BTO RESEARCH REPORT 719

Analysis of waterbird population trends for Northern Ireland's sea loughs: assessing the potential impacts of aquaculture and disturbance.

Part 1 – Strangford Lough and Carlingford Lough

Katherine Booth Jones, Neil Calbrade, Ian Woodward & Graham Austin

BTO
Inspired by birds, informed by science

Analysis of waterbird population trends for Northern Ireland's sea loughs: assessing the potential impacts of aquaculture and disturbance:

Part 1 – Strangford Lough and Carlingford Lough

Authors

Katherine Booth Jones, Neil Calbrade, Ian Woodward, Graham Austin

Report of work carried out by the British Trust for Ornithology

on behalf of the DAERA Marine and Fisheries Division

March 2019

BTO Research Report No. 719

Executive Summary

1. Carlingford and Strangford Loughs are both protected sites and important SPAs in Northern Ireland, holding nationally and internationally important populations of wintering waterbirds. Carlingford Lough supports approximately 6,100 individual waterbirds throughout the winter annually, of which six species are features of the SPA. Strangford Lough is the 18th most important waterbird site in the UK, supporting approximately 61,000 individuals annually and 28 waterbird species are features of the SPA.
2. The Wetland Bird Survey (WeBS) is a long-running survey recording numbers of all waterbird species on wetland sites throughout the UK. WeBS 'Core Counts' record waterbird numbers, monthly throughout the year, at high tide for 68 and 10 count sectors covering Strangford Lough and Carlingford Lough, respectively. WeBS 'LowTide Counts' record waterbird numbers, monthly over the winter period (November to February) at low tide for 144 sectors for Strangford Lough. Strangford Lough is exceptional in that LowTide Counts are undertaken annually. Carlingford Lough is typical in that LowTide Counts are only undertaken intermittently (approximately every sixth winter). These data can be used to assess population trends in different parts of the loughs.
3. This study aimed to produce the first sector-level analysis of WeBS data in Northern Ireland, on two of the sea-lough sites that host aquaculture activities. This will improve understanding of the fluctuations in numbers of waterbirds within the sites and inform the consenting of operations and assessment of development plans on these SPAs.
4. Smoothed population trends were generated using data from the period 2000/01 to 2016/17, and assessed for the most recent winter period for each of the 28 waterbird species which are features of Strangford Lough SPA, and including species which are SPA features of Carlingford Lough. For most species there were sufficient numbers recorded on at least some sectors to assess sector trends, relative importance in relation to the loughs' populations and whether the proportion of the entire loughs' populations supported by each sector had increased or decreased significantly. These trend analyses were undertaken for both high-tide and low-tide counts for Strangford Lough. In the case of Carlingford Lough trend analyses could only be undertaken using high-tide counts because the intermittent nature of low-tide coverage is unsuitable for such an analysis.
5. To examine the potential impact of intertidal oyster cultivation on waterbird populations in the loughs, waterbird population trends in sectors that overlapped with intertidal oyster culture were examined. Potential changes in population trends over time in relation to commencement and scaling-up of aquaculture activity, and divergence from the trend of the overall lough were used to indicate potential impact of aquaculture activity on bird trends in the relevant sectors.
6. In Carlingford Lough high-tide trends suggested that sectors between Rostrevor and Newry showed declines in intertidal waders and Shelduck, but were supporting populations of grassland waders such as Lapwing and Black-tailed Godwit. Sectors between Rostrevor to Newry and Omeath to Ballagan Point also had declining populations of diving waterbirds, namely Great Crested Grebe and Goldeneye.
7. Trends were more available for Strangford Lough's waders than for the waterfowl, but trends were more generally negative for waders. In particular the sectors between Hannah's Hedge to Walshestown Quay and Hare's Island to Nickey's Point suffered particularly with declines in

Redshank. Rough Island to Sewarage had negative trends for the majority of waders. Numbers of Light-bellied Brent Goose, Greylag Goose and Shelduck declined at Gasworks to Anne's Point, while dabbling ducks and Shelduck declined at Hare Island to Salt Water Bridge.

8. The overall impression from low tide counts was of decreasing trends across all species and time scales, all around the lough. Collections of low tide sectors with negative trends across a spread of species occurred in the north-west of the lough and between Hare Island and Ringburr. However, a range of mudflat species and Pintail had increasing low tide trends in the Ards Sluice Gates to Cunningburn area, in contrast with the high tide trends in the area.
9. The increase in oyster tonnage between 2010 and 2017 did not appear to result in a decline in the majority of species analysed for Mill Bay, Carlingford Lough. The only species to have suffered a negative population trend around the time of the establishment of intertidal oyster cultivation in Mill Bay was the Grey Plover. This species only occurs in small numbers in Carlingford Lough, concentrated in Mill Bay.
10. Although there was no information available on the exact initiation of intertidal oyster cultivation in Strangford Lough, the only declines observed in the sectors that overlapped the licenced area were long-term declines, and therefore not likely to reflect an avoidance response to the commencement of oyster cultivation in the sectors. The short-term positive trends in Oystercatcher and Redshank populations observed in Mill Bay were not reflected in Strangford Lough at high tide, but there was a short-term positive trend in Redshank at low tide. Dunlin suffered short-term declines in low tide sectors, potentially related to recent changes in the sectors.
11. To build on the initial findings of this report we recommend developing a more targeted field-based study to assess the potential impact of disturbance associated with aquaculture activity on waterbirds. Data collection describing how the numbers and behaviour (e.g. feeding, diving, resting) of waterbirds vary through the tidal cycle would be of particular importance, as the tide has a strong influence on both the behaviour of waterbirds in estuaries, and also influences the husbandry activity in intertidal oyster trestle areas.

