

Marine Institute

**Carlingford Lough Waterbird and
Disturbance Surveys**

Winter 2019-20

Bird Survey Report

July 2020

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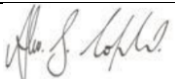

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The findings outlined within this report and the data we have provided are to our knowledge true and express our bona fide professional opinions. This report has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) Code of Professional Conduct. Where pertinent, CIEEM Guidelines used in the preparation of this report include the *Guidelines for Ecological Report Writing* (CIEEM, 2017), *Guidelines for Preliminary Ecological Appraisals* (CIEEM, 2015) and *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine*, (CIEEM, 2018). CIEEM Guidelines include model formats for Preliminary Ecological Appraisal and Ecological Impact Assessment. Also, where pertinent, evaluations presented herein take cognisance of recommended Guidance from the EPA such as *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA, 2017), and in respect of European Sites, *Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC* (European Commission, 2018).

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No method of assessment can completely remove the possibility of obtaining partially imprecise or incomplete information. In line with Best Practice, any limitation to the methods applied or constraints however are clearly identified within the main body of this document.

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Title		Carlingford Lough Waterbird and Disturbance Survey – Winter 2019-20 Bird Survey Report		

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1. INTRODUCTION

INIS Environmental Consultants Ltd. (INIS) were contracted to co-ordinate a series of waterbird population surveys and disturbance surveys at Carlingford Lough, Co. Louth during the 2019/20 winter season. The waterbird surveys followed the standard methodology used for surveying wintering waterbirds at low tide (Lewis & Tierney, 2014); the surveys included four low tide surveys and a single high tide survey.

The waterbird disturbance surveys were carried out to monitor areas where Oyster Aquaculture takes place within Carlingford Lough SPA and focused on Light-bellied Brent Geese (*Branta bernicla hrota*) within the SPA. Monthly surveys were carried out from the autumn migration period (October 2019) through to spring migration (April 2020) whereby maximum numbers and disturbance responses and movement of Light-bellied Brent Goose flocks and individuals were monitored on an hourly basis during survey periods.

This report details the results of the 2019/20 waterbird survey programme at Carlingford Lough. The results are examined and discussed in light of similar surveys undertaken by Martin (2011) and described in NPWS (2013). Due to the cross-border nature of the site, it was not surveyed previously as part of the National Parks & Wildlife Service (NPWS) Waterbird Survey Programme (NPWS, 2012) Survey Programme.

1.1. Constraints and limitations

There are a number of limitations inherent to field-based surveying. These particularly relate to availability of suitable weather conditions for completing surveys, with good visibility and little wind or rain of paramount importance. As such, when undertaking and completing fieldwork, careful consideration and planning is made to ensure optimal weather conditions during survey periods. The data presented here were all collected in optimal weather conditions.

When counting shorebirds, disturbance can substantially impact on the birds present within small areas if they are able to disperse away from the source of disturbance to adjacent areas of similar habitat but out with the areas where surveying is taking place. Such disturbance may happen in advance of the count taking place or during the survey period. To gauge levels of disturbance Best Practice methods include an assessment of disturbance levels encountered during the recording period. Such an assessment of disturbance allows the likely impact on shorebird numbers and distribution to be determined, particularly when looking at likely response to different disturbance events. Details of recorded disturbance are therefore provided.

Constraints and any limitations to available datasets used for comparative analysis are presented in where known.

1.2. Statement of Authority

Mr Howard Williams MCIEEM CEnv CBiol MRSB MIFM is Lead Ecologist with Inis and has more than 20 years' experience as a professional ecologist, specialising in birds. Following his degree, he worked as a biologist for the ESB for three years (1997-2000). Mr Williams has completed in excess of 500

separate ecology assessments in Ireland and the UK since 2000. Mr Williams is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). He is a Chartered Environmentalist (CEnv) with the Society for the Environment (Soc Env) and a Chartered Biologist (CBiol) with the Society of Biology. He is also a full member of the Institute of Fisheries Management. Mr Williams is principal ecologist with INIS Environmental Consultants Ltd and currently project manager on all INIS projects in the Republic of Ireland and the UK.

Breffni Martin BSc is an ecological consultant specialising in birds and habitats. He has studied Carlingford Lough and Dundalk Bay for the last 15 years completing over 400 hours of focal observations on oystercatchers as part of an appropriate assessment of a cockle fishery in Dundalk bay (2014-17), as well as over 700 hours observations on birds in Carlingford Lough (2010-11) in a study which informed the designation of the outer part of the Lough. He also completed over 60 boat-based surveys, and hundreds of hours of MMO work in the Lough. Breffni a board member of Birdwatch Ireland and director and acting manager of the Louth Nature Trust, an environmental NGO which runs the little tern protection scheme at Baltray (Boyne valley), amongst other things.

2. EXISTING ENVIRONMENT

2.1. Site Description

Carlingford Lough is a 15km long and narrow sea inlet that is also the estuary of the Newry River (Crowe, 2005). A glacial fjord, the Lough is flanked by glacial moraines and mountains - the Mourne Mountains to the north and Cooley Mountains to the south-west. The Lough straddles the border between Northern Ireland (County Down) and Ireland (County Louth). The Lough is generally shallow with the average depth between 2 and 10 m, although the narrow channels that run along the centre of the Lough may be as deep as 25 m (Taylor *et al.*, 1999). The site is underlain mainly by a bedrock of carboniferous limestone and this appears at times in the form of bedrock shore or outcrops of dipping limestone. Biogenic reefs are present in an area of tidal rapids at the south west mouth of the Lough. Granite boulders are also found as are banks comprising of sand and gravel and intertidal mudflats (NPWS, 2002). There are a number of small rock and shingle islands at the mouth of the Lough which are of importance for Harbour and Grey Seals, as well as breeding terns.

The site designated as Carlingford Lough SPA (Site Code 4078) covers a total area of 595ha on the southern side of Carlingford Lough between Carlingford Harbour and Ballagan Point (see Figure 2.1). The SPA is split into two sections either side of Greenore Point. Of the total area of the SPA, 304ha are considered to be sub-tidal habitats (i.e. habitats below mean low water mark), 282ha of intertidal habitats and 9ha of supratidal habitats (i.e. habitats occurring above mean high tide mark). The predominant habitats within the SPA are intertidal sand and mud flats, but also areas of mixed substrate, rocky foreshore, *Zostera* beds, *Salicornia* beds, anoxic mud and saltmarsh.

This SPA is of special conservation interest for non-breeding (over-wintering) Light-bellied Brent Goose (*Branta bernicla hrota*). There are extensive mudflats along the northern shore of the Lough and together with saltmarsh these are included in the 827ha area designated as a SPA in the United Kingdom (site code UK9020161). The qualifying species for this SPA are wintering Light-bellied Brent Goose as well as Common Tern (*Sterna hirundo*) and Sandwich Tern (*Sterna sandvicensis*) as breeding species.

Carlingford Shore SAC (Site code 002306) is designated for Perennial Vegetation of Stony Banks and Annual Driftline Vegetation. The areas of *Zostera* and *Salicornia* are not included in the qualifying interests. The SPA and SAC site synopses are given in Appendix 1.



Figure 2.1: Location of Carlingford Lough SPA, Co. Louth (source: NPWS, 2012); the SPA is outlined in blue.

2.2. Carlingford Lough Waterbirds

2.2.1. Waterbird Special Conservation Interests (SCIs)

Carlingford Lough SPA is of special conservation interest for non-breeding (wintering) Light-bellied Brent Goose which occurs in numbers of international importance.

2.2.2 Published status and trends of Carlingford waterbirds

Systematic counting of birds in Carlingford Lough started through the Wetland Birds Survey (WeBS) in 1994-95 in the part in Northern Ireland and the Irish Wetland Birds Survey (I-WeBS) in 1998-99 on the Irish side (NPWS, 2013). Because of the political situation Carlingford Lough was counted from the north and the south as separate non coordinated counts. Some more detailed work was undertaken as part of an EIS for a port development (Martin, 2011). From 2014, WeBS/I-WeBS counts were coordinated between north and south which has considerably increased the quality of data. The present report describes the first survey undertaken using low tide methodology in Carlingford Lough.

3. METHODOLOGIES

3.1. Background to the low tide survey programme

The Irish Wetland Bird Survey (I-WeBS) is the primary method by which data are collected for wintering waterbird populations at Irish wetland sites. These data, largely collected by volunteer field surveyors since the winter season of 1994/95, have underpinned the designation of Special Protection Areas (SPAs), and have enabled the production of waterbird population estimates and trends at national and at site level (e.g. Crowe & Holt, 2013; Burke *et al.*, 2019; Lewis *et al.*, 2019). I-WeBS surveys are undertaken primarily on a rising or high tide, when birds are pushed closer to shore or are gathering at roost sites and are therefore easier to count than when widely distributed across exposed tidal flats.

