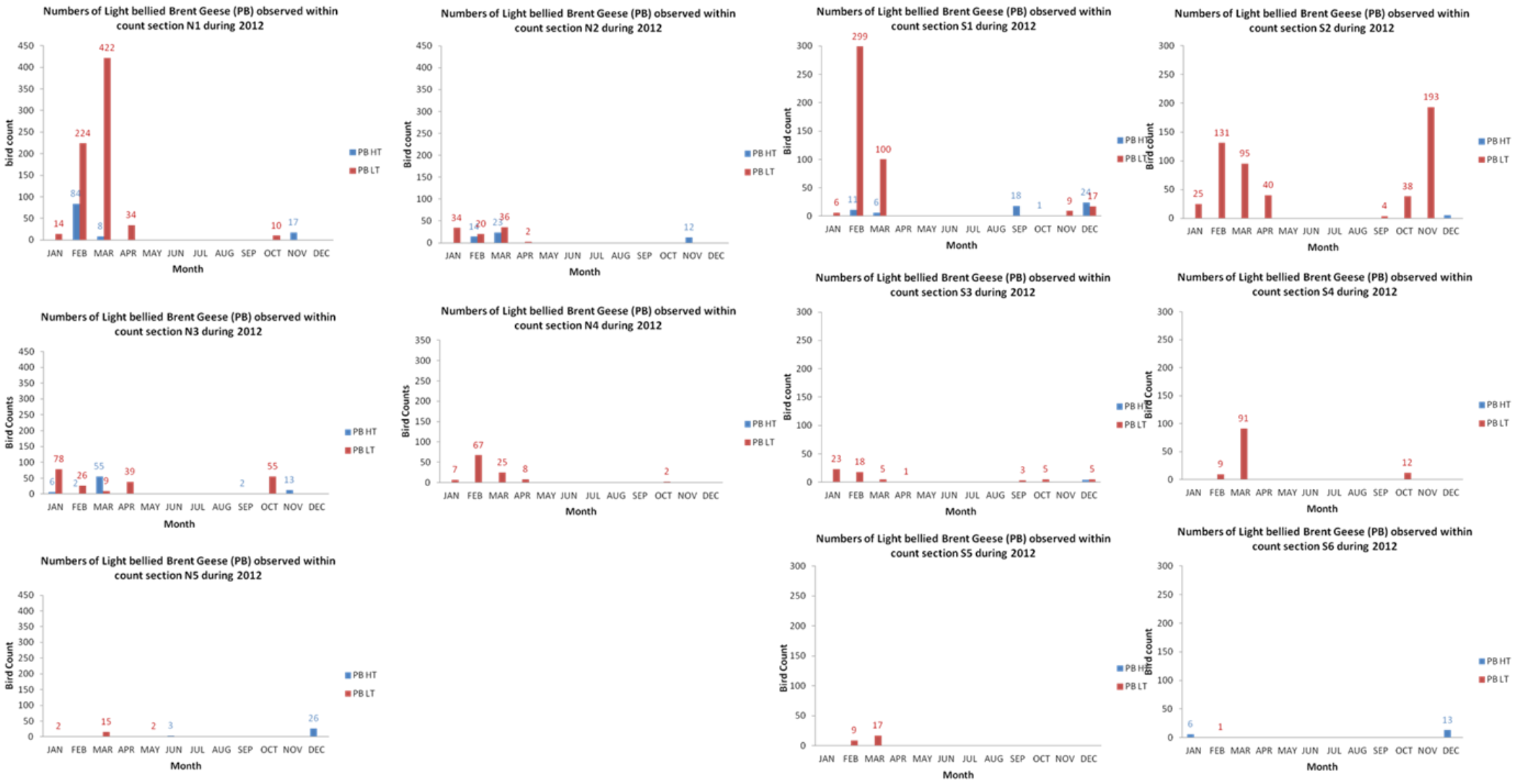


Figure 2.16: Graphs showing the numbers of Light Bellied Brent Geese counted by the Loughs Agency from Jan to Dec 2012 within Carlingford Lough survey sites. Red bars represent low tide counts and blue bars represent high tide counts.

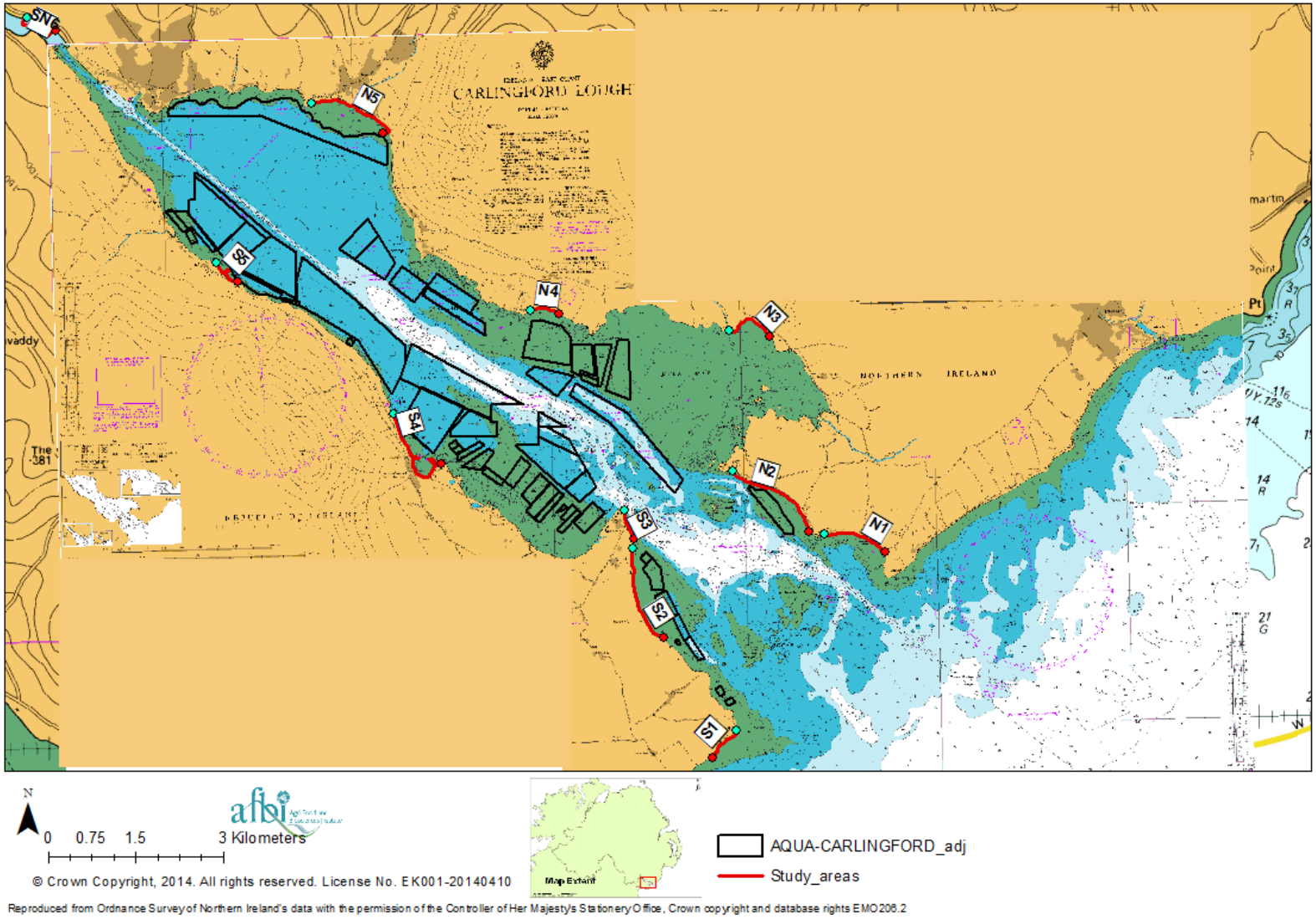


Figure 2.15: Map showing the location of the count areas within which the Loughs Agency (LA) undertook monthly bird counts from Jan to Dec 2012. Only the start (red dot on map) and end (turquoise dot on map) were supplied to AFBI. Boundaries of the survey areas were not drawn out to sea (LA pers comm.) 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.