Contents

Table of tables

1. INTRODUCTION

1.1. Background

The five sea loughs of Northern Ireland (Carlingford, Strangford, Belfast, Larne and Lough Foyle) all hold Special Protection Area (SPA) and Ramsar Convention designations for their importance to wetland biodiversity. In addition, all the sea loughs also contain Areas of Special Scientific Interest (ASSIs), protected areas that aim to preserve the best of Northern Ireland's wildlife and geology, and are safeguarded under The Environment (Northern Ireland) Order 2002 (Part IV). Strangford Lough, Co. Down, is Northern Ireland's largest sea lough, the most important coastal site in Northern Ireland and the 18th most important site in the UK in terms of waterbird population. It supports approximately 60,500 individuals (five-year average of peak counts, Frost *et al*., 2020) on a variety of marine and intertidal habitats, including nationally and internationally important wintering populations of 28 species of waterbird. Carlingford Lough a smaller lough, positioned at the southern border between the Republic of Ireland and Northern Ireland. The inland portion of the lough is dominated by intertidal mud-flats, important to waterbirds such as the Light-bellied Brent Goose *Branta bernicla hrota*, which is one of the waterbird features of the lough's SPA, along with nationally important populations of (Eurasian) Oystercatcher *Haematopus ostralegus*, (Common) Ringed Plover *Charadrius hiaticula*, Grey Plover *Pluvialis squatorola*, Dunlin *Calidris alpina* and (Common) Redshank *Tringa totanus*. Carlingford Lough supports approximately 7,300 individual waterbirds throughout the winter annually (Frost et al., 2020).

In addition to their importance to wintering waterbirds, Northern Ireland's sea loughs are also important sites in terms of human use. Recreational activities such as boating, wildfowling and dog-walking have the potential to cause disturbance, particularly to winter birds feeding or roosting, while some activities may also modify the habitat or ecosystem, such as shellfish or seaweed harvesting and gravel extraction. One of the most commercially important and potentially impactful uses of the sea loughs is aquaculture.

Aquaculture is a growing industry in Northern Ireland; in 2020 the shellfish aquaculture sector was valued at £11 million annually (DAERA, 2020). All five sea loughs in Northern Ireland host aquaculture activities, cultivating predominantly mussels, but also oysters, scallops and clams. In Carlingford Lough in particular, intertidal oyster (mostly Pacific Oyster, *Crassostrea gigas*) cultivation has been steadily increasing in tonnage since 2010. However, to date there has been little research into the impact of intertidal oyster cultivation on waterbird abundance, and this has not been investigated at all in Northern Ireland. Possible impacts of intertidal oyster cultivation are hypothesised to be linked with interference with access to foraging habitat and by disturbance and flushing from roosting and foraging on intertidal areas caused by aquaculture husbandry (Ahmed and Solomon, 2016).

The key responsibility of the Department of Agriculture, Environment and Rural Affairs' (DAERA's) Marine and Fisheries Division is to ensure the protection of Northern Ireland's marine and coastal areas while promoting their sustainable use. The BTO have been requested to provide DAERA with an analysis of sector-level WeBS data for Carlingford and Strangford Loughs, to reveal how key species of waterbirds in the two sea loughs are distributed within the SPAs, and to identity whether the populations are increasing or decreasing in the sectors relative to the SPAs as a whole. The methodology for this will follow similar reports for Natural England for estuaries in Britain *(*Austin *et*

al. 2008; Ross-Smith *et al.* 2013, 2015). We also examine the evidence for impacts of active intertidal oyster cultivation in Carlingford and Strangford Loughs by comparing waterbird population trends in sectors with intertidal oyster cultivation to trends at the site level. This will enable DAERA to more fully assess the potential impact of existing and future aquaculture (and other developments) on SPA populations.

1.2. Objectives

The aim of this project is to produce the first sector-level analysis of WeBS data in Northern Ireland, on two of the sea-lough sites that host aquaculture activities. This will improve understanding of the fluctuations in numbers of waterbirds within the sites and inform the consenting of operations and assessment of development plans on these SPAs. The four main objectives of this work are to:

- Identify the abundance trends for the short (5 years), medium (10 years) and long (15 years) term for the 28 waterbird species that are internationally or nationally important features of the Strangford Lough SPA, which includes the six internationally and nationally important waterbird species that are features of the Carlingford Lough SPA (see Table 1 Species list

-). Trends will be calculated from high- and low-tide counts for Strangford Lough, and high-tide counts for Carlingford Lough. Sector-level trends will be compared with trends for the respective sites as a whole. The work will identify those WeBS sectors where large numbers of species are declining or increasing contrary to or more rapidly than on the site as a whole.

- Identify WeBS sectors that support important proportions of the species on the site.

- Where possible, identify potential drivers of change in the sectors where changes in waterbirds population are observed, such as changes in food supply/suitable roosting/feeding habitats.

- Identify sectors where changes in waterbird numbers overlap with shellfish aquaculture farms to infer whether there might be short-, medium- or long-term impacts of aquaculture disturbance on waterbird trends.

Table 1 Species list

The sector-level analysis will be carried out on the 28 internationally or nationally important waterbird species that are features of the Strangford Lough SPA (where data allows) for both Strangford and Carlingford Lough. This list includes the waterbird features of Carlingford Lough.