However, while I-WeBS surveys are designed to obtain the most accurate peak counts of waterbirds at a site, they cannot provide information about waterbird abundance or distribution during the low tide period, when many waterbirds are feeding. This gap in knowledge was addressed somewhat in 2009/10, when the National Parks and Wildlife Service (NPWS) initiated a programme of low tide surveys which took place over the three winter seasons of 2009/10, 2010/11 and 2011/12 at 32 coastal SPAs (The NPWS Waterbird Survey Programme). Due to the cross-border nature of Carlingford Lough SPA, it was not surveyed as part of the NPWS Waterbird Survey Programme. However, comparable counts were undertaken in 2010-11 (by Martin (2011); described in NPWS (2013)).

3.2. Survey design and count area

3.2.1. Waterbird distribution surveys

During the 2019/20 season, a standard survey programme of four low tide counts and one high tide count was undertaken. Low tide surveys were carried out on 23rd October 21st November 2019 and 4th December 2019 and 19th February 2020. The high tide survey was undertaken on 14th January 2020. Optimum dates were chosen in each month when the survey period spanned midday to facilitate travel to/from the site, but also to ensure surveys were carried out in the best weather and light conditions.

The surveys covered the two subdivisions (sub-sites) of Carlingford Lough SPA (see Table 3.1; Figure 3.1). The two count sub-sites, 0Z482 and 0Z480, were counted by one fieldworker on each survey day. All of the 2019/20 season surveys were carried out by a single surveyor.

Table 3.1: Count Sub-sites of Carlingford Lough

Sub-site Code	Sub-site Name	Sub-site area
0Z480	Ballagan to Greenore	303ha
0Z482	Greenore to Carlingford	292ha

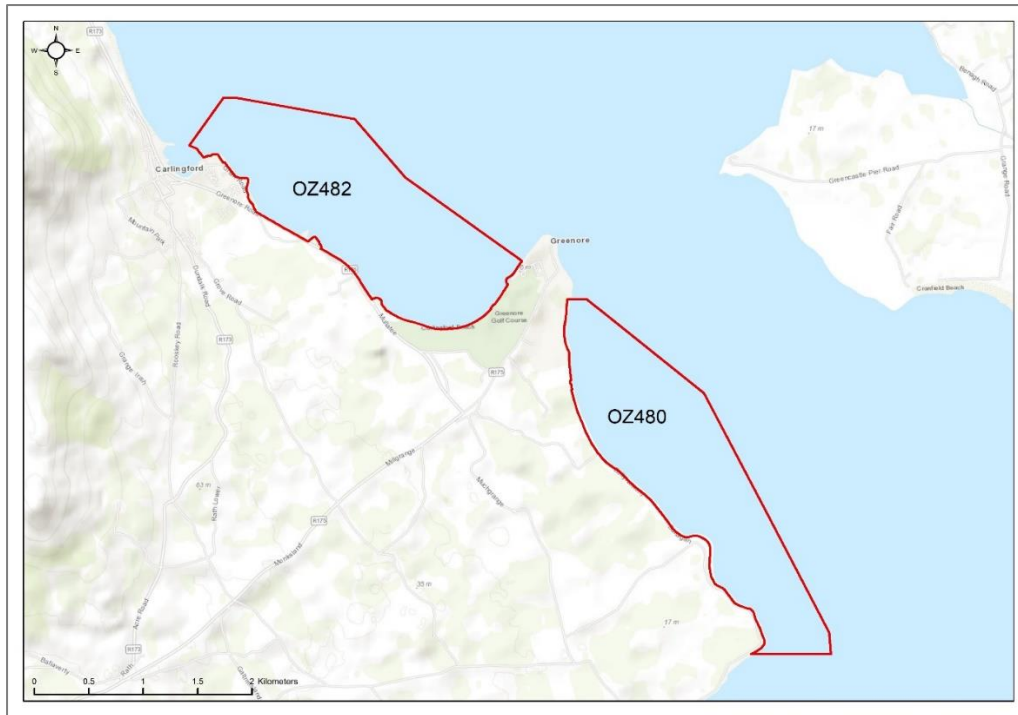


Figure 3.1: Count sub-sites used for the Carlingford Lough waterbird surveys.

3.2.2. Light-bellied Brent Goose disturbance surveys

INIS have extensive experience of undertaking through-the-tide disturbance surveys of shorebirds at a number of coastal sites, including coastal SPAs, throughout Ireland. The methodology developed for Carlingford Lough was deployed to assess the level of disturbance to Brent Geese within Carlingford Lough SPA.

For the purposes of this study, two zones on the southern shore are identified (See Figure 3.2):

- Zone 1: part of the outer Lough; and
- Zone 2: the inner Lough.

The zones have significantly different habitats with Zone 1 comprising sandy mudflats backing onto a moderately high energy shingle beach. Zone 2 is more sandy mud than muddy sand whilst the reverse is the situation in Zone 1. Zone 2 supports a significant *Zostera* bed (see Figure 3.3) but in recent years the invasive seaweed, *Sargassum muticum*, commonly known as Japanese wireweed, has spread over the mudflats and in deeper water. Patches of *Spartina anglicans* are also spreading in the mudflat areas. There is extensive aquaculture activity, primarily pacific oysters, with up to half of the available mudflat/sandflat areas being occupied.



Figure 3.2: Survey zones used for the Carlingford Lough disturbance surveys.



Figure 3.3: Survey Zone 2, showing *Zostera* beds in blue, *Spartina anglica* in red, and mussel bed in black

3.3. Field survey methods

3.3.1. Waterbird surveys

The survey period on each day extended from two hours either side of low or high tide (depending on the survey being undertaken). Waterbirds were counted within each count sub-site, and the data for each sub-site were recorded separately. Waterbird counts were conducted on the ‘look-see’ basis (Bibby *et al.*, 2000) which involves scanning across the survey area and counting all birds seen. Birds were recorded according to their species code following the 2-letter coding system used by I-WeBS and developed by the British Trust for Ornithology.

In addition to counts of each species, the behaviour of waterbirds during counts was attributed to one of two categories (foraging or roosting/other) while the position of the birds was recorded as per one of four broad habitat types (intertidal, subtidal, supratidal and terrestrial). Field maps of count sub-sites were used to map significant flocks of foraging/roosting birds (‘flock maps’).

Information on the presence of activities that could cause disturbance to waterbirds was also recorded. Following Lewis & Tierney (2014), activity types were categorised as follows:

(1) human, on-foot - shoreline (2) human, on foot – intertidal aquaculture, (3) bait-diggers (4) non-powered watercraft (5) powered watercraft, (6) water-based recreation (e.g. wind-surfers) (7) horse-riding (8) dogs (9) aircraft (10) shooting (11) other (12) winkle pickers (13) aquaculture machinery (14) other vehicles.

When an activity was observed to cause a disturbance, the waterbird species affected were recorded and a letter code system used to indicate the bird's response to the activity as follows:-

W - Weak response, waterbirds move slightly away from the source of the disturbance.

M - Moderate response, waterbirds move away from the source of the disturbance to another part of your sub-site; they may return to their original position once the activity ceases.

H - High response, waterbirds fly away to areas outside of your sub-site and do not return during the current count session.

The length of the activity was also recorded by adding by the codes **A – D** (see below) and a record was made as to whether the activity was already occurring within the sub-site when the count started.

A – short/discrete event.

B – activity occurs for up to 50% of the count period.

C – activity length estimated at >50% but < 100% of the count period.

D – activity continues after the count period has ended.

3.3.2. Light-bellied Brent Goose disturbance surveys

Within each of the two Survey Zones where Oyster Aquaculture takes place, monthly surveys of the location, movements and behavior of Light-bellied Brent Goose took place from the autumn migration period (October 2019) through to spring migration (April 2020). For each Survey Zone, one VP was selected that offered good views of the trestles in that area. These VPs were identified during an initial site reconnaissance visit and for the northern zone the VP included the large area of Eelgrass present towards the shore within its field of view.

The survey methodology followed a complete tidal cycle, typically centred on a low tide, and covering the period from three hours before to three hours after. Light-bellied Brent Geese were counted within the survey area on an hourly basis i.e. a single visit resulted in six hourly counts. During the hour, repeat counts were made to obtain the maximum number of birds within each survey area during the allocated hour of survey time.

The observer was required to arrive at least 30 minutes prior to starting to survey to ensure that their approach did not cause a disturbance in itself. Counts were undertaken using the 'look see' method (Bibby *et al.*, 2000) whereby each area was scanned using a telescope and all Light-bellied Brent Geese observed were identified and counted. The number of birds was recorded within the following categories:

- **Position re. tideline** – either ‘on tideline’ or ‘not on tideline’. Note that ‘on tideline’ includes birds +/- 10m away from it, and birds within the channel that remains at low water.
- **Activity** – foraging or roosting/other.
- **Trestles** – recorded as either ‘on trestles’ or ‘not on trestles.’

Other information was recorded such as weather conditions, start time and end time, sector code, count quality, etc. Each count was also accompanied by a field map upon which an estimate of the tideline position was drawn by the fieldworker. These maps also included flight-lines of Light-bellied Brent Geese moving into, out of and through the survey area.