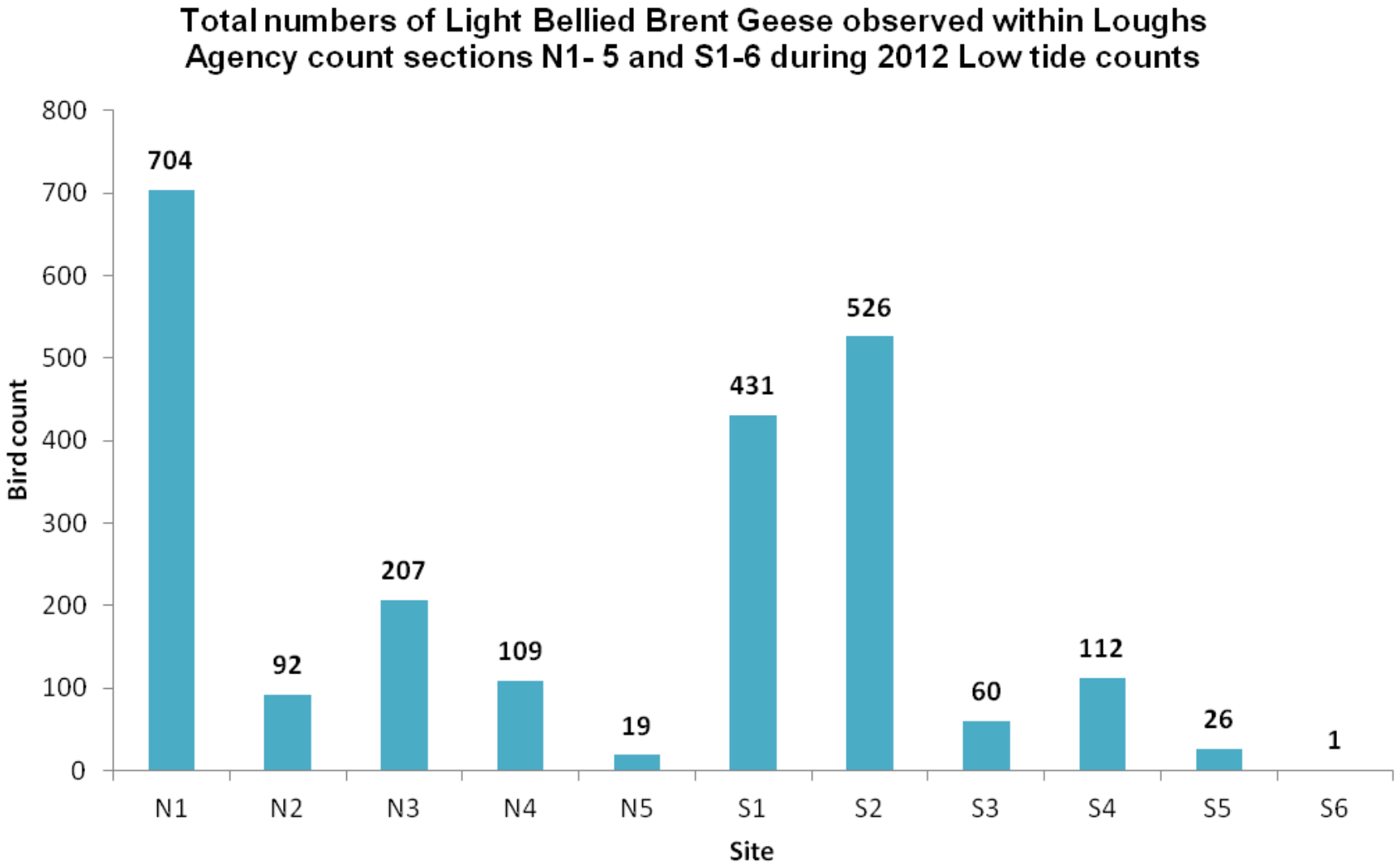


Figure 2.18: Total numbers of Light bellied Brent Geese observed by the Loughs Agency from Jan – Dec 2012 at survey sites within Carlingford Lough. Dark blue bars indicate high tide counts and light blue bars represent low tide counts.