Strangford Lough	Carlingford Lough
Internationally important (3):	**Internationally important (1):**
Light-bellied Brent Goose	Light-bellied Brent Goose
Knot	
Redshank	
Nationally important (25):	**Nationally important (5):**
Bar-tailed Godwit	Oystercatcher
Black-tailed Godwit	Ringed Plover
Coot	Grey Plover
Curlew	Dunlin
Dunlin	Redshank
Eider	
Gadwall	
Great-crested Grebe	
Greylag Goose	
Greenshank	
Goldeneye	
Golden Plover	
Grey Plover	
Lapwing	
Mallard	
Mute Swan	
Oystercatcher	
Pintail	
Red-breasted Merganser	
Ringed Plover	
Shelduck	
Shoveler	
Teal	
Turnstone	
Wigeon	

2. Methodology

2.1. Waterbird data

WeBS is responsible for a number of monthly or periodic count schemes including the WeBS Core Counts, the WeBS LowTide Counts and the Non-estuarine Waterbird Survey. This report is based on data collected by the Core Count and LowTide Count surveys.

The WeBS Core Count scheme is a long-running survey that monitors waterbird numbers on sites throughout the UK via monthly site visits, when numbers of all waterbird species are recorded (Frost *et al.,* 2020). The primary aim of the Core Count scheme is to provide abundance estimate for whole sites which then feed into population estimates, species indices and multispecies indicators. On coastal sites, WeBS Core Count visits are normally undertaken over high tide, the nominal date for survey visits chosen to correspond with spring high-tides when waterbirds are concentrated near the high water mark or concentrated into high-tide roosts facilitating accurate counting. On large sites, such as Strangford Lough and Carlingford Lough, where it is not feasible, or indeed desirable, to make a single count for the entire site, synchronous counts of smaller count sectors are undertaken by teams of volunteer counters. These sector counts are routinely summed to give the overall site total, and during this process the completeness of the overall count assessed. This is required because all sectors are not necessarily counted on all occasions. This completeness assessment is species specific because the absence of data from a given sector would not be expected to affect the overall total equally for all species. Furthermore, completeness is assessed on a month by month, year by year basis using algorithms that allow for both seasonal and long-term trends in site usage. Thus a consolidated count for a site composed of multiple sectors is considered complete when those sectors counted on the month in question would be expected to hold at least 75% of the site total for the species in question for the season and year in question. Whilst the division of large sites into sectors has evolved principally in response to the practicality of undertaking counts, the divisions between sectors typically follow distinctive features of the environment. Thus an analysis of waterbird trends on the individual sectors can inform in a biologically meaningful manner.

Ten constituent and extant WeBS Core Count sectors of Carlingford Lough (Figures 2.1.i and 2.1.ii) and sixty-eight sector of Strangford Lough (Figures 2.1.iii & 2.1.iv) were considered in this report

The WeBS LowTide scheme has been running since the winter of 1992/93 and as the name indicates, counts are undertaken over low-tide. The objective of the LowTide Count scheme is to quantify the within-site distribution of species over the low-tide period as so identify important habitat/areas for feeding waterbirds. Counts are organised in a similar manner to those undertaken for the Core Count scheme other that monthly counts are restricted to the main winter period (November to February inclusive). Unlike Core Counts there is less emphasis on synchronicity of counts across a site as these counts are not typically summed to derive abundance estimates for the overall site. Indeed, if a given flock of waterbirds is recorded on several sectors during the course of a visit this does not compromise the principal aims of the LowTide Counts indicating as it does that all those sectors are important to the birds. It is not feasible to count all sites in all winters and typically the LowTide Count scheme aims to cover about 10 to 20 estuaries UK-wide each winter and ensure any given site is included at least once every five to ten years. This means that although LowTide Counts cannot normally be used to derive sector level trends for the type of analysis being undertaken here.

Unfortunately, there have never been any LowTide Count surveys undertaken for Carlingford Lough, however exceptionally, the LowTide Count scheme has run annually since 1992 on Strangford Lough. Consequently, for Strangford Lough we are able to consider waterbird trends at the sector level for both high-tide and low-tide. There has been a number of occasions when LowTide Count sections for Strangford Lough have been redefined and this adds complexity to the interpretation of trends as unlike Core Count sectors these changes have not resulted from direct splitting or combining of previous sections. Fortunately, the majority of these changes occurred prior to the period being considered by this report. There are, however, a number of sectors included where a full time-series of count is not available.

One hundred and twenty-eight constituent and extant WeBS LowTide Count sectors of Strangford Lough (Figure 2.1.v) were considered in this report.