The effects of any activities upon the geese within survey areas was also recorded as per the standard low tide methodology (Lewis & Tierney, 2014) as follows:

(1) human, on-foot - shoreline (2) human, on foot – intertidal aquaculture, (3) bait-diggers (4) non-powered watercraft (5) powered watercraft, (6) water-based recreation (e.g. wind-surfers) (7) horse-riding (8) dogs (9) aircraft (10) shooting (11) other (12) winkle pickers (13) aquaculture machinery (14) other vehicles.

When an activity was observed to cause a disturbance, a letter code system used to indicate the bird’s response to the activity as follows:

W - Weak response, birds move slightly away from the source of the disturbance.

M - Moderate response, birds move away from the source of the disturbance to another part of your sub-site; they may return to their original position once the activity ceases.

H - High response, birds fly away to areas outside of your sub-site and do not return during the current count session.

The length of the activity was also recorded by adding by the codes **A – D** (see below) and a record was made as to whether the activity was already occurring when the count started.

A – short/discrete event.

B – activity occurs for up to 50% of the count period.

C – activity length estimated at >50% but < 100% of the count period.

D – activity continues after the count period has ended.

Where possible all Light-bellied Brent Geese observed were checked for colour rings.

3.4. Data analysis

3.4.1. General

Field data were collected in notebooks and later transferred by the field surveyor into Excel datasheets. At the end of the survey season the Excel datasheets were compiled and validated before being formatted and entered into an Access database. From Access, data summaries were produced such as site totals, sub-site totals, etc.

Waterbird numbers were assessed with reference to national and international threshold levels as follows:

- A waterbird species that occurs in numbers that correspond to 1% or more of the individuals in the all-Ireland population of the species is said to occur in numbers of all-Ireland importance. Current population threshold values are published in Burke *et al.* (2019).
- A waterbird species that occurs in numbers that correspond to 1% or more of the individuals in the biogeographic population of the species or subspecies is said to occur in 'internationally important numbers.' Current international population threshold values are published by the African-Eurasian Migratory Waterbird Agreement (AEWA) Conservation Status Review 7 (CSR7) (AEWA 2018) (published online at wpe.wetlands.org).

3.4.2. Waterbird distribution

Following the methods used in NPWS (2012), data analyses were undertaken to determine the proportional use of two sub-sites by Light-bellied Brent Goose, relative to the whole area surveyed on each survey occasion. This gives an indication of the preferred distribution of Light-bellied Brent Goose within the SPA. Analyses were undertaken on datasets as follows:

- Total numbers (low tide surveys);
- Total numbers (high tide survey);
- Total numbers of foraging birds (low tide surveys);
- Intertidal foraging densities (low tide surveys).

3.4.3. Trends

This is the first survey undertaken at Carlingford Lough using low tide methodology. Methodology used in the 2010-11 survey (Martin, 2011) and I-WeBS are only partially comparable. I-WeBS data are presented, along with a comparison of the 2010-11 (Martin, 2011) data and 2019-20 data from the work reported here.

3.4.4. Light-bellied Brent Goose disturbance surveys

The results of the disturbance survey were analysed to assess possible impacts on the Light-bellied Brent Goose population in Carlingford Lough, including disturbance related to aquaculture, recreation and other activities with the potential to impact upon this species within the SPA.

4. RESULTS

4.1. Survey schedule and conditions

The 2019/20 winter waterbird survey season proceeded relatively unhampered by weather conditions. Very few weekend days were chosen for counting, largely for weather reasons. All surveys were carried out in good weather conditions (Table 4.1).

Table 4.1: *Weather conditions for the 2019/20 survey programme.*

Date	Tide Focus	Sub-site	Cloud	Rain	Wind	Notes
23.10.19	LT1	OZ482	3	1	3	No survey constraints
23.10.19	LT1	OZ480	3	1	3	No survey constraints
21.11.19	LT2	OZ482	3	1	3	No survey constraints
21.11.19	LT2	OZ480	3	1	3	No survey constraints
04.12.19	LT3	OZ482	1	1	2	No survey constraints
04.12.19	LT3	OZ480	1	1	2	No survey constraints
19.02.20	LT4	OZ482	3	2	2	No survey constraints
19.02.20	LT4	OZ480	3	1	2	No survey constraints
14.01.20	HT1	OZ482	1	1	2	No survey constraints
14.01.20	HT1	OZ480	1	1	2	No survey constraints

4.2. Species assemblage and diversity

A total of 29 waterbird species were recorded in the two sub-sites surveyed including seven species of wildfowl, 14 species of waders and four species of gull (Table 4.2). Five species that are Red-listed in as species of high conservation concern in Ireland (Colhoun & Cummins, 2013) were recorded (Knot, Curlew, Redshank, Black-headed Gull and Herring Gull), along with 16 species that are Amber-listed.

The diversity of species recorded in the two sub-sites is shown in Table 4.3. A total of 20 species were recorded in sub-site OZ480 with 26 species recorded in OZ482. Light-bellied Brent Goose was recorded in both sub-sites.

4.3. Total numbers of waterbirds

The total numbers of waterbirds recorded during each survey visit during winter 2019-20 to the two sub-sites are shown in Table 4.4. Total numbers recorded during low tide surveys ranged from 1,895 individuals (October 2019) to a peak count of 2,777 individuals (February 2020). A total of 2,120 waterbirds were counted during the January 2020 high tide survey (Table 4.4).

Table 4.2: Species recorded during the winter surveys at Carlingford; the status of each species on Annex I (EU Birds Directive) and on the Red and Amber lists Birds of Conservation Concern in Ireland (Colhoun & Cummins, 2013) are also shown, along with scientific nomenclature and BTO 2-letter recording code used during fieldwork.

Species name	Scientific name	Code	BoCCI	Annex I
Light-bellied Brent Goose	<i>Branta bernicla hrota</i>	PB	Amber	
Shelduck	<i>Tadorna tadorna</i>	SU	Amber	
Wigeon	<i>Anas penelope</i>	WN	Amber	
Teal	<i>Anas crecca</i>	T.	Amber	
Mallard	<i>Anas platyrhynchos</i>	MA		
Red-breasted Merganser	<i>Mergus serrator</i>	RM		
Eider	<i>Somateria mollissima</i>	EI	Amber	
Cormorant	<i>Phalacrocorax carbo</i>	CA	Amber	
Shag	<i>Phalacrocorax aristotelis</i>	SA		
Little Egret	<i>Egretta garzetta</i>	ET		Yes
Grey Heron	<i>Ardea cinerea</i>	H.		
Oystercatcher	<i>Haematopus ostralegus</i>	OC	Amber	
Ringed Plover	<i>Charadrius hiaticula</i>	RP	Amber	
Grey Plover	<i>Pluvialis squatarola</i>	GV	Amber	
Lapwing	<i>Vanellus vanellus</i>	L.		
Knot	<i>Calidris canutus</i>	KN	Red	
Purple Sandpiper	<i>Calidris maritima</i>	PS		
Dunlin	<i>Calidris alpina</i>	DN	Amber	
Snipe	<i>Gallinago gallinago</i>	SN	Amber	
Black-tailed Godwit	<i>Limosa limosa</i>	BW	Amber	
Bar-tailed Godwit	<i>Limosa lapponica</i>	BA	Amber	Yes
Curlew	<i>Numenius arquata</i>	CU	Red	
Greenshank	<i>Tringa nebularia</i>	GK	Amber	
Redshank	<i>Tringa totanus</i>	RK	Red	
Turnstone	<i>Arenaria interpres</i>	TT		
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	BH	Red	
Common Gull	<i>Larus canus</i>	CM	Amber	
Herring Gull	<i>Larus argentatus</i>	HG	Red	
Great Black-backed Gull	<i>Larus marinus</i>	GB	Amber	

Table 4.3: Sub-site diversity (tick marks indicate that a species was recorded in that sub-site)

Species name	Sub-site 0Z480	Sub-site 0Z482
Light-bellied Brent Goose	✓	✓
Shelduck		✓
Wigeon		✓
Teal		✓
Mallard		✓
Eider	✓	
Red-breasted Merganser	✓	✓
Cormorant	✓	✓
Shag	✓	
Little Egret		✓
Grey Heron	✓	✓
Oystercatcher	✓	✓
Ringed Plover	✓	✓
Grey Plover		✓
Lapwing	✓	✓
Knot		✓
Purple Sandpiper	✓	
Dunlin	✓	✓
Snipe		✓
Black-tailed Godwit	✓	✓
Bar-tailed Godwit	✓	✓
Curlew	✓	✓
Greenshank		✓
Redshank	✓	✓
Turnstone	✓	✓
Black-headed Gull	✓	✓
Common Gull	✓	✓
Herring Gull	✓	✓
Great Black-backed Gull	✓	✓
Total Species	20	26

4.4. Species totals

Totals for individual species from each survey visit during the 2019-20 recording period at Carlingford Lough are shown in Table 4.4. During the low tide survey peak counts of Light-bellied Brent Goose, the qualifying interest, was 261 birds, though it should be noted that during the disturbance counts larger numbers were recorded, the peak being 350 in Zone 2 on the 20th December.