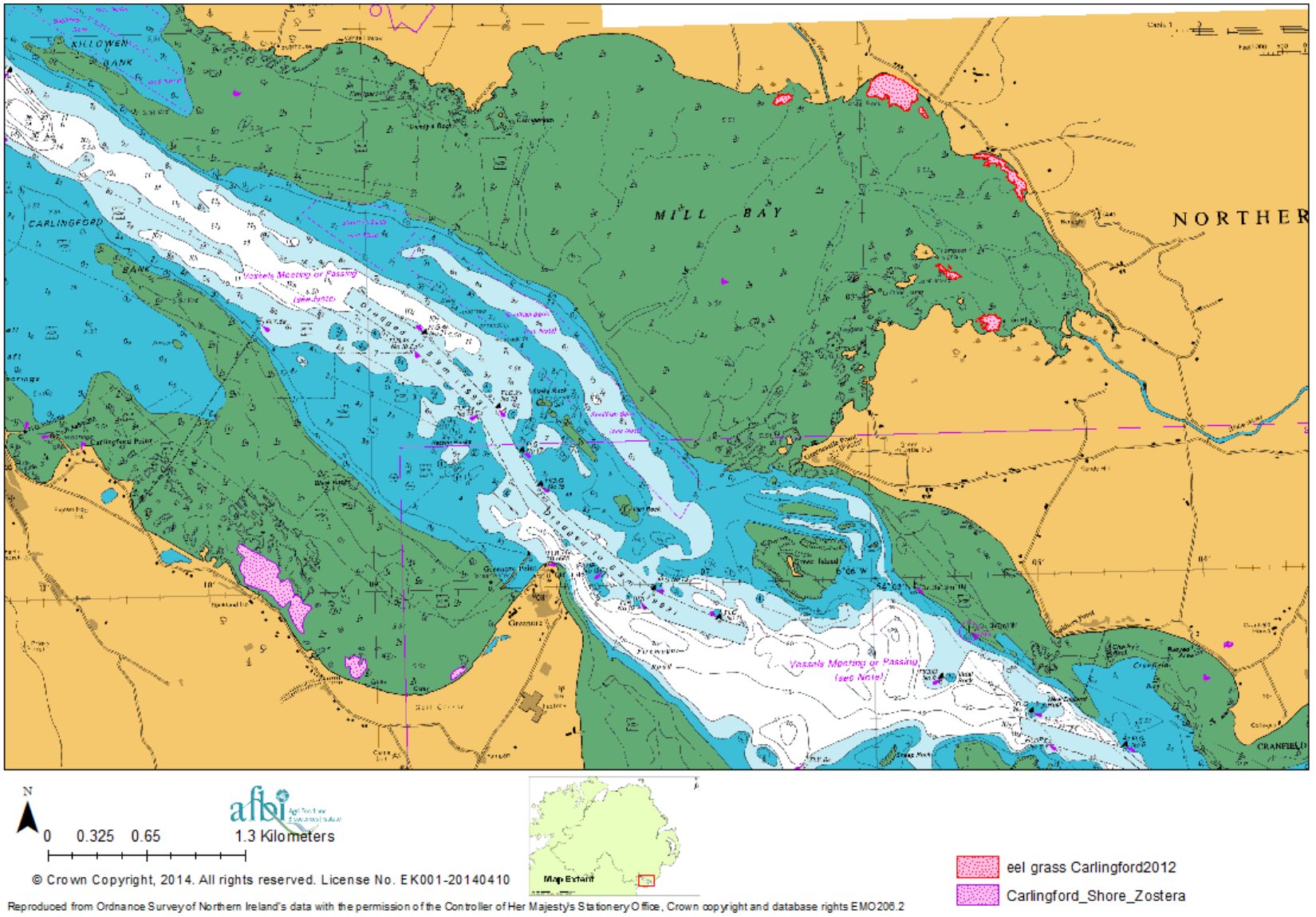


Figure 2.16: Map showing distribution of intertidal eelgrass on both the Northern and Souther shores of Carlingford Lough as mapped by NIEA and NPWS respectively.

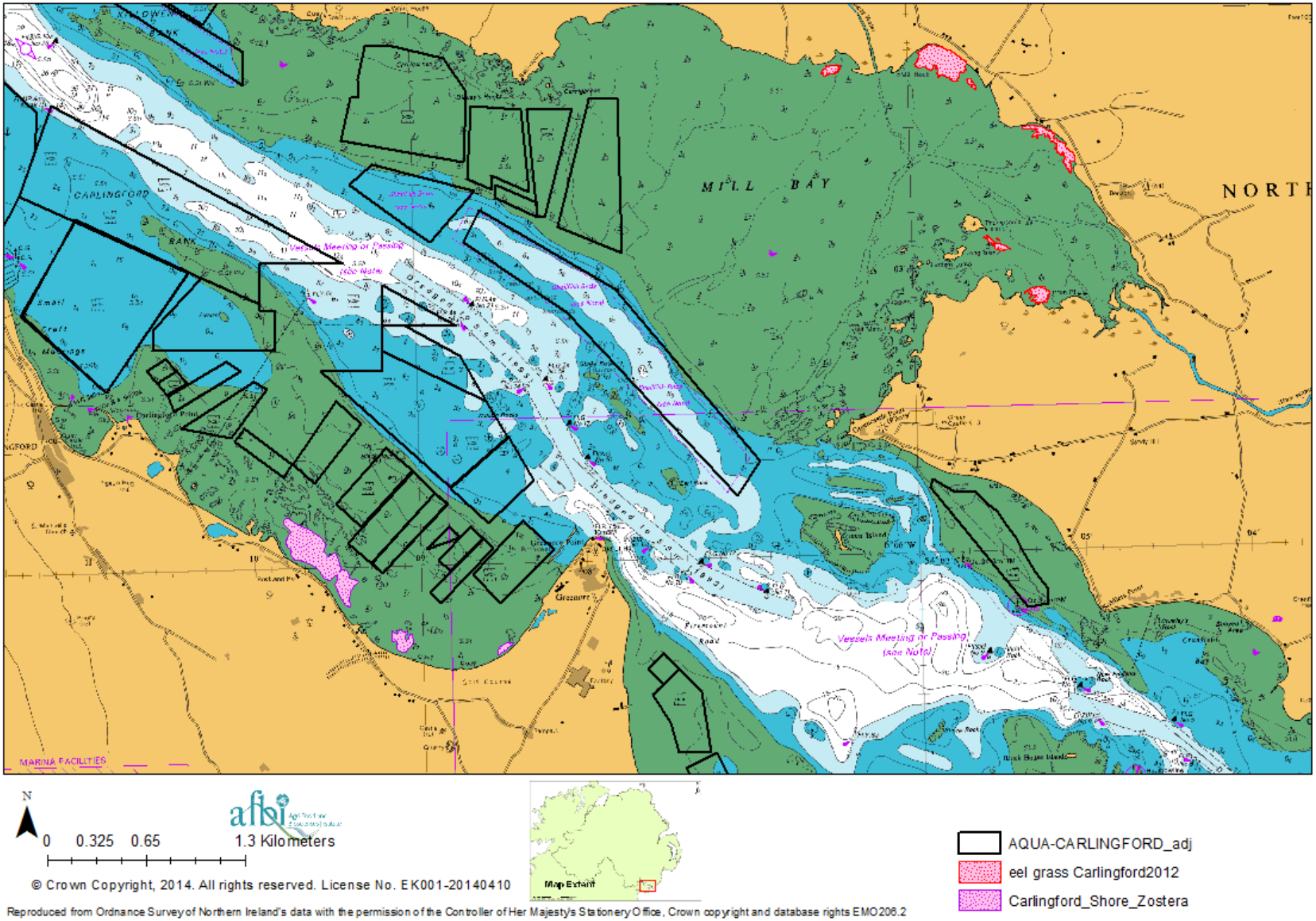


Figure 2.20: Map showing the distribution of intertidal eelgrass on both the Northern and Southern shores of Carlingford Lough alongside all licensed aquaculture sites within the Lough.