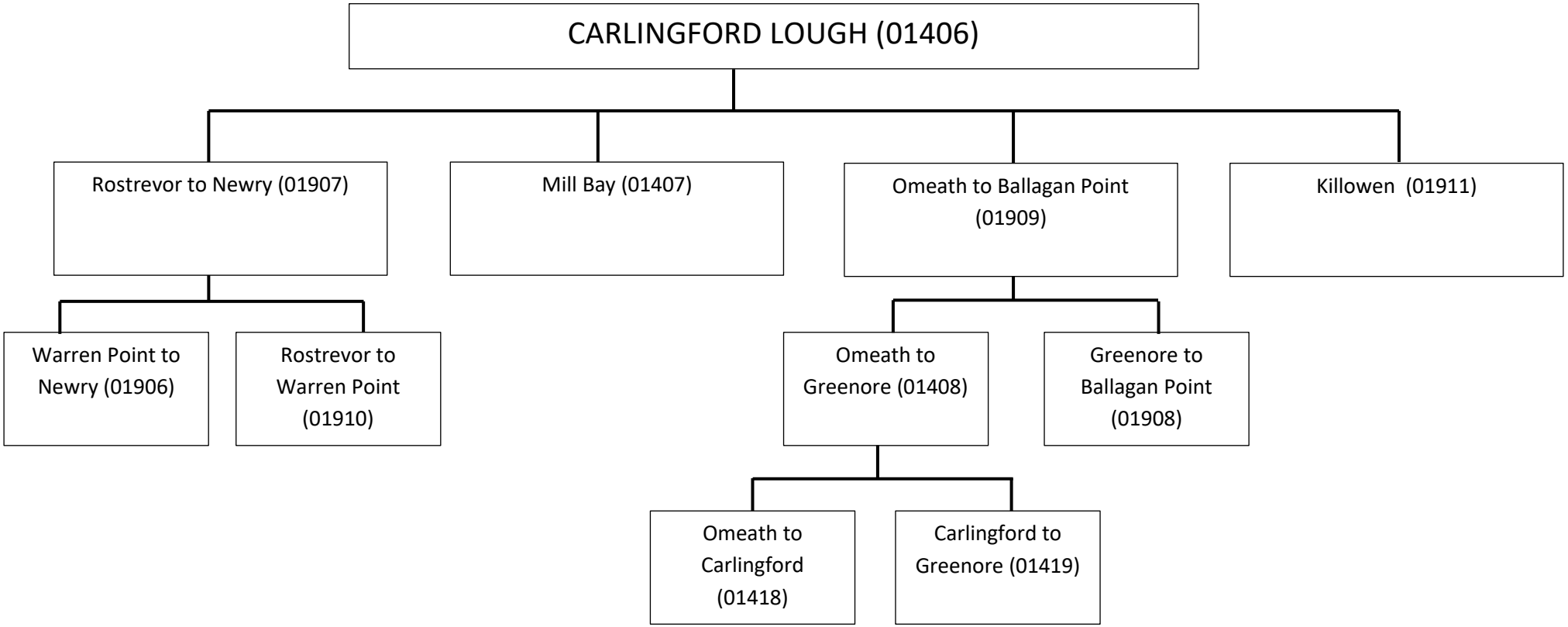


Figure 2.1.i: Structural hierarchy of WeBS count sectors in Carlingford Lough**.** Sectors at the finest spatial scale are primarily considered for interpretation in this report.

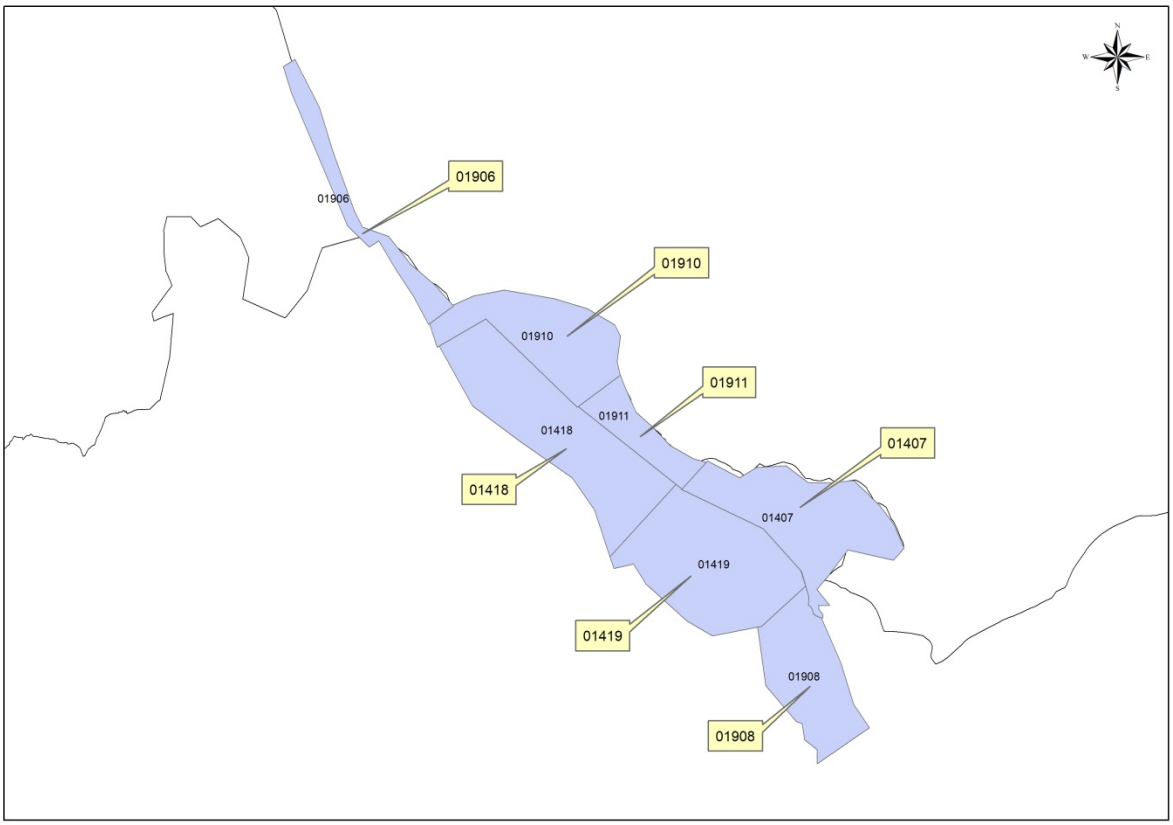


Figure 2.1.ii: Locations of each count sector in Carlingford Lough. These WeBS sectors are the most recent subdivisions for WeBS counts in Carlingford Lough, and represent the finest spatial scale over which data are collected (see Figure 2 1 i).