Table 4.4: Total numbers of waterbirds counted at Carlingford Lough during each survey visit over winter 2019/20; thresholds to determine national and international importance of populations for each species (where applicable) are also shown (after Burke et al., 2019).

Species Name	1% Int	1% Nat	LT1	LT2	LT3	LT4	HT1
Light-bellied Brent Goose	400	350	174	243	261	122	48
Shelduck	2,500	100	4			11	
Wigeon	14,000	560	205	192	326	218	156
Teal	5,000	360	4		32	22	22
Mallard	53,000	280	31	6	18	28	20
Eider	9,800	55			4		
Red-breasted Merganser	860	25			47	16	4
Cormorant	1,200	110	38	31	125	104	96
Shag	2,000	-		4		12	
Little Egret	1,100	20	11	12	28	7	12
Grey Heron	5,000	25	9	14	27	17	25
Oystercatcher	8,200	610	130	301	168	330	528
Ringed Plover	540	120	24	18	74	36	61
Grey Plover	2,000	30	5	1	4		
Lapwing	72,300	850	188	170	168	170	216
Knot	5,300	160			135	57	104
Purple Sandpiper	110	20				2	
Dunlin	13,300	460	132	200	271	236	275
Snipe	100,000	-			2		
Black-tailed Godwit	1,100	200	26	31	48	56	42
Bar-tailed Godwit	1,500	170	13	6	20	16	31
Curlew	7,600	350	51	57	93	43	41
Greenshank	3,300	20	11	5	6	4	9
Redshank	2,400	240	202	281	222	175	167
Turnstone	1,400	95	54	56	85	115	107
Black-headed Gull	31,000	-	311	35	280	135	24
Common Gull	16,400	-	90	112	109	114	78
Herring Gull	14,400	-	118	247	187	44	46
Great Black-backed Gull	3,600	-	64	10	37	30	37
All Species			1,895	2,032	2,777	2,120	2,149

Maximum counts of Red-breasted Merganser, Grey Heron, Redshank and Turnstone all exceeded numbers in excess of the 1% national population threshold on one of the low tide survey visits, with Grey Heron and Turnstone also exceeding the national population threshold on the high tide roost survey visit in January. No species had number recorded in excess of the 1% international threshold.

4.5. Trends in waterbird numbers

Because this is the first occasion that the low tide methodology used in this survey was used there is no available comparative data for low tide counts other than a survey completed in 2010/11 (Martin, 2011). However, that study assessed Light-bellied Brent Goose numbers through the full tidal cycle and was undertaken on four days per month as opposed to one day, so the 2019/20 data is not directly comparable. Nevertheless, the data from the 2010-11 and 2019-20 survey are compared in Table 4.5.

Table 4.5: *Light-bellied Brent Goose numbers in the two sub-sites from this survey (2019-20) compared to data from Martin (2011).*

	Sub-site OZ480			Sub-site OZ482			Carlingford Lough (all)		
	2010-11	2019-20	Change	2010-11	2019-20	Change	2010-11	2019-20	Change
October	126	9	-92.8%	218	165	-24.3%	344	174	-49.4%
November	109	37	-66.1%	294	206	-29.9%	403	243	-39.7%
December	275	89	-67.6%	412	172	-58.3%	687	261	-62.0%
January	177	0	-100%	132	48	-63.6%	309	48	-84.5%
February	346	12	-96.5%	176	110	-37.5%	522	122	-76.6%

I-WeBS has been undertaken only irregularly at Carlingford Lough, with counts available for 2009-10; 2011-12 and 2015-16¹. These data are shown in Table 4.6 along with the high-tide roost count from January 2020.

Table 4.6: *Light-bellied Brent Goose numbers from the January 2020 high tide roost survey and historical data from I-WeBS.*

	2009-10	2011-12	2015-16	2019-20
Light-bellied Brent Goose	13	156	19	48

¹ Data sourced from BirdWatch Ireland website showing I-WeBS data for Carlingford Lough [<https://f1.caspio.com/dp/f4db3000060acbd80db9403f857c>; accessed July 2020].

4.6. Sub-site totals

The total numbers of waterbirds recorded during each survey visit within each sub-site are shown in Table 4.7 (sub-site OZ480) and Table 4.8 (sub-site OZ482).

Table 4.7: Total numbers of waterbirds counted at sub-site OZ480 at Carlingford Lough during each survey visit over winter 2019/20.

Species	LT1	LT2	LT3	LT4	HT1
Light-bellied Brent Goose	9	37	89	12	
Eider			4		
Red-breasted Merganser			47	16	
Cormorant	20	22	36	93	96
Shag		4		12	
Grey Heron	2	5	4	1	
Oystercatcher	42	132	52	157	210
Ringed Plover	3	12	35	1	6
Lapwing	71	74	20	61	
Purple Sandpiper				2	
Dunlin	37	45	68	30	9
Black-tailed Godwit		16			
Bar-tailed Godwit	4		6		
Curlew	8	50	36	24	
Redshank	63	208	129	78	49
Turnstone	16	36	26	58	66
Black-headed Gull	146	35	30	20	22
Common Gull	45	92	38	20	62
Herring Gull	102	143	85	20	40
Great Black-backed Gull	57	8	18	18	37
Total	625	919	723	623	597

Roosting locations of birds recorded in the high tide roost survey in January are shown in Figure 4.1 (for sub-site OZ480) and Figure 4.2 (for sub-site OZ482).

Table 4.8: Total numbers of waterbirds counted at sub-site 0Z482 at Carlingford Lough during each survey visit over winter 2019/20.

Species	LT1	LT2	LT3	LT4	HT1
Light-bellied Brent Goose	165	206	172	110	48
Shelduck	4			11	
Wigeon	205	192	326	218	156
Teal	4		32	22	22
Mallard	31	6	18	28	20
Red-breasted Merganser					4
Cormorant	18	9	89	11	
Little Egret	11	12	28	7	12
Grey Heron	7	9	23	16	25
Oystercatcher	88	169	116	173	318
Ringed Plover	21	6	39	35	55
Grey Plover	5	1	4		
Lapwing	117	96	148	109	216
Knot			135	57	104
Dunlin	95	155	203	206	266
Snipe			2		
Black-tailed Godwit	26	15	48	56	42
Bar-tailed Godwit	9	6	14	16	31
Curlew	43	7	57	19	41
Greenshank	11	5	6	4	9
Redshank	139	73	93	97	118
Turnstone	38	20	59	57	41
Black-headed Gull	165		250	115	2
Common Gull	45	20	71	94	16
Herring Gull	16	104	102	24	6
Great Black-backed Gull	7	2	19	12	
Total	1,270	1,113	2,054	1,497	1,552

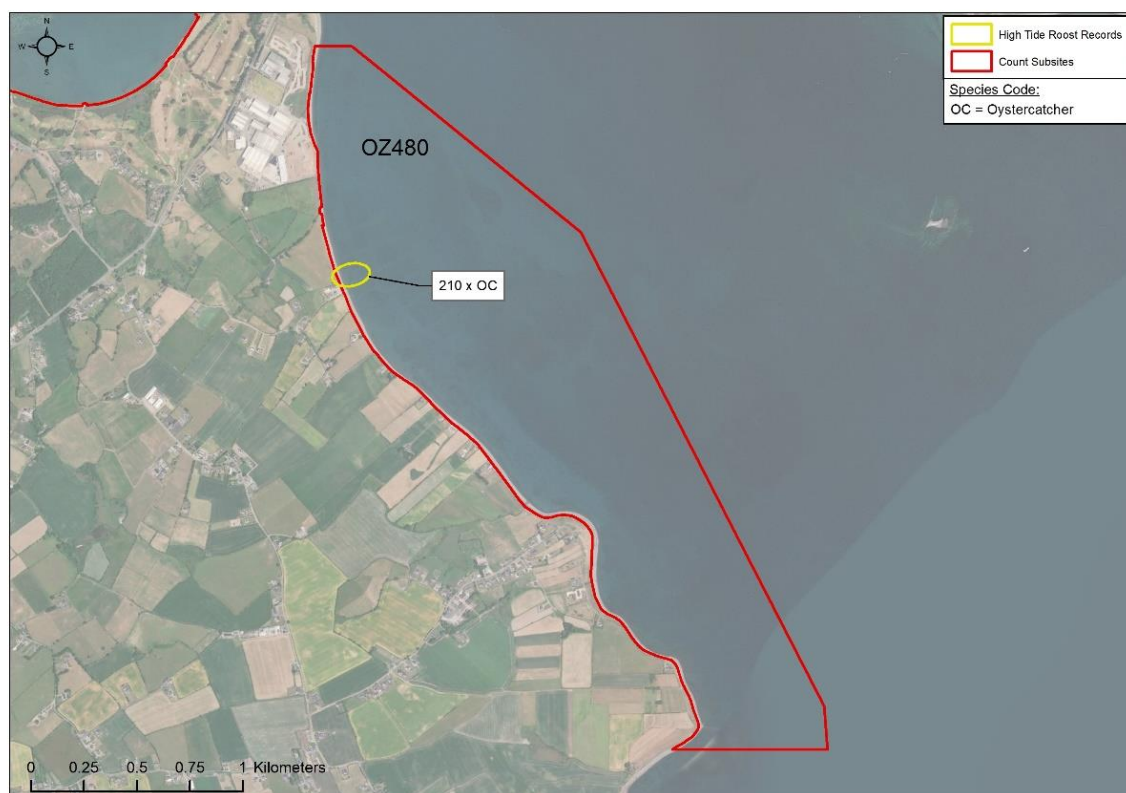


Figure 4.1: High tide roost records (from January 2020) for sub-site OZ480 (see Table 4.2 for species codes used during bird recording fieldwork)