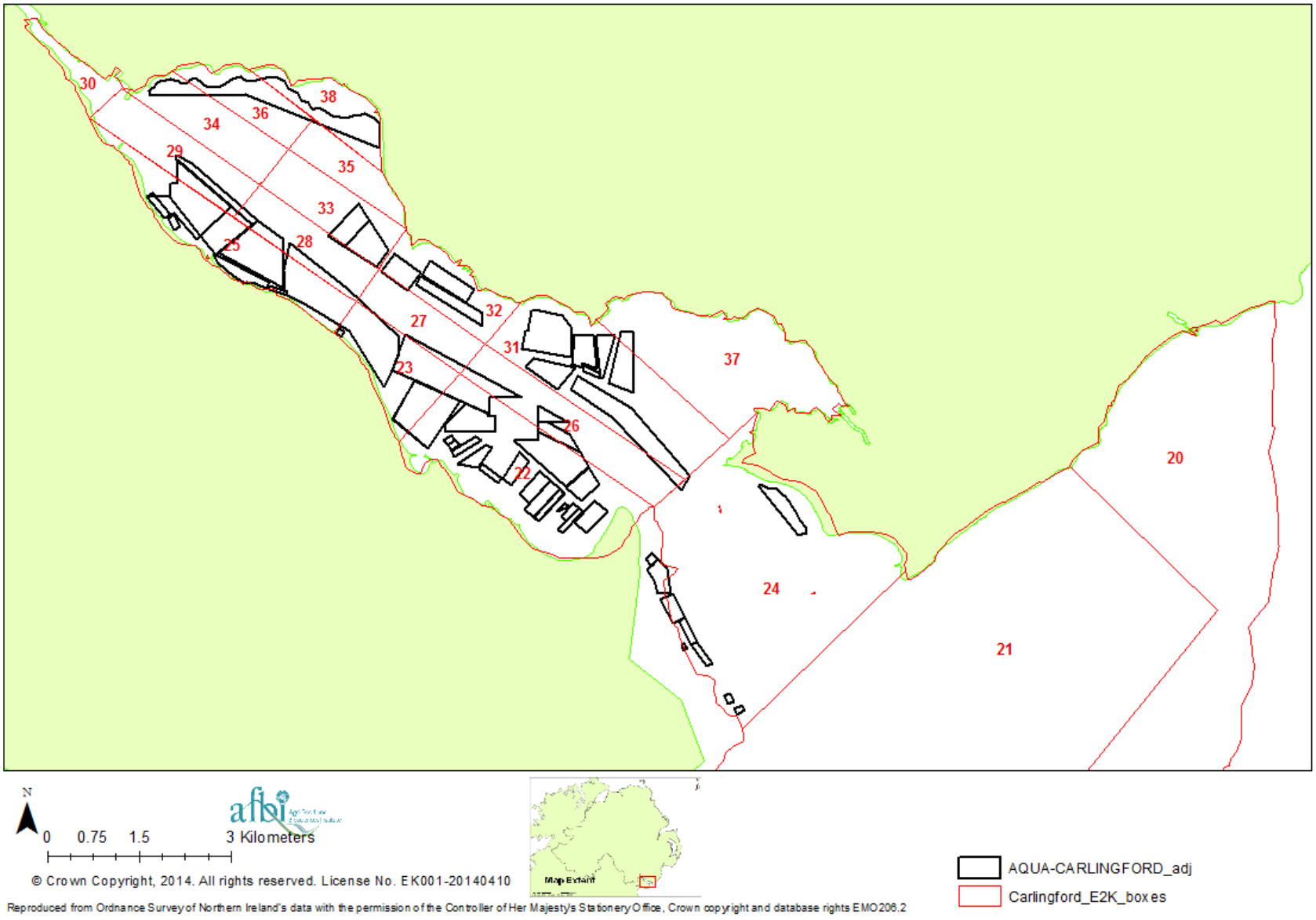


Figure 2.17: Map showing the location of the Carlingford Lough SMILE model boxes alongside licensed aquaculture sites.

3. Conclusions

Licensed aquaculture beds within Carlingford Lough occupy approximately 23.9% of total area of the Lough. Approximately 1,425.88 hectares of the whole of the Lough is designated as a SPA. The area of overlap of designated SPA sites and licensed aquaculture sites is approximately 209.73 hectares which equates to approximately 14.71% of the total designated area. The total area of the Carlingford Lough SAC occupied by aquaculture is approximately 48.98 hectares which equated to approximately 9.31% of the total area of the SAC.

3.1. SPA features

Breeding Bird populations

Investigators in America have recommended buffer or set back distances, to minimise human disturbance to Tern species of 100 m (Rodgers and Smith, 1997), 180 m (Rodgers and Smith 1995), and 200 m (Erwin 1989). The studies listed above were based on field investigations and several different types of human disturbance were studied which included walking (Erwin, 1989, Rodgers and Smith 1995, and 1997), canoeing, (Rodgers and Smith 1995), and motorboats (Rodgers and Smith 1995, 1997). There are no licensed aquaculture sites within 500 m of the Islands within Carlingford Lough on which Tern populations breed.

As Tern species feed mainly on fish, shellfish aquaculture will not impact on the availability of prey species for these birds. There are several factors that are impacting the Tern numbers and breeding success within Carlingford Lough, food availability is not one of these factors (Wolsey 2011, 2012).

Tern populations within Carlingford Lough have fallen within recent years. This decline had been attributed to; 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). There is no evidence to suggest that aquaculture activities within Carlingford Lough are negatively impacting the conservation objectives for this designated feature.

Overwintering (non breeding) birds

Approximately 14.71% of the total area of Carlingford Lough designated as a SPA is currently occupied by licensed intertidal aquaculture sites. The preferred food of

Light bellied Brent Geese is intertidal eelgrass (Owen and Black 1990, Hassall and Lane 2005, Inger *et al.* 2006). There are no licensed aquaculture sites within the areas identified as intertidal eelgrass beds within Carlingford Lough. Alternative food sources that can be exploited by Light Bellied Brent Geese include green algae, saltmarsh plants and terrestrial grassland (Owen and Black 1990, Inger *et al.* 2006).

In their investigations into the effects of intertidal oyster aquaculture on the distribution of waterbirds within six sites in the republic of Ireland Gittings and O'Donoghue (2012) found that Light Bellied Brent Geese showed a variable response to oyster trestles. At some sites investigated Light bellied Brent Geese were observed feeding on top of the oyster trestles.

Brent Geese are both diurnal and nocturnal feeders (Owen and Black, 1990 and Hughes and Green, 2005). In general operators of intertidal aquaculture sites can only access their trestles at low tide and would typically only be on site during daylight hours. However, during the darker winter months, low tides do not always coincide with daylight hours and therefore some limited access to aquaculture sites may be required during the hours of darkness. As there is no eelgrass on present on licensed aquaculture sites within Carlingford Lough, Light-bellied Brent Geese should be able to feed during night time low tides undisturbed by aquaculture operators.

Light Bellied Brent Geese numbers within Carlingford Lough are relatively stable (NIEA pers comm.). There is no evidence to suggest that aquaculture activities within Carlingford Lough are negatively impacting the conservation objectives of this designated feature.

3.2. SAC features

Annual vegetation of drift lines

Intertidal shellfish aquaculture occurs on the lower intertidal zone and there therefore will not be any spatial overlap between aquaculture and this feature of the SAC. There is no evidence to suggest that aquaculture activities within Carlingford Lough are negatively impacting the conservation objectives of this designated feature.

Perennial vegetation of stony banks

Intertidal shellfish aquaculture occurs on the lower intertidal zone and there therefore will not be any spatial overlap between aquaculture and this feature of the SAC.

There is no evidence to suggest that aquaculture activities within Carlingford Lough are negatively impacting the conservation objectives of this designated feature.

3.3. Ecological carrying capacity of Carlingford Lough

Aquaculture species reduce the overall ecosystem phytoplankton biomass and hence food availability for other organisms within Carlingford Lough by up to 70%. This value was highest in model boxes where only mussel aquaculture is undertaken.

Analysis of measured data (taken from Taylor *et al* 1999) shows up to -62% annual variation within chlorophyll a values (using 90th percentile figures) recorded between sampling years. 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.

This data indicates that using 2014 stocking data mussel production within all model boxes is currently at the ecological threshold (or above in the case of boxes 36, 38 and 25) whilst there is limited potential for the controlled expansion of intertidal oyster culture in certain areas.

It should be noted that for the purpose of this report (to represent the worst case scenario) within the model **ALL** currently licensed aquaculture sites within Carlingford Lough were activated which in reality is not the case. There is currently a moratorium in place within Northern Ireland on the granting of any further Fish Culture Licences for the bottom culture of mussels.