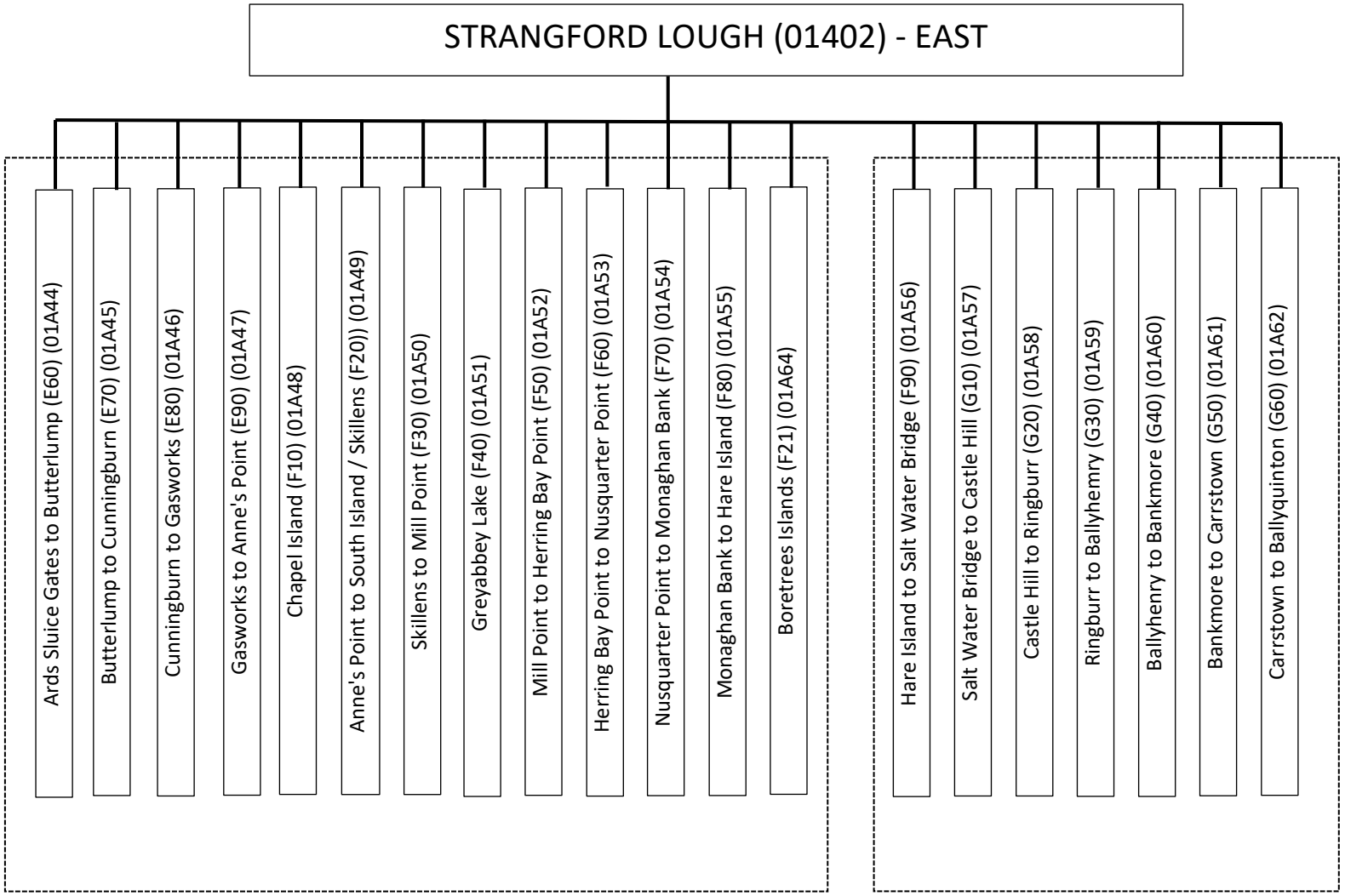


Figure 2.1.iii: Structural hierarchy of WeBS count sectors on Strangford Lough - East. Sectors at the finest spatial scale are primarily considered for this report.