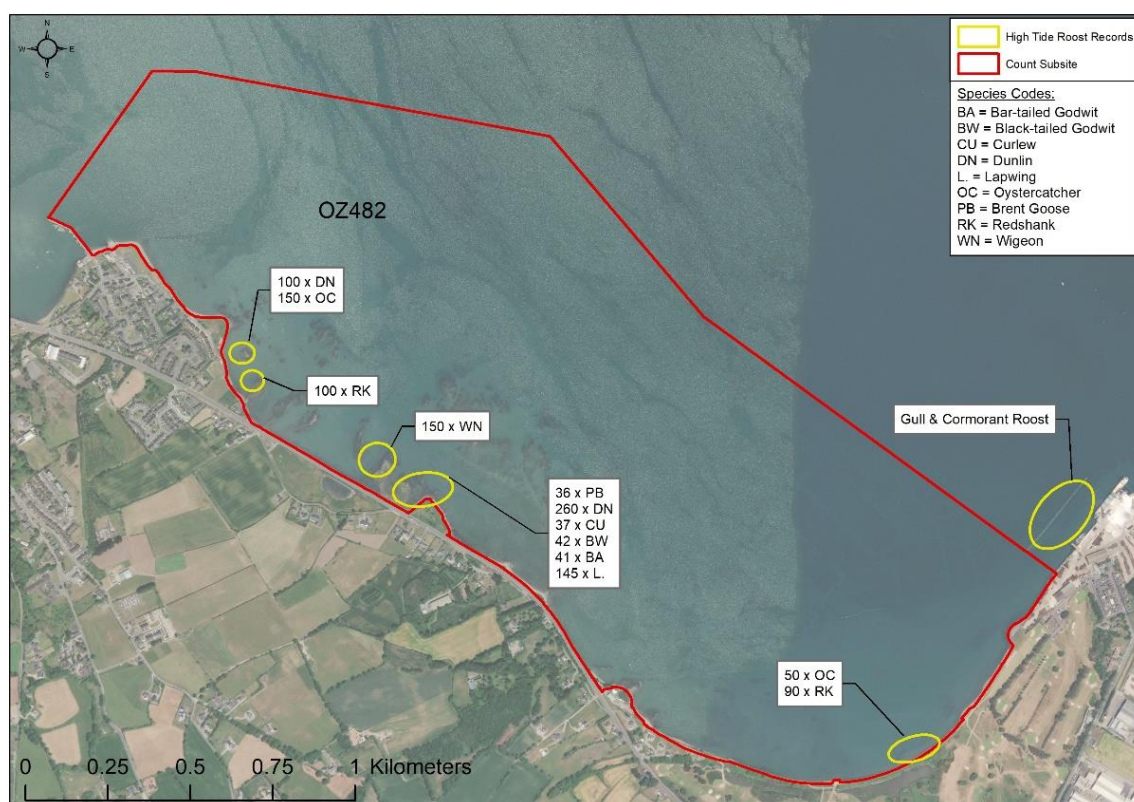


Figure 4.2: High tide roost records (from January 2020) for sub-site OZ482 (see Table 4.2 for species codes used during bird recording fieldwork)

4.7. Waterbird densities

Waterbird densities for the two sub-sites are shown in Table 4.9. Waterbird density is higher in sub-site 0Z482, due to a more complex range of habitats, and the presence of many small freshwater streams carrying a food source on to the site. Subsite 0Z482 also supports greater cover of eelgrass (*Zostera sp.*) which is an important component in the diet of Brent Geese. In contrast, sub-site 0Z480 is limited to mud and sand flats, with only two significant freshwater streams.

Table 4.9: Average density (birds/100ha) and range (min-max; birds/100ha) of total waterbirds within count sub-sites 2019/20

Species name	Sub-site 0Z480			Sub-site 0Z482		
	Mean	Min	Max	Mean	Min	Max
Light-bellied Brent Goose	9.70	0.00	29.37	48.01	16.44	70.55
Shelduck				1.03	0.00	3.77
Wigeon				75.14	53.42	111.64
Teal				5.48	0.00	10.96
Mallard				7.05	2.05	10.62
Eider	0.26	0.00	1.32			
Red-breasted Merganser	4.16	0.00	15.51	0.27	0.00	1.37
Cormorant	17.62	6.60	31.68	8.70	0.00	30.48
Shag	1.06	0.00	3.96			
Little Egret				4.79	2.40	9.59
Grey Heron	0.79	0.00	1.65	5.48	2.40	8.56
Oystercatcher	39.14	13.86	69.31	59.18	30.14	108.90
Ringed Plover	3.76	0.33	11.55	10.68	2.05	18.84
Grey Plover				0.68	0.00	1.71
Lapwing	14.92	0.00	24.42	46.99	32.88	73.97
Knot				20.27	0.00	46.23
Purple Sandpiper	0.13	0.00	0.66			
Dunlin	12.48	2.97	22.44	63.36	32.53	91.10
Snipe				0.14	0.00	0.68
Black-tailed Godwit	1.06	0.00	5.28	12.81	5.14	19.18
Bar-tailed Godwit	0.66	0.00	1.98	5.21	2.05	10.62
Curlew	7.79	0.00	16.50	11.44	2.40	19.52
Greenshank				2.40	1.37	3.77
Redshank	34.79	16.17	68.65	35.62	25.00	47.60
Turnstone	13.33	5.28	21.78	14.73	6.85	20.21
Black-headed Gull	16.70	6.60	48.18	36.44	0.00	85.62
Common Gull	16.96	6.60	30.36	16.85	5.48	32.19
Herring Gull	25.74	6.60	47.19	17.26	2.05	35.62
Great Black-backed Gull	9.11	2.64	18.81	2.74	0.00	6.51
All Species	230.17	197.03	303.30	512.74	528.30	557.73

The densities for birds foraging in intertidal habitats during the four low tide surveys conducted over the winter of 2019-20 at Carlingford Lough are shown in Table 4.10 (note that the data for high tide surveys is excluded from this table). One species (Red-breasted Merganser) was not recorded using intertidal habitats during the fieldwork period.

Table 4.10: Average density (birds/100ha) and range (min-max; birds/100ha) of waterbirds recorded foraging in intertidal habitats within both sub-sites during 2019-20 fieldwork for low tide surveys.

Species name	Mean	Min	Max
Light-bellied Brent Goose	61.44	39.01	86.17
Shelduck	1.33	0.00	3.90
Wigeon	83.42	68.09	115.60
Teal	5.14	0.00	11.35
Mallard	7.36	2.13	10.99
Eider	0.35	0.00	1.42
Cormorant	4.34	0.00	13.48
Shag	1.06	0.00	4.26
Little Egret	3.46	2.48	4.26
Grey Heron	4.61	3.19	6.03
Oystercatcher	81.12	46.10	117.02
Ringed Plover	13.48	6.38	26.24
Grey Plover	0.89	0.00	1.77
Lapwing	48.23	41.13	57.45
Knot	17.02	0.00	47.87
Purple Sandpiper	0.18	0.00	0.71
Dunlin	74.38	46.81	96.10
Snipe	0.18	0.00	0.71
Black-tailed Godwit	14.27	9.22	19.86
Bar-tailed Godwit	4.88	2.13	7.09
Curlew	20.83	15.25	32.98
Greenshank	2.30	1.42	3.90
Redshank	78.01	62.06	99.65
Turnstone	27.48	19.15	40.78
Black-headed Gull	54.17	12.41	110.28
Common Gull	34.04	24.11	40.43
Herring Gull	52.84	15.60	87.59
Great Black-backed Gull	9.57	3.55	21.99
All Species	706.38	653.55	785.11

4.8. Light-bellied Brent Goose distribution

The monthly disturbance surveys targeted at Light-bellied Brent Goose indicated some broad patterns in habitats use, with certain areas favoured within the two survey Zones (see Figure 4.3). Of the eight “favoured” areas, six largely correlate with the location of four watercourses which are likely to be important for drinking and washing (see Figure 4.3). The two other favoured areas are likely linked to the availability of feeding opportunities (refer to Figure 3.3).