4. Recommendations

In light of the information contained within the above sections AFBI have the following recommendations for the management of aquaculture activities within Carlingford Lough:

a) Operators should continue to take care to avoid areas of intertidal eelgrass when accessing their sites.

b) Investigations should be undertaken by competent authorities to investigate the flushing distances (in response to different types of human disturbance, walking, vehicles, boats etc) of the Tern species which breed on islands within Carlingford Lough.

c) Light Bellied Brent Geese populations within the Northern shores of Carlingford Lough should be counted at low tide in keeping with practices currently undertaken within other Northern Irish SPA sites such as Strangford Lough.

d) 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 within the Lough.

e) The size of the licensed areas for intertidal oyster culture within the Northern areas of the Lough are not representative of the areas within which trestles are placed. It is recommended that either;

    a. Licences are amended so that only the areas within which aquaculture activities are undertaken are licensed i.e. reduce the areas licensed, or
    b. Licences are amended to include a maximum number of trestles permitted per site.

f) The programme of benthic monitoring (PSA, and infaunal samples) initiated in 2014 at newly licensed sites should continue and further monitoring at

designated stations within each licensed intertidal aquaculture area should be established.

g) 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.

h) AFBI shall source the best available shellfish production figures so that the SMILE model can be run biannually to establish if shellfish production is within the ecological carrying capacity for the Lough.

It should be noted that this report has been prepared to enable DARD to assess licence applications submitted for aquaculture sites within areas on the Northern Shore of Carlingford Lough.

5. Assessment under Article six of the Habitats Directive

In accordance with Regulation 43(1) of the Conservation (Natural Habitats, etc) (Northern Ireland) 1995 (as amended), 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: Aquaculture Activities within and adjacent to Natura 2000 sites in Carlingford Lough.

Name of Project or Plan.	**Carlingford Lough licensed aquaculture sites.**
Name and location of Natura 2000 site (s)	**Carlingford Lough SPA** Area: 830.51 hectares Site code: UK9020161 Date Classified: March 1998 (see Figure 1.1 for a map of the site boundary) **Carlingford Lough cSAC** Area: 526.27 hectares Site code: 002306 Date Classified: first proposed as eligible as a Site of Community Importance (SCI) in June 2006 (See Figure 1.2 for a map of the site boundary) **Carlingford Shore SPA** Area: 595.37 hectares Site code: 004078 Date Classified: October 1996 (See Figure 1.3 for a map of the site boundary)
Natura 2000 site features:	**Carlingford Lough SPA** The site qualifies under Article 4.1 of EC Directive 79/409 on the Conservation of Wild Birds by regularly supporting important numbers of the following species: **During the Breeding Season** Common Tern (Sterna hirundo). For the period 1993-1997, the five year peak mean for Common Tern at this site constituted 10.9% of the all Ireland breeding population. Sandwich Tern (Sterna sandvicensis). For the period 1993-1997, the five year peak mean for Sandwich tern at this site constituted 13.1% of the all Ireland breeding population. The site qualifies under Article 4.2 of EC Directive 79/409 on the Conservation of Wild Birds by regularly supporting important numbers of the following species: **Over winter (non breeding)**

	Light bellied Brent Geese (Branta bernicla hrota). For the period 1990-1995, the five year peak mean for Light bellied Brent Geese at this site was 319 individuals which constituted 1.6% of the wintering Canada/Ireland population. **Carlingford Lough cSAC** This site has been designated due to the presence of the following Annex I Habitats; ▪ Mudflats and sandflats not covered by seawater at low tide ▪ Atlantic salt meadows ▪ Annual vegetation of drift lines ▪ Perennial vegetation of stony banks **Carlingford Shore SPA** The site qualifies under Article 4.2 of EC Directive 79/409 on the Conservation of Wild Birds by regularly supporting important numbers of the following species: **Over winter (non breeding)** During the winter the site regularly supports 1% or more of the biogenic population of Light-bellied Brent Goose (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96-1999/00) was 253 individuals. The Wetland habitats contained within Carlingford Lough SPA are identified of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore the wetland habitats are considered to be an additional Special Conservation Interest (NPWS 2013b).
Description of the Project or Plan	**Size and Scale** There are currently fourteen licensed aquaculture sites within the northern area of Carlingford Lough and forty one in the southern area of the Lough (Figures 2.1 and 2.4 and Table 2.1). **Land Take** The total area of Carlingford Lough occupied by licensed aquaculture sites is approximately 1,171.1 hectares which equates to approximately 23.9% to the total are of the Lough. Of this approximately 48.98 hectares overlaps with the boundary of the Carlingford Lough cSAC (approximately 9.31% of the total area designated). As the bird species for which both SPAs within Carlingford Lough are designated will utilise the whole area of the Lough the total area designated a SPA was calculated. Of this area approximately 209.73 hectares is currently occupied by licensed aquaculture sites, equating to

	approximately 14.7% of the total designated area. **Distance from Natura 2000 site key features** Approximately 17.9% of the total area licensed for aquaculture is within the boundaries of the areas designated as SPAs and approximately 4.18% is within the boundary of the Carlingford Lough cSAC. There are no licensed aquaculture sites within 500 m of the areas of the Lough where breeding Tern populations are monitored. There are no licensed aquaculture sites within the areas of the Lough identified as eelgrass beds. However Light Bellied Brent Geese may utilise areas occupied by Intertidal aquaculture within Carlingford Lough. There is no spatial overlap between licensed aquaculture sites and the Annex I habitats for which the Carlingford Lough cSAC is designated.
Is the Project or Plan directly connected with or necessary to the management of the site (provide details)?	**No**
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.	Please refer to the information contained within Sections 2 to 4 of this report.

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).**	***Effect Significant/Not Significant? Why?**
Common Tern	Aquaculture activities have the potential to cause disturbance through human presence within nesting areas and damage/disturbance to feeding areas/species.	Sites licensed for aquaculture are not within 500 m of the islands identified as having Terns present. The main food source for Tern species is fish, therefore shellfish aquaculture will not impact on prey

		availability. Further information can be found within Sections 2.2.1 and 3 of this report.
Sandwich Tern	Aquaculture activities have the potential to cause disturbance through human presence within nesting areas and damage/disturbance to feeding areas/species.	Sites licensed for aquaculture are not within 500 m of the islands identified as having Terns present. The main food source for Tern species is fish, therefore shellfish aquaculture will not impact on prey availability. Further information can be found within Sections 2.2.1 and 3 of this report.
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.	Studies on the impacts of oyster culture on waterbirds found that Light Bellied Brent Geese showed a variable response to oyster trestles and were observed feeding on top of the oyster trestles at some sites. Light Bellied Brent Geese feed mainly on eelgrass. None of the sites licensed for intertidal aquaculture are within areas identified as having eelgrass present. Further information can be found within Sections 2.2.1 and 3 of this report.
Annual vegetation of drift lines	This feature occurs on deposits of shingle lying at or above mean high water spring tides and will therefore not be impacted by intertidal and subtidal aquaculture. There is potential for indirect impacts through site access.	Operators of these sites access the shore solely via existing slipways or manmade paths. Further information can be found within Sections 2.2.2 and 3 of this report.
Perennial vegetation of stony banks	This feature occurs at the high tide limit and will therefore not be impacted by intertidal and	Operators of these sites access the shore solely via existing slipways or manmade paths.

	subtidal aquaculture. There is potential for indirect impacts through site access.	Further information can be found within Sections 2.2.2 and 3 of this report.