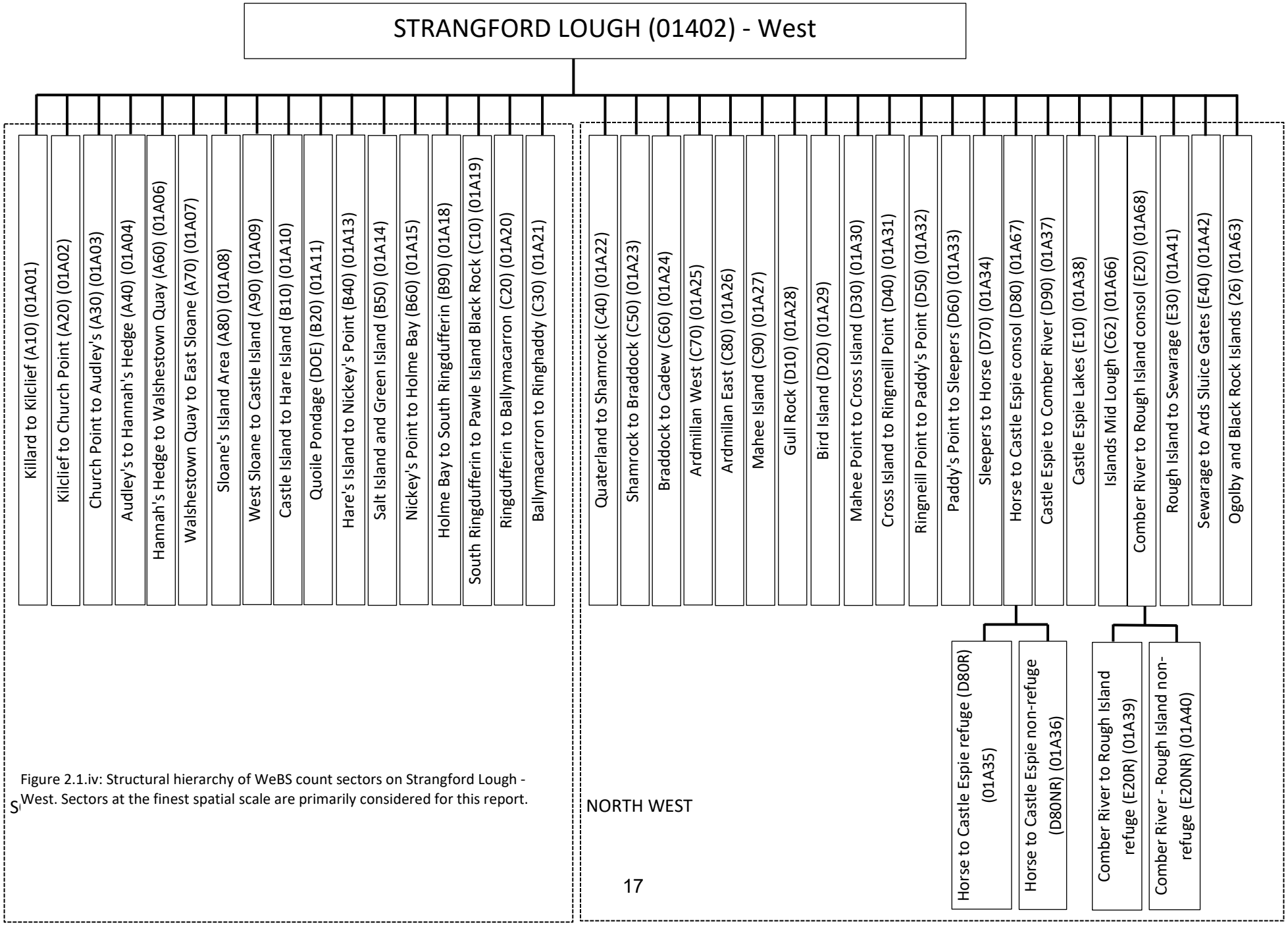


Figure 2.1.iv: Structural hierarchy of WeBS count sectors on Strangford Lough - West. Sectors at the finest spatial scale are primarily considered for this report.

S

NORTH WEST

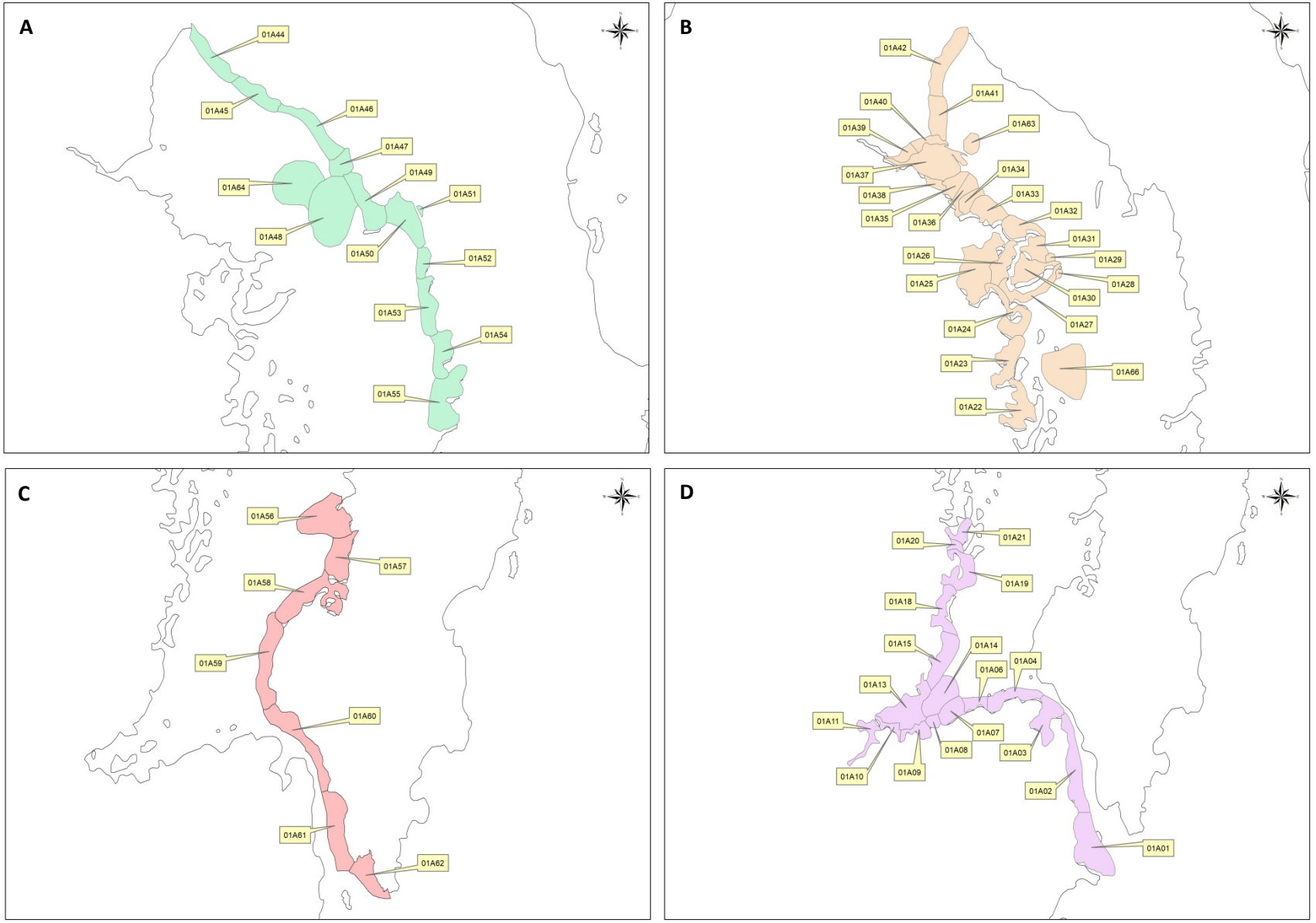


Figure 2 1 v: Locations of each Core Count (high tide) count sector in Strangford Lough (A = North-East, B = North-West, C= South-East, D = South-West). These WeBS sectors are the most recent subdivisions for WeBS counts in Strangford Lough, and represent the finest spatial scale over which data are collected (see Figure 2.1.iii and Figure 2 1 iv).