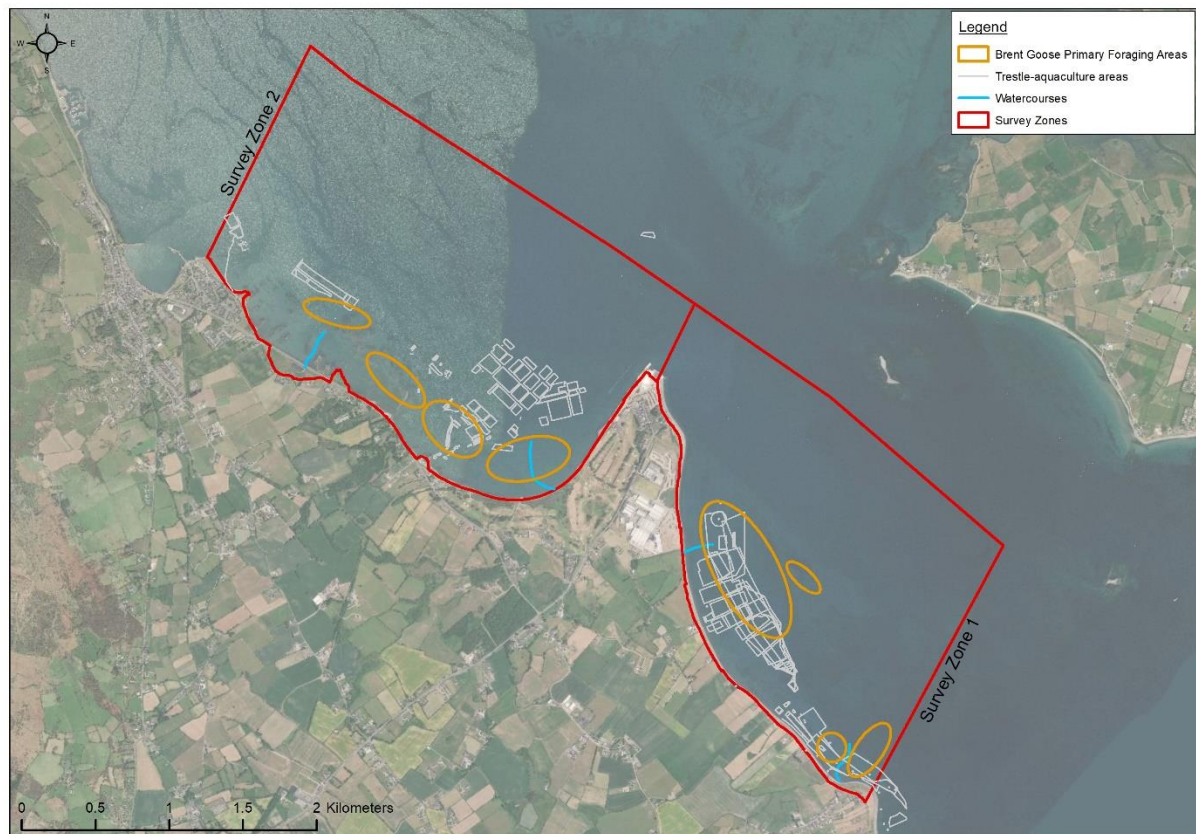


Figure 4.3: Favoured sites (marked in orange) used by Light-bellied Brent Goose during hourly observations within the survey zones; watercourses running into the survey areas marked in blue; survey zones are outlined in red. Aquaculture areas (trestles) are also outlined.

Although not recorded during the January high tide roost survey (see Figures 4.1 and 4.2), during the targeted surveying for Light-bellied Brent Goose, small numbers were recorded at roost during high tide in Zone 2 (36 birds) on the water amongst the saltmarsh grasses, which they may consume during roosting. Light-bellied Brent Goose does not typically roost during high tide in Zone 1, probably because there is no saltmarsh habitat and the current is too fast.

4.9. Activities and disturbance

Disturbance events recorded during fieldwork are shown in Table 4.10. Out of 46 disturbance events, two were considered to have a high impact on Light-bellied Brent Goose, with birds flying away from the study area; these were caused by a dog walking and a walker on the mudflats. One event, involving

motorised watercraft, caused moderate disturbance, with birds moving within the study area. Six disturbance events caused a slight movement of birds within the survey area

Table 4.10: Disturbance Activities recorded at Carlingford Lough 2019/20.

Month	Survey Zone	Disturbance Activity	Duration	Observed Impact on Light-bellied Brent Goose
October	1	Aquaculture machinery	Up to 50% of count period	None
	2	Aquaculture machinery	Up to 50% of count period	Slight movement of birds away from disturbance
		Aircraft	Short/discrete	Slight movement of birds away from disturbance
		Construction work	Continued after count	None
November	1	Aquaculture machinery	Up to 50% of count period	None
	2	Aquaculture machinery	Up to 50% of count period	Slight movement of birds away from disturbance
		Aircraft	Short/discrete	Slight movement of birds away from disturbance
		Construction work	Continued after count	None
		Winkle picking	Up to 50% of count period	None
		Aquaculture (on foot; checking oyster bags)	Short/discrete	None
December	1	Aquaculture machinery	Up to 50% of count period	None
		Winkle picking	Up to 50% of count period	None
		Bait diggers	Up to 50% of count period	None
	2	Aquaculture machinery	Continued after count	Slight movement of birds away from disturbance
		Non-aquaculture vehicle	Up to 50% of count period	Slight movement of birds away from disturbance
		Aquaculture machinery	Short/discrete	None
		Winkle picking	Up to 50% of count period	None
		Aquaculture (on foot; checking oyster bags)	Short/discrete	None
		Dogs (off lead with walker)	Short/discrete	High impact - all birds flew away
		Walker on mudflat	Short/discrete	High impact - all birds flew away
January	1	Aquaculture machinery	Continued after count	None
		Aquaculture (on foot)	Continued after count	None
		Winkle picking	Up to 50% of count period	None
	2	Construction work	Continued after count	None
		Winkle picking	Short/discrete	None
		Walker on mudflat	Short/discrete	None

Month	Survey Zone	Disturbance Activity	Duration	Observed Impact on Light-bellied Brent Goose
February	1	Aquaculture machinery	Continued after count	None
		Aquaculture (on foot)	Continued after count	None
		Winkle picking	Up to 50% of count period	None
	2	Construction work	Continued after count	None
		Winkle picking	Short/discrete	None
		Walker on mudflat	Short/discrete	None
March	1	Aquaculture machinery	Continued after count	None
		Aquaculture (on foot)	Continued after count	None
		Winkle picking	Up to 50% of count period	None
		Winkle picking	Short/discrete	None
	2	Construction work	Continued after count	None
		Winkle picking	Short/discrete	None
		Walker on mudflat	Short/discrete	None
		Powered watercraft	Short/discrete	Moderate impact – birds moved to another part of the site
April	1	Aquaculture machinery	Continued after count	None
		Aquaculture (on foot)	Continued after count	None
		Winkle picking	Up to 50% of count period	None
	2	Construction work	Continued after count	None
		Winkle picking	Short/discrete	None
		Walker on mudflat	Short/discrete	None

5. DISCUSSION

5.1. Overview of the 2019/20 season

The first counts were undertaken from the 24th October by which time the typical assemblage of wintering water birds was already present and all summer birds (notably terns) had departed. Twenty-nine species of waterbirds were recorded including four gull species, with Lesser Black-backed Gull absent. Nine wildfowl and 16 wader species were observed. Notably absent were Scaup and Great Crested Grebe, both of which have been in decline in Carlingford Lough form over a decade.

It is also notable that very few birds of prey were recorded.

The 2019/20 species list includes two species (Little Egret and Bar-tailed Godwit) listed on Annex I of the EU Bird's Directive, and five species that are on the Birds of Conservation Concern in Ireland (BoCCI) lists (Colhoun & Cummins, 2013).

5.2. Waterbird numbers and trends

Numbers of Light-bellied Brent Goose were in line with expectations over previous years and seem to be largely determined by events on migration and on wintering grounds, at least in the context of Carlingford Lough. The site summary (NPWS, 2013) indicates 175 birds; IWeBs counts range from 186 to zero birds on some counts. As previously noted, this is the first low tide count so numbers are not directly comparable, however the 2010/11 study (Martin, 2011) noted 543 on the 16th December 2010 while the max count recorded during 2019/20. However the low tide survey methodology is not directly comparable with the method used in 2010-11, which included several monthly counts, increasing the likelihood of higher numbers being encountered on any given month, particularly due to the complex way in which Light-bellied Brent Goose move around Carlingford Lough and Dundalk Bay (NPWS, 2013).

5.3. Waterbird distribution

As the tide recedes most waders and wildfowl species follow the tide out, with the exception of Turnstone and Redshank which tend to spread out over the upper shore, sometimes gathering where a feeding opportunity emerges. From low tide other waders tend to do the same thing, so that species tend to be widely spread out and not clustered in flocks.