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	Please refer to sections 1 to 4 of this report. Investigations have demonstrated that licensed aquaculture sites within Carlingford Lough are not negatively impacting the conservation objectives of the designated features of the three designated Natura 2000 sites within the Lough.

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.

Is the potential scale or magnitude of any effect likely to be significant? :	
Alone?	**Yes**☐ **No**☒
In-combination with other projects of plans?	**Yes**☐ **No**☐

List of Agencies / Organisations Consulted: Provide contact name and telephone or email address.	No new Agencies/Organisations were consulted during the production of this updated report. Please see AFBI 2013 for a list of those originally consulted.
Habitats Regulations Assessment Summary	**See sections 2-4 above**

Conclusion: Is the proposal likely to have a significant effect on an N2K site?	**Yes**☐ **No**☒

Data collected to carry out the assessment

Who carried out the assessment?	The Agri-food and Biosciences Institute (AFBI) acting on behalf of the Department of Agriculture and Rural Development.
Sources of data	**NIEA** – eelgrass data **NPWS** – 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 **BIM** – Republic of Ireland aquaculture shapefiles, **DARD** – Northern Ireland aquaculture shapefiles, vessel black box raw data, Northern Ireland production data **Aquaculture producers** – Republic of Ireland production data
Level of assessment completed	Stage one: Screening
Where can the full results of the assessment be accessed and viewed?	DARD Fisheries and Environment Division Block 1 Downshire Civic Centre Downshire Estate Ardglass Road Downpartick

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Annex I: NIEA Competent Authority Habitat Regulations Assessment template

Habitat Regulations Assessment

In accordance with Regulation 43(1) of the Conservation (Natural Habitats, etc) (Northern Ireland) 1995 (as amended), "(Name of Competent Authority)" 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.

As part of that consideration, "Name of Competent Authority)" has:-
(a) taken into account the mitigation measures contained in the project, plan or proposal, along with all legally enforceable obligations designed to avoid environmental effects; and

(b) applied the precautionary approach set out in European Commission Guidance: "Managing Natura 2000 Sites"[1] and by the European Court of Justice in C-127/02, Waddenzee, paragraphs 56 and 59.[2]

"The authorisation of a plan or project may only be granted if the Competent National Authority is certain that it will not have any adverse effect on the integrity of the site concerned. That is where no reasonable scientific doubt remains as to the absence of such effect."

(c) consulted the Department and have regard to any representations made by it within such reasonable time as the competent authority may specify for the purposes of the assessment or determining whether an assessment is required for a plan or project. This is required by Regulation 43(3), The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007. [3]

(d) Some notes and hyperlinks to assist completion of this template have been inserted to help the Competent Authority/Public body complete their HRA. These can be removed.

Web link references for the above:

1. European Commission Guidance: "Managing Natura 2000 Sites" http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf

2. European Court of Justice in C-127/02, Waddenzee, paragraphs 56 and 59 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62002J0127:EN:PDF

3. The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007 http://www.legislation.gov.uk/nisr/2007/345/regulation/14/made

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Notes:

1. The below template has been **adapted** by NIEA Natural Heritage, Conservation Designations and Protection Unit (CDP) from the European guidance document "Assessment of plans and projects significantly affecting Natura 2000 sites. If in doubt the Competent Authority may discuss with CDP or return to the European document : "The Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC." http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

2. The Competent Authority should fill the template report form correctly showing references and include relevant annexes if necessary. If the stage 1 shows likely significant impact and /or need for mitigation then the Competent Authority should move on to stage 2 (Appropriate Assessment).

3. Under current legislation the Department of the Environment (NIEA CDP) is not obliged to Quality Assure another Competent Authority HRA as part of Environment (NI) Order (39, 40) Assent application.

4. You may delete this note section from your final draft.

Stage 1: Test of Likely Significance

Name of Project or Plan.	**i.e. New tourism facility, Belfast Harbour.** **i.e. Pipe work construction, Cookstown.** **i.e. Draft Railway Upgrade Policy (Gov Department)**
Reference (if available)	
Name and location of Natura 2000 site (s) (Note: Natura 2000 or N2K means SAC and/or SPA. You may put more than one N2K site here if more than one to be assessed i.e. Strangford Lough SPA and Strangford Lough SAC. Initial consultation with the Department as in point (c) above as should help clarify N2K name, location and N2K site features plus all the most recent NIEA available conservation objectives and condition assessments of the sites. Note ASSI features which are not SAC or SPA are not required for HRA!	**Northern Ireland SPAs** **http://www.ni-environment.gov.uk/protected_areas_home/spec_protect.htm** **Northern Ireland SACs** **http://www.ni-environment.gov.uk/protected_areas_home/spec_conserve.htm** ***Map of proposal in relation to the N2K site would be useful as annex. GIS data sets are available at http://www.ni-environment.gov.uk/other-index/digital-intro.htm*** NIEA also have a map browser for NI protected sites http://maps.ehsni.gov.uk/NIEAProtectedAreas/
Natura 2000 site features: refer to JNCC website shown Note: ensure that you assess all features that are classified as A, B, C. You may make mention of any site features of lesser presence i.e. D or E but this is mostly where they are connected to the existence of A, B,C features. Features that are of a presence or distribution below this are not considered N2K. See Data Form on the JNCC web page for the site.	**Specific SAC features :** **http://www.jncc.gov.uk/ProtectedSites/SACselection/SAC_list.asp?Country=NI** **Specific SPA features :** **http://www.jncc.gov.uk/page-1404** **(note current review of SPA features means that the JNCC website is not 100% accurate please contact paul.mcanulty@doeni.gov.uk for most recent SPA conservation objectives and features list.**

Description of the Project or Plan **Suggested topics to be covered:** • Size and scale • Land-take • Distance from Natura 2000 site or key features of the site • Resource requirements (water abstraction etc) • Emission (disposal to land, water or air) • Excavation requirements • Transportation requirements • Duration of construction, operation, de-commissioning etc • Other	
Is the Project or Plan directly connected with or necessary to the management of the site (provide details)?	**If yes proceed no further if no other N2K site or feature can be impacted. If there is a possibility that N2K features may be impacted then complete Stage 1 to consider if there is a significant impact.**
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.	

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).**	***Effect Significant/Not Significant? Why?**

***Only mitigation measures designed within the application can be considered at this stage. Any conditions that the Competent Authority would impose must be assessed through the appropriate assessment stage (Stage 2).**

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	**Effect considered significant/non-significant:**

Provide details of any other projects or plans that together with the project or plan being assessed could (directly or indirectly) affect the site.	**Provide details of any likely in-combination effects and quantify their significance -**

Is the potential scale or magnitude of any effect likely to be significant? :	
Alone?	**Yes☐ No☐**
In-combination with other projects of plans?	**Yes☐ No☐**

List of Agencies / Organisations Consulted: Provide contact name and telephone or email address.	**Note when and who in the Department you contacted with regard to Regulation 43(3) as well as other contacts used to create this report.**
Habitats Regulations Assessment Summary	**It is important that this makes scientific sense and is backed by good evidence or reasoning.**

Conclusion: Is the proposal likely to have a significant effect on an N2K site?	Yes☐ No☐
IF IT HAS BEEN DETERMINED THAT THE PROPOSAL WILL NOT HAVE A SIGNIFICANT EFFECT THEN ASSESSMENT IS COMPLETED. IF ANY PART OF THE PROPOSAL IS LIKELY TO HAVE A SIGNIFICANT EFFECT AN APPROPRIATE ASSESSMENT WILL BE REQUIRED – STAGE 2 AA.	