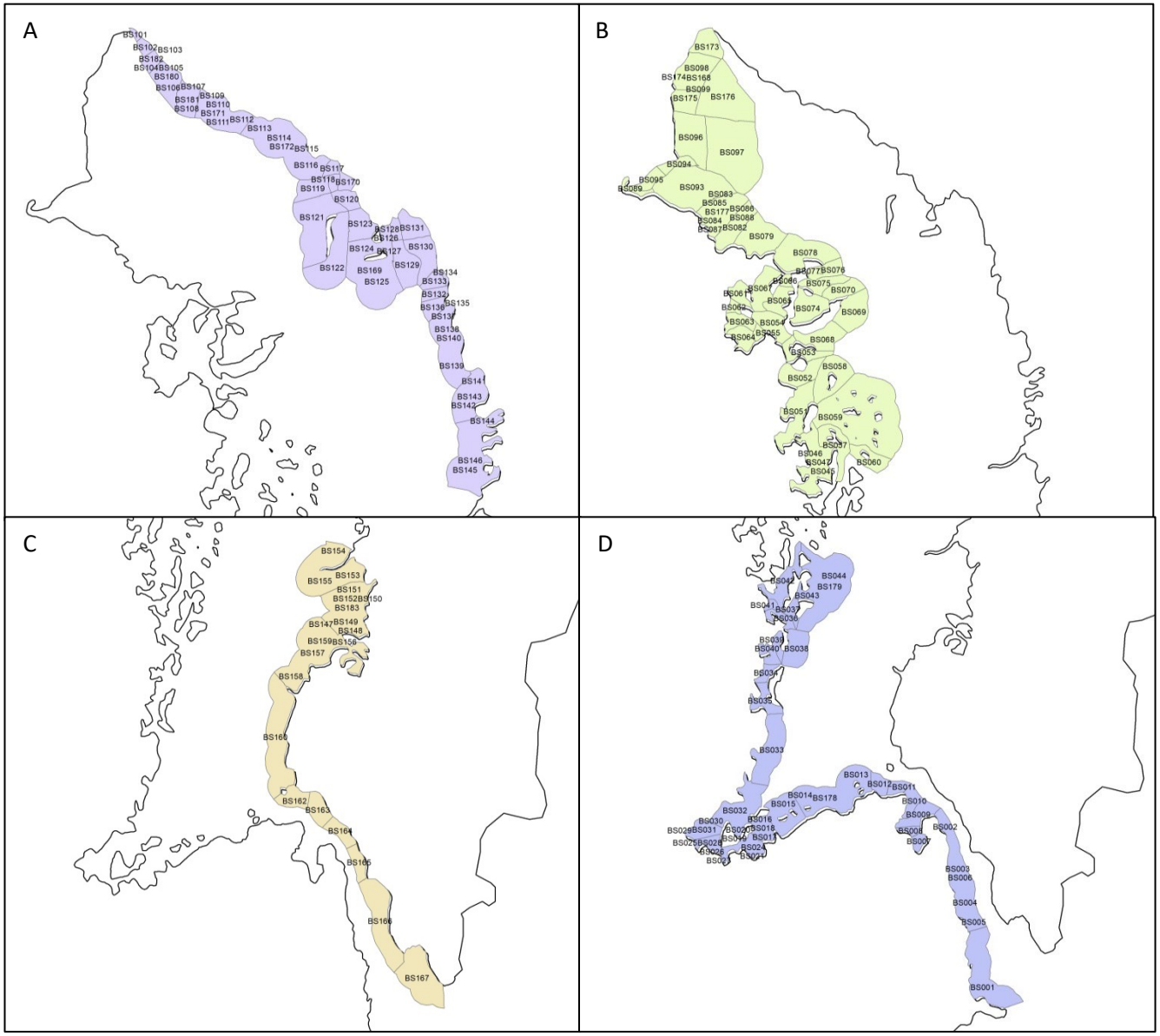


Figure 2.1.vi: Locations of each low tide count sector in Strangford Lough (A = North-East, B = North-West, C= South-East, D = South-West).

2.1.1. Smoothed waterbird trends and percentage change

The methodology used to produce smoothed site, regional and national trends as reported by WeBS Alerts(Woodward *et al*., 2019) can be usefully extended to generate trends on smaller areas of interest such as single or appropriately grouped WeBS count sectors. It is, however, important to recognise that the numbers of birds underlying the observed trend on sectors are generally much lower than those underlying site trends reported by WeBS Alerts which, by definition, are at least equal to the national qualifying threshold for the site as a whole. Consequently, individual trends should not be 'over-interpreted'. For example, a 50% decline from 30 birds to 15 birds would give much less cause for concern than a 50% decline from 1000 to 500 birds the latter being much more likely to reflect a real and substantial loss of birds from an area than the former. However, whilst acknowledging this, a consistent pattern of decline across multiple species, even when the numbers involved for some of them are comparatively low, is strongly indicative of adverse factors affecting the sector in question, and the particular suite of species showing a decline in numbers can guide us in where to look for problems (for example, does the suite of species represent those known to be particularly sensitive to disturbance or those with similar ecological requirements).