Dunlin tend to move around the lower shore in several fast-moving flocks. Golden plover (when present) prefer the southern area of Zone 2, along with Knots when they are not foraging for clams in the patches of muddy sand and sandy mud. Of the wildfowl, Light-bellied Brent Goose tend to congregate at the *Zostera* during October, then moving to the green algae areas which are fed by freshwater streams. It should be noted that there is a discharge of sewage at Greenore port which may backwash over the southern end of Zone 2 and add to the eutrophication, and hence algal blooms. This is supported by the data observed here, with the distribution of Light-bellied Brent Goose matching the availability of these resources.

Wigeon prefer the middle part of Carlingford Lough, although both compete for *Zostera* when it is present, and both compete for green algae as the tide rises and feeding opportunities becomes scarcer. Light-bellied Brent Goose also tend to dominate the aquaculture areas whereas the smaller Wigeon have a tendency to avoid them.

Wigeon are generally absent from Zone 1, or only occur in small numbers whereas Light-bellied Brent Goose use both and in the latter part of the year may favour Zone 1 over Zone 2.

5.4. Waterbird disturbance

Generally speaking there was very little disturbance observed and where it was observed bird responses were weak, typically by walking away from the source of the disturbance, occasionally flying a short distance. All species seem highly habituated to the principal course of disturbance, aquaculture, with one exception. Construction activity was ongoing at the Carlingford Oyster company facility and all species simply avoided the area keeping a distance of about 50 metres (the chief disturbance was from excavators working and flashing warning lights). Walkers and dog walkers were a regular phenomenon and traffic along the road bordering both sites a constant feature, but again produced very little response from any bird species. Equally, occasional bait diggers produced very little observable response.

Responses to the main sources of disturbance were minimal suggesting that birds are highly habituated to disturbances including aquaculture activities, walkers/dog walkers, bait diggers, traffic and construction activity. Given that most counts took place on weekdays disturbance from recreational activities may have been underestimated.

Outside of the count dates a significant disturbance triggering a strong bird response was observed at the north end of Zone 2. At this location there is a mussel bed used by up to 200 oystercatchers. Immediately adjacent to it is an oyster cultivation concession. Disturbance included walking or driving straight across the sand/mud flats rather than sticking to the designated pathways, parking on the oyster bed through low tide and various running about and strewing oyster cultivation equipment (trestles and bags) in a disorganised way. The result is significant deprivation of foraging opportunities for the oystercatchers.

6. CONCLUSION

This first survey of the southern shore of Carlingford Lough using low tide methodology was successfully completed. The chief conclusions are as follows:

- The bird species using the areas are well habituated to aquaculture activity and generally undisturbed by it;
- They forage and roost amongst and on top of the oyster cultivation structures (trestles and bags) on almost all tides (particularly Light-bellied Brent Goose geese who exploit the fact that green algae grown on the oysters);
- Distribution follows patterns previously observed in 2010/11;
- Bird numbers show a slight decline in relation to previous studies, however the methodology is not directly comparable.

In future, low tide studies in this area need to take account of the fact that there is a large sub-site on the other side of the Lough and birds regularly commute back and forth to exploit foraging and roosting opportunities exposed by the movement of the tide. Future studies should also take account of the fact that the qualifying interest, Light-bellied Brent Goose, primarily roost in Dundalk Bay and commute into Carlingford Lough as the tide starts to expose feeding areas, or in the early morning, returning to roosting areas typically at dusk. When birds arrive they spread out over the Lough searching for feeding areas and filling them, with a portion of the flock carrying on to Mill Bay on the north side of the Lough, typically after stopping to drink and wash at a stream at the south end of Zone 1.

Such subsite/habitat preference highlights the importance of sensitive site management and sustainable use of coastal wetland sites. While sites may seem large in size and to have ‘plenty of room’ for birds, foraging habitat selection can often lead to birds having a very restricted distribution. Moreover, as site-specific conservation objectives are now published for most coastal SPA sites in the Republic of Ireland, and one objective is based around the maintenance of the distribution of waterbirds, knowledge and assessment of waterbird distribution over time, is of paramount importance in assessing the favourable conservation status of a designated SPA and marrying that with human activity. The continuation of studies such as the one reported here are therefore an important part of the overall delivery of conservation management for these internationally important sites.

REFERENCES & LITERATURE CONSULTED

- AEWA (2018) *AEWA Conservation Status Review 7 (CSR7) Report on the conservation status of migratory waterbirds in the agreement area. Seventh Edition. Agreement on the Conservation of African- Eurasian Migratory Waterbirds*. May 2018.
- ASU (2010) A survey of mudflats and sandflats in Ireland. An intertidal soft sediment survey of Bannow Bay. Report commissioned by the Marine Institute by The Aquatic Services Unit. April 2010.
- Austin, G.E., Calbrade, N.A., Mellan, H.J., Musgrove, A. J., Hearn, R.D., Stroud, D.A., Wotton, S. R. & Holt, C.A. (2014) *Waterbirds in the UK 2012/13: The Wetland Bird Survey*. BTO, RSPB and JNCC, in association with WWT. British Trust for Ornithology, Thetford.
- Balmer, D., Gillings, S., Caffrey, B., Swan, B., Downie, I. & Fuller, R. (2013) *Bird Atlas 2007-11 The breeding and wintering birds of Britain and Ireland*. British Trust for Ornithology.
- Béchet, A. (2006) European Management Plan 2009-2011. Golden Plover *Pluvialis apricaria*. Technical Report 2009 – 034.
- Bibby, C. J., Burgess, N. D., Hill, D. A. & Mustoe, S. H. (2000). *Bird Census Techniques*. Academic Press.
- BirdLife International (2001) Important Bird Areas and potential Ramsar Sites in Europe. BirdLife International, Wageningen, the Netherlands.
- Boland, H. & Crowe, O. (2012) *Irish wetland bird survey: waterbird status and distribution 2001/02 – 2008/09*. BirdWatch Ireland, Kilcoole, Co. Wicklow.
- Burke, B., Lewis, L. J., Fitzgerald, N., Frost, T., Austin, G. & Tierney, T. D. (2019) Estimates of waterbird numbers wintering in Ireland, 2011/12 – 2015/16. *Irish Birds* 11, 1-12.
- Buxton, N. E. (1981) The importance of food in the determination of the winter flock sites of Shelduck. *Wildfowl* 32, 79-87.
- Colhoun, K. & Cummins, S. (2013) Birds of conservation concern in Ireland 2014-2019. *Irish Birds* 9, 523-544.
- Colhoun, K., Mackie, K., Gudmundsson, G.A. & McElwaine, G. (2017) Results of the Canadian Light-bellied Brent Goose Census. *Goose News* 16, 23.
- Crowe, O. (2005) *Ireland's Wetlands and their waterbirds: Status and Distribution*. BirdWatch Ireland. Newcastle, Co Wicklow.
- Crowe, O. & Holt, C. (2013) Estimates of waterbird numbers wintering in Ireland 2006/07 – 2010/11. *Irish Birds* 9, 545-552.
- Crowe, O., Austin, G. E., Colhoun, K., Cranswick, P., Kershaw, M. & Musgrove, A. J. (2008) Estimates and trends of waterbird numbers wintering in Ireland, 1994/95-2003/04. *Bird Study* 55, 66-77.
- Frost, T.M., Austin, G.E., Calbrade, N.A., Holt, C.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. & Balmer, D.E. (2016) *Waterbirds in the UK 2014/15: The Wetland Bird Survey*. BTO, RSPB and JNCC, in association with WWT. British Trust for Ornithology, Thetford.
- Lewis, L. J. & Kelly, T. C. (2012) Aspects of the spatial ecology of waders along an estuarine gradient. *Irish Birds* 9, 375-384.

- Lewis L. J. & Tierney, T. D. (2014) Low tide waterbird surveys: survey methods and guidance notes. *Irish Wildlife Manuals* No. 80. National Parks & Wildlife Service, Department of the Arts, Heritage and Gaeltacht.
- Lewis, J. L., Tierney, N., Boland, H. & Tierney, T. D. (2016) Tidal variation in the use of Dublin Bay by wintering waterbirds. *Irish Birds* 10, 373 – 382.
- Lewis, L. J. Austin, G., Boland, H., Frost, T., Crowe, O. & Tierney, T. D. 2017. Waterbird populations on non-estuarine coasts of Ireland: results of the 2015/16 Non-Estuarine Coastal Waterbird Survey (NEWS-III). *Irish Birds* 10, 511-522.
- Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019) Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10 - 2015/16. *Irish Wildlife Manuals* No. 106. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.
- Martin, B. (2011) Comparative Assessment of Occurrence, Distribution, and Behaviour of Waterbirds In Two Areas of Carlingford Lough's Southern Shore with Emphasis on Brent Geese. Unpublished Report.
- Musgrove, A J, Langston, R H W, Baker, H and Ward, R M (eds) (2003) Estuarine Waterbirds at Low Tide: the WeBS Low Tide Counts 1992/93 to 1998/99. WSG/BTO/WWT/RSPB/JNCC, Thetford.
- NPWS (2011) Carlingford Lough Special Protection Area. Site Code 004078. Site Synopsis. Version 1. November 2011. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- NPWS (2013) Conservation Objectives: Carlingford Shore SAC 002306. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- NPWS (2013) Conservation Objectives: Carlingford Lough SPA 004078. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. Overview Volume 1. Unpublished report, National Parks & Wildlife Service. Department of the Environment, Heritage and Local Government, Ireland.
- NPWS (2013) *Carlingford Shore SAC (Site Code 002306) Conservation Objectives Supporting Document*. August 2013.
- Oudman, T. (2017). Red knot habits: An optimal foraging perspective on tidal life at Banc d'Arguin. Rijksuniversiteit Groningen.
- Oudman, T., Piersma, T., Ahmedou Salem, M., reis, M., Dekinga, A., Holthuijsen, Horn, J., van Gils, J. & Bijleveld, A. (2018) Resource landscapes explain contrasting patterns of aggregation and site fidelity by red knots at two wintering sites. *Movement Ecology* 6, 24. <https://doi.org/10.1186/s40462-018-0142-4>
- Robinson, J. A., Colhoun, K., Gudmundsson, G. A., Boertmann, D., Merne, O. J., O'Briain, M., Portig, A. A., Mackie, K. & Boyd, H. (2004) *Light-bellied Brent Goose Branta bernicla hrota (East Canadian High Arctic population) in Canada, Ireland, Iceland, France, Greenland, Scotland, Wales, England, the Channel Islands and Spain 1960/61 – 1999/2000*. Waterbird Review Series. The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