Data collected to carry out the assessment

Who carried out the assessment?	**If you are an agent or consultant on behalf of a Competent Authority please give your details plus the responsible person in the CA who commissioned it.**
Sources of data	**Use hyper links, references or include as annex**
Level of assessment completed	
Where can the full results of the assessment be accessed and viewed?	**Must be an official address of the Competent Authority**

DO NOT PROCEED FURTHER IF YOU HAVE ESTABLISHED THAT THIS PROPOSAL IS UNLIKELY TO IMPACT A N2K SITE AND NO MITIGATION IS REQUIRED

Stage 2: Appropriate Assessment Report

Fig 1 Assessment of the Effects of the Project or Plan on the Integrity of the Site

Describe the elements of the project or plan (alone or in combination with other projects or plans) that are likely to give rise to significant effects on the site (from screening assessment)	
Set out the Conservation objectives of the site	
Describe how the project or plan will affect key species, key habitats and the integrity of the site (determined by structure and function and conservation objectives). Acknowledge uncertainties and any gaps in information.	
Describe what mitigation measures are to be introduced to avoid or reduce the adverse effects on the integrity of the site. Acknowledge uncertainties and any gaps in information	

Fig 2 Appropriate Assessment: Mitigation Measures

List measures to be introduced	Explain how the measures will avoid the adverse effects on the integrity of the site.	Explain how the measures will reduce the adverse effects on the integrity of the site.	Provide evidence of how they will be implemented and by whom.
(i)			
(ii)			
(iii)			

List mitigation measures (as above)	**Provide evidence of the degree of confidence in their likely success**	**Provide time-scale, relative to the project of plan, when they will be implemented**	**Explain the proposed monitoring scheme and how any mitigation failure will be addressed**
(i)			
(ii)			
(iii)			

Stage 3: Assessment of Alternative Solutions Matrix

Assessment of Alternative Solutions		
The objectives of the Plan or Project	**The 'Do Nothing' Alternatives**	
Predicted adverse effects of the project or plan on the Natura 2000 site following the Appropriate Assessment		
Comparison with chosen project or plan		
Possible Alternatives	Evidence of how the alternative solutions were assessed	Describe the relative effects on the conservation objectives of on Natura 2000 (greater or less adverse effects)
Alternative locations/routes		
Alternative One		
Alternative Two		
Alternative Three		
Alternative Size and Scale		
Alternative One		

Alternative Two		
Alternative Three		
Alternative means of meeting objectives (e.g. demand management)		
Alternative One		
Alternative Two		
Alternative Three		

Assessment of Alternative Solutions (continued)

Comparison with chosen project or plan		
Possible Alternatives	Evidence of how the alternative solutions were assessed	Describe the relative effects on the conservation objectives of on Natura 2000 (greater or less adverse effects)
Alternative methods of construction		
Alternative One		
Alternative Two		
Alternative Three		
Alternative operational methods		
Alternative One		
Alternative Two		
Alternative Three		
Alternative decommissioning methods		
Alternative One		

Alternative Two		
Alternative Three		
Alternative time-scales		
Alternative One		
Alternative Two		
Alternative Three		
Conclusions on Assessment of Alternatives		

Alternative Solutions Assessment Statement

Describe the alternative solution that would avoid or minimise significant impacts on the Natura 2000 site	**Explain why the proposed project or plan is favoured over the other alternatives solutions assessed.**	
Provide an overall statement to explain why it is considered that in this instance there are no alternatives that would avoid reducing the conservation value of the Natura 2000 site.		

Stage 4: Evidence of Assessment Matrix

Consultation on Alternative Solutions			
List of Agencies Consulted:	**Response to consultation**	**Impact of alternatives on the Natura 2000 site are considered adverse (explain)**	**Impact of alternatives on the Natura 2000 site are considered positive or neutral (explain)**

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?	

Assessment where no alternative solutions exist and where adverse impacts remain

Compensatory Measures Assessment Matrix

Name and brief description of the project or plan and how it will adversely affect the Natura 2000 site

Description of the compensatory measures	
Assessment Questions	**Response**
How were compensatory measures identified?	
What alternative measures were identified?	
How do these measure relate to the conservation objectives of the site?	
Do these measures address, in comparable proportions, the habitats and species negatively affected?	
How would the compensatory measures maintain or enhance the overall coherence of Natura 20000	
Do these measures relate to the same biogeographical region in the same Member State?	
If the compensation measures require the use of land outside of the affected Natura 2000 site, is that land in the long term ownership and control of the project or plan proponent or relevant national or local authority?	
Do the same geological, hydrogeological, soil, climate and other local conditions exist on the compensation site as exist on the Natura 2000 site adversely affected by the project or plan?	
Do the compensatory measures provide functions comparable to those that had justified the selection criteria of the original site?	
What evidence exists to demonstrate that this form of compensation will be successful the long term?	

Evidence of Assessment Matrix

Consultation on Compensatory Measures			
List of Agencies Consulted	**Response to consultation**	**Compensatory Measures were considered acceptable**	**Compensatory Measures were not considered acceptable**
Data collected to carry out the Assessment			
Who carried out the assessment			
Sources of Data			
Level of assessment			
Where can the full results of the assessment be accessed and viewed?			

Annex II: Natura 2000 standard data form Carlingford Lough SPA (site code UK9020161)

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 A **1.2 Site code** UK9020161

1.3 Compilation date 199803 **1.4 Update** 199902

1.5 Relationship with other Natura 2000 sites

1.6 Respondent(s) International Designations, JNCC, Peterborough

1.7 Site name Carlingford Lough

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
06 07 00 W	54 03 00 N

2.2 Site area (ha) 830.51 **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
	X				

3. Ecological information:

3.1 Annex I habitats

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

Annex I habitat	% cover	Representativity	Relative surface	Conservation status	Global assessment

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

		Population				Site assessment			
		Resident	Migratory						
Code	Species name		Breed	Winter	Stage	Population	Conservation	Isolation	Global
A193	*Sterna hirundo*		339 P			B		C	
A191	*Sterna sandvicensis*		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. Screes. 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 (fjard)

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC)

During the breeding season the area regularly supports:

Sterna hirundo (Northern/Eastern Europe - breeding)	10.9% of the all-Ireland breeding population 5 year mean, 1993-1997
Sterna sandvicensis (Western Europe/Western Africa)	13.1% of the all-Ireland breeding population 5 year mean, 1993-1997

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: Natura 2000 standard data form Carlingford Lough cSAC (site code 002306)

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*
I	IE0002306	200106	

1.5. RELATION WITH OTHER NATURA 2000 SITES:

1.6. RESPONDENT(S):
National Parks & Wildlife Service of the Department of the Environment, Heritage and Local Government. 7 Ely Place, Dublin 2, Ireland.