- Taylor, J., Charlesworth, M. & Service, M. (1999) Nutrient inputs and trophic status of Carlingford Lough. A report by Queens University of Belfast and the Department of Agriculture for Northern Ireland.
- Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Sirwardena, G.M. & Baillie, S.R. (eds) (2002) *The migration atlas: movements of the birds of Britain and Ireland*. T & A D Poyser, London.
- Wetlands International (2012) *Waterfowl Population Estimates – Fifth Edition*. Wetlands International, Wageningen, The Netherlands.

APPENDIX I: CARLINGFORD LOUGH SPA/SAC SITE SYNOPSES

SITE SYNOPSIS

SITE NAME: CARLINGFORD LOUGH SPA

SITE CODE: 004078

Carlingford Lough SPA comprises parts of the south side of Carlingford Lough, Co. Louth, between Carlingford Harbour and Ballagan Point. The predominant habitats present are intertidal sand and mud flats

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Light-bellied Brent Goose. The E.U. Birds Directive pays particular attention to wetlands, and as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

In winter the site supports an internationally important population of Light-bellied Brent Goose (253 – all figures are five year mean peaks for the period 1995/96 to 1999/2000). A range of other waterfowl species occurs within the site, including Wigeon (107), Oystercatcher (289), Dunlin (392), Bar-tailed Godwit (33), Redshank (108) and Turnstone (29). The intertidal flats provide feeding areas for the wintering birds. The sub-tidal areas outside the SPA support a range of species including Great Crested Grebe, Cormorant and Red-throated Diver.

Carlingford Lough SPA is of international importance for its Light-bellied Brent Goose population. Of note is the occurrence of Bar-tailed Godwit, a species that is listed on Annex I of the E.U. Birds Directive.

14.11.2011

Site Name: Carlingford Shore SAC**Site Code: 002306**

The Carlingford Shore SAC site comprises the entire southern shoreline of Carlingford Lough and continues round the tip of the Cooley Peninsula to just west of Cooley Point. While the principal conservation interests lie in the perennial vegetation of shingle banks and the annual vegetation of drift lines, the site also has intertidal sand and mudflats, patches of saltmarsh, some areas of dry grassland, and an area of mixed deciduous woodland. The site is flanked by Carlingford Mountain to the south-west. The underlying rock within the SAC is mainly carboniferous limestone. This outcrops in places in the form of bedrock shore or reefs. Granite boulders are occasionally found. Intertidal mudflats and sand/gravel banks also occur.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

- [1210] Annual Vegetation of Drift Lines
- [1220] Perennial Vegetation of Stony Banks

In Carlingford Shore SAC the shingle and drift line habitats extend more or less continuously from Greenore to west of Cooley Point. They occur as a strip of varying width, from only a few metres in places, to up to about 50 m. One of the best developed areas is south of Ballagan Point. The substrate varies from stones and cobbles to gravels and coarse sands. The exposure level of this shoreline is high.

The perennial vegetation of the upper beach of these shingle banks is widely ranging, well developed and often stable. In places lichens encrust the stones farther back from the sea. Typical species present throughout the site include oraches (*Atriplex* spp., including *A. prostrata*, *A. glabriuscula* and *A. littoralis*), Sea Beet (*Beta vulgaris* subsp. *maritima*), Wild Carrot (*Daucus carota*), Red Fescue (*Festuca rubra*), Sea-milkwort (*Glaux maritima*), Lyme-grass (*Leymus arenarius*) and Sea Radish (*Raphanus raphanistrum* subsp. *maritimum*). This grades landward mainly into lowland dry grassland, though there are patches of wet grassland.

The vegetation of the stony banks is often interspersed with the vegetation occupying accumulations of drift material and gravels rich in nitrogenous organic matter. The vegetation is sparse. Species seen include Prickly Saltwort (*Salsola kali*), Sea Rocket (*Cakile maritima*), Sea Sandwort (*Honkenya peploides*), Sea Spurge (*Euphorbia paralias*), Sea Mayweed (*Matricaria maritima*) and oraches. The Red Data

Book species Oysterplant (*Mertensia maritima*) is also found. This plant is protected under the Flora (Protection) Order, 1999.

There are small patches of saltmarsh on the drier sections of outcropping reefs and at the landward edge of the site. Species present include Sea Aster (*Aster tripolium*), Sea Purslane (*Halimione portulacoides*), Lax-flowered Sea-lavender (*Limonium humile*), Common Saltmarsh-grass (*Puccinellia maritima*), Sea Arrowgrass (*Triglochin maritima*) and Sea Plantain (*Plantago maritima*). In areas which are more regularly flooded Annual Sea-blite (*Suaeda maritima*) is found. A small brackish lake is present on the landward side of the railway line.

A relatively extensive expanse of intertidal flats (more sand than mud) occur, particularly between Greenore Point and Carlingford Harbour. The flats in this area are broken by outcropping reefs and some shingle deposits and saltmarsh on the drier higher rocks. These flats are very important feeding grounds for wildfowl and waders. Patches of green algae (filamentous, *Ulva* sp. and *Enteromorpha* sp.) and lugworm casts occur in places, while fucoid seaweeds are common on the more stony flats. Abundant barnacle shells and lichens are also present on many of the rocks. Eelgrass (*Zostera* sp.) beds are found on the flats - the main food source for the internationally important population of Pale-bellied Brent Goose at the site. Small tufts of cord-grass (*Spartina* sp.) are also found.

Above the low-lying shoreline dry grassland often occurs, with species such as Red Fescue, Common Bent (*Agrostis stolonifera*), Ribwort Plantain (*Plantago lanceolata*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Yarrow (*Achillea millefolium*) and Common Ragwort (*Senecio jacobaea*). West of Carlingford town the shoreline is backed in places by low cliffs. An area of mixed woodland occurs at Ferry Hill, overlooking the mouth of the Newry River. This has a low canopy dominated by Elder (*Sambucus nigra*) and with some Pedunculate Oak (*Quercus robur*), Beech (*Fagus sylvatica*) and Sycamore (*Acer pseudoplatanus*). The non-native and invasive Rhododendron (*Rhododendron ponticum*) is common.

The threshold for internationally important numbers of birds within the site has been exceeded in single years, by some species such as Pale-bellied Brent Goose in the 1980s and 1994/95. The site is nationally important for a number of species such as Great Crested Grebe, Cormorant, Ringed Plover and Red-Breasted Merganser. This classification is based on species which attained interim all-Ireland importance on the basis of the three year mean maximum counts for the winters 1994/95-96/97. There are a number of bird species recorded, including Golden Plover and Bar-tailed Godwit, which are listed under Annex I of the E.U. Birds Directive. The intertidal flats between Greenore and Carlingford have been designated a Special Protection Area (SPA) under the E.U. Birds Directive. Black Guillemots (6) were recorded in pairs nesting in wooden breakwater in Greenore and 8 birds were seen at the breakwater. A colony of Terns in Northern Ireland feed in the SPA, particularly Sandwich Tern with some Common Tern.

Approximately 25-30 Grey Seals haul out on reefs between Greenore and Carlingford. This species is listed in Annex II under the E.U. Habitats Directive.

The principal activities in the site are recreational usage and shellfish production. Much of the area around the mean low water mark (MLWM) between Carlingford Harbour and Greenore is under production of oyster, and to a lesser extent, clams. The principal threat to the shoreline habitats is further commercial development, either for shellfish or tourism. 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.

Carlingford Shore has a wide diversity of habitats including very good examples of perennial vegetation of stony banks and drift lines. The presence of Red Data Book species adds to the ecological interest. The wide area of intertidal flats within the site is internationally important for birds and is designated as a Special Protection Area. The presence of Grey Seal, an Annex II species under the E.U. Habitats Directive, adds to the conservation value of the site.