1.7. SITE NAME:
Carlingford Shore

1.8. SITE INDICATION AND DESIGNATION/CLASSIFICATION DATES:

DATE SITE PROPOSED AS ELIGIBLE AS SCI:	*DATE CONFIRMED AS SCI:*
200106	
DATE SITE CLASSIFIED AS SPA:	*DATE SITE DESIGNATED AS SAC:*

2. SITE LOCATION

2.1. SITE CENTRE LOCATION

LONGITUDE	LATITUDE
W 6 15 1	54 5 2

W/E (Greenwich)

2.2. AREA (HA):

526.27

2.3. SITE LENGTH (KM):

2.4. ALTITUDE (M):

MINIMUM	MAXIMUM	MEAN
0	15	3

2.5. ADMINISTRATIVE REGION:

NUTS CODE	REGION NAME	% COVER
IE011	Border	100

2.6. BIOGEOGRAPHIC REGION:

Alpine	Atlantic	Boreal	Continental	Macaronesian	Mediterranean
☐	☑	☐	☐	☐	☐

3. ECOLOGICAL INFORMATION

3.1. HABITAT types present on the site and assessment for them:

ANNEX I HABITAT TYPES:

CODE	%COVER	REPRESENTATIVITY	RELATIVE SURFACE	CONSERVATION STATUS	GLOBAL ASSESSMENT
1140	90	D			
1330	1	D			
1220	1	A	C	B	A
1210	1	A	C	B	A

3.2. SPECIES

covered by Article 4 of Directive 79/409/EEC

and

listed in Annex II of Directive 92/43/EEC

and

site assessment for them

3.2.a. BIRDS listed on Annex I of Council directive 79/409/EEC

3.2.b. Regularly occuring Migratory Birds not listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION				SITE ASSESSMENT		
		Resident	Migratory			Population	Conservation	Isolation
			Breed	Winter	Stage			
A017	Phalacrocorax carbo			91 i		C	B	C
A046	Branta bernicla			170 i		C	B	C
A050	Anas penelope			92 i		C	B	C
A053	Anas platyrhynchos			25 i		C	B	C
A130	Haematopus ostralegus			181 i		C	B	C
A137	Charadrius hiaticula			53 i		C	B	C
A149	Calidris alpina			144 i		C	B	C
A160	Numenius arquata			89 i		C	B	C
A162	Tringa totanus			81 i		C	B	C
A164	Tringa nebularia			4 i		C	B	C
A169	Arenaria interpres			13 i		C	B	C

3.2.c. MAMMALS listed on Annex II of Council directive 92/43/EEC

3.2.d. AMPHIBIANS and REPTILES listed on Annex II of Council directive 92/43/EEC

3.2.e. FISHES listed on Annex II of Council directive 92/43/EEC

3.2.f. INVERTEBRATES listed on Annex II of Council directive 92/43/EEC

3.2.g. PLANTS listed on Annex II of Council directive 92/43/EEC

3.3. Other Important Species of Flora and Fauna

GROUP						SCIENTIFIC NAME	POPULATION	MOTIVATION
B	M	A	R	F	I	P			
						P	Mertensia maritima	P	A

(B = Birds, M = Mammals, A = Amphibians, R = Reptiles, F = Fish, I = Invertebrates, P = Plants)

4. SITE DESCRIPTION

4.1. GENERAL SITE CHARACTER:

Habitat classes	% cover
Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	90
Salt marshes, Salt pastures, Salt steppes	1
Coastal sand dunes, Sand beaches, Machair	2
Shingle, Sea cliffs, Islets	4
Dry grassland, Steppes	1
Broad-leaved deciduous woodland	1
Mixed woodland	1
Total habitat cover	**100 %**

Other site characteristics

The site comprises the entire southern shoreline of Carlingford Lough and continues to the southern part of the Carlingford peninsula. While the principal conservation interests lie in the shingle and sandy shoreline habitats, the site also has intertidal sand and mud flats, patches of salt marsh, some areas of dry grassland, and an area of mixed deciduous woodland. Tourism is an important activity in the area.

4.2. QUALITY AND IMPORTANCE:

The site has very good examples of annual driftline vegetation and perennial vegetation of stony banks and shingle. These habitats extend as a strip of varying width for up to 6 km from Cooley Point to Greenore and are mostly of good quality. The Red Data Book and legally protected Mertensia maritima occurs here at the southern limit of its known Irish distribution. The shoreline habitats support wintering waterfowl in moderate numbers.

4.3. VULNERABILITY

The principal threat to the shoreline habitats is further commercial development, particularly for tourism related activities. Coastal defence works is also a threat to the shoreline. Aquaculture occurs in Carlingford Lough and may have negative impacts on the wintering bird populations.

4.4. SITE DESIGNATION:

4.5. OWNERSHIP

State : Department of the Marine
Private : Multiple

4.6. DOCUMENTATION

Colhoun, K. (1998). I-WeBS Report 1996-97. BirdWatch Ireland, Dublin.

Farrell, L. and Randall, R.E. (1992). The distribution of Mertensia maritima (L.) Gray, oyster plant, in Ireland. Irish Naturalists' Journal 24: 138-140.

Hunt, J., Derwin, J., Coveney, J. and Newton, S. (2000). Republic of Ireland. Pp. 365-416 in: M.F. Heath and M.I. Evans (eds). Important Bird Areas in Europe: Priority sites for conservation 1: Northern Europe. Cambridge, UK: BirdLife International (BirdLife Conservation Series No. 8).

Merne, O.J. (1989). Important bird areas in the Republic of Ireland. In: Grimmett, R.F.A. and Jones, T.A. (eds) Important Bird Areas in Europe. ICBP Technical Publication No. 9. Cambridge.

Moore, D. and Wilson, F. (1999). National Shingle Beach Survey of Ireland 1999. Unpublished report to National Parks and Wildlife Service, Dublin.

Praeger, R.L. (1934). The Botanist in Ireland. Hodges, Figgis and Co., Dublin.

Sheppard, R. (1993). Ireland's Wetland Wealth. IWC, Dublin.

5. SITE PROTECTION STATUS AND RELATION WITH CORINE BIOTOPES

5.1. DESIGNATION TYPES at National and Regional level:

5.2. RELATION OF THE DESCRIBED SITE WITH OTHER SITES:

designated at National or Regional level:

designated at International level:

5.3. RELATION OF THE DESCRIBED SITE WITH CORINE BIOTOPE SITES:

CORINE SITE CODE	OVERLAP TYPE	% COVER
800000347		

6. IMPACTS AND ACTIVITIES IN AND AROUND THE SITE

6.1. GENERAL IMPACTS AND ACTIVITIES AND PROPORTION OF THE SURFACE OF THE SITE AFFECTED

IMPACTS AND ACTIVITIES WITHIN the site

CODE	INTENSITY	% OF SITE	INFLUENCE
140	A B **C**	1	+ 0 -
200	**A** B C	5	+ 0 -
221	A **B** C	10	+ 0 -
240	A **B** C	10	+ **0** -
220	A **B** C	10	+ **0** -
622	A **B** C	10	+ 0 -
871	**A** B C	1	+ 0 -

IMPACTS AND ACTIVITIES AROUND the site

CODE	INTENSITY	INFLUENCE
140	A B C	+ 0 -
200	**A** B C	+ 0 -
400	A **B** C	+ 0 -
502	A B C	+ **0** -

6.2. SITE MANAGEMENT AND PLANS

BODY RESPONSIBLE FOR THE SITE MANAGEMENT

SITE MANAGEMENT AND PLANS

A Conservation Plan for the management of this site will be prepared.

7. MAPS OF THE SITE

- Physical map

- Aerial photograph(s) included:

NUMBER	AREA	SUBJECT	DATE
0277772	Cooley Peninsula	Overview of site	199506

8. SLIDES