Thus, using the latest available validated WeBS data at the time of writing (those to winter 2016/17 inclusive), following (Atkinson *et al*. 2000, 2006), smoothed trends were calculated using Generalized Additive Models (GAMs) for the relevant species. The smoothing is to ensure that year-specific factors, such as poor conditions on the breeding grounds or particularly harsh weather on the wintering grounds, that are not related to changes in the quality of the loughs themselves, do not contribute overly to the trend. Percentage change has been calculated for short- (5 year) medium- (10 year) and long-term (15 year). To ensure statistical robustness, percentage change is calculated with reference to the penultimate winter in the time series available so as to avoid referring to the end points of the smoothed trend (which are less robust). WeBS does not have the necessary data collated at the sector level to support analysis of longer time-series. By way of analogy with the WeBS Alerts system, declines of at least 25% but below 50% are flagged as medium-declines (or moderate declines), and declines of 50% or greater are flagged as high-declines (or sharp declines). We specifically do not use the terms medium- and high-Alerts because unlike the percentage change reported by WeBS Alerts, medium and high declines reported at the sector level do not constitute a formal WeBS Alert. The corresponding percentage change required to balance the numbers to their former level following a decline are likewise termed medium- or moderate (at least 33% but below 100%) and high- or sharp (100% or greater) increases.

Trends can only be produced for species where sufficient data exist across the years being considered, and cannot be produced for species which are recorded irregularly and/or in very low numbers in Strangford or Carlingford Loughs in winter (Carlingford Lough: Mute Swan *Cygnus olor*, Greylag Goose A*nser anser*, Gadwall *Mareca strepera*, (Northern) Pintail *Anas acuta*, (Northern) Shoveler *Spatula clypeata*, (Common) Eider *Somateria mollissima*, Red-breasted Merganser *Mergus serrator*, (Eurasian) Coot *Fulica atra*, (Red) Knot *Calidris canutus*, (Common) Greenshank *Tringa nebularia*; Strangford Lough: Red-breasted Merganser, Great-crested Grebe *Podiceps cristatus*, Greenshank). In addition, trends are for the winter period only, and robust WeBS trends cannot be produced for species which are almost entirely recorded on passage (Greenshank). Wintering trends rely on the assumption that the number of individuals present at a site usually remains relatively stable for several weeks at a time (or longer) and hence monthly WeBS counts are representative of

the wintering population. This is not the case during passage months: numbers can fluctuate on a daily basis as birds arrive and depart, so counts may vary by chance from year to year according to whether or not the count date happens to coincide with a peak in passage. In addition, passage birds are present for a relatively short but unknown length of time, which may also vary from year to year. For both these reasons, numbers counted during passage months cannot be considered representative of the passage population in a particular year, and hence trends are not produced.

2.1.2. Placing the smoothed waterbird indices into context

Once the smoothed sector indices have been produced the observed trends are placed in context of the site trends. Following (Banks and Austin, 2004), the standard WeBS methodology as used to compare site trends with regional and national trends when reporting WeBS Alerts (Woodward et al., 2019) is extended here to compare counts sector trends with site trends. Where waterbird numbers of a given species on a given count sector follow those of the species across the site as a whole then the proportion of site numbers on the sector will remain constant. Any significant deviation from this gradient of zero would indicate that the waterbird populations on the relevant count sector are doing either better or less well than would be expected from the site trend. Consequently:

- where a decline on a sector reflects a decline across the site as a whole it is unlikely that the observed site trend is being driven by factors affecting that sector. If this is true of the majority of sectors, then this may indicate that the observed site decline in the species in question is due to factors external to the site and are thus not due to site management issues *per se*;

- where a decline on a sector is more pronounced than that across the site as a whole, this may suggest that factors affecting that sector could be contributing to the overall decline;

- where a decline on a sector is less pronounced than the decline across the site as a whole, this suggests that relatively favourable conditions on that sector are helping buffer site declines;

- where an increase on a sector is less pronounced than that across the site as a whole, this suggests that the sector is already at carrying capacity for the species in question or, if historically it supported greater numbers, that the quality of the sector to that species has diminished;

- where an increase on a sector is greater than that across the whole site, this suggests that trends on that sector are driving the increase across the site or that the sector in question is relatively attractive compared to the site as a whole when increased numbers arrive at the site due to external factors.

The comparisons between sectors and site are derived from a logistic regression model with a binomial error term. The resulting plots depict the percentage contribution of the sector to the site as a whole and the associated confidence limits represent both variation in this proportion between months in a given year and the underlying sample size (for example, we would be more confident of

our estimate that a sector contributed 10% of the site total if 100 birds out of 1000 on the site were counted there than we would be if this was 10 out of 100). This is based on the winter period as routinely used for all WeBS reporting (Nov-Mar for waders and Sep-Mar for other species). Only data from months where counts consolidated across the site as a whole had been assessed as complete were used - following standard WeBS protocol described above.

Having considered the trends on the sectors, each in the context of trends across the site as a whole, it is important to consider the site trends in a broader context – here the whole of Northern Ireland (following standard WeBS Alerts reporting), as this can modify our interpretation of the pattern of change across sectors. This is especially important where there has been an increase or decline at the broader scale. Consequently:

- where there has been an apparent re-distribution of a species within the site (that is, declines on some sectors appear to be balanced by increases on other sectors), but the proportional contribution of the site to increasing regional numbers is declining, then this implies that those sectors with static or declining numbers are actually of concern because we would expect them to be increasing in parallel with the other sectors. Thus, in such cases, the apparent redistribution within the site is misleading and the species in question may be facing problems on those sectors not supporting an increase in numbers;

- where a species is in decline at the broader scale we would expect declines on at least some of the sectors of the site regardless of whether birds are being affected by adverse factors locally. Thus, we would expect those sectors of least suitable habitat to a given species to be the first to show a decline in numbers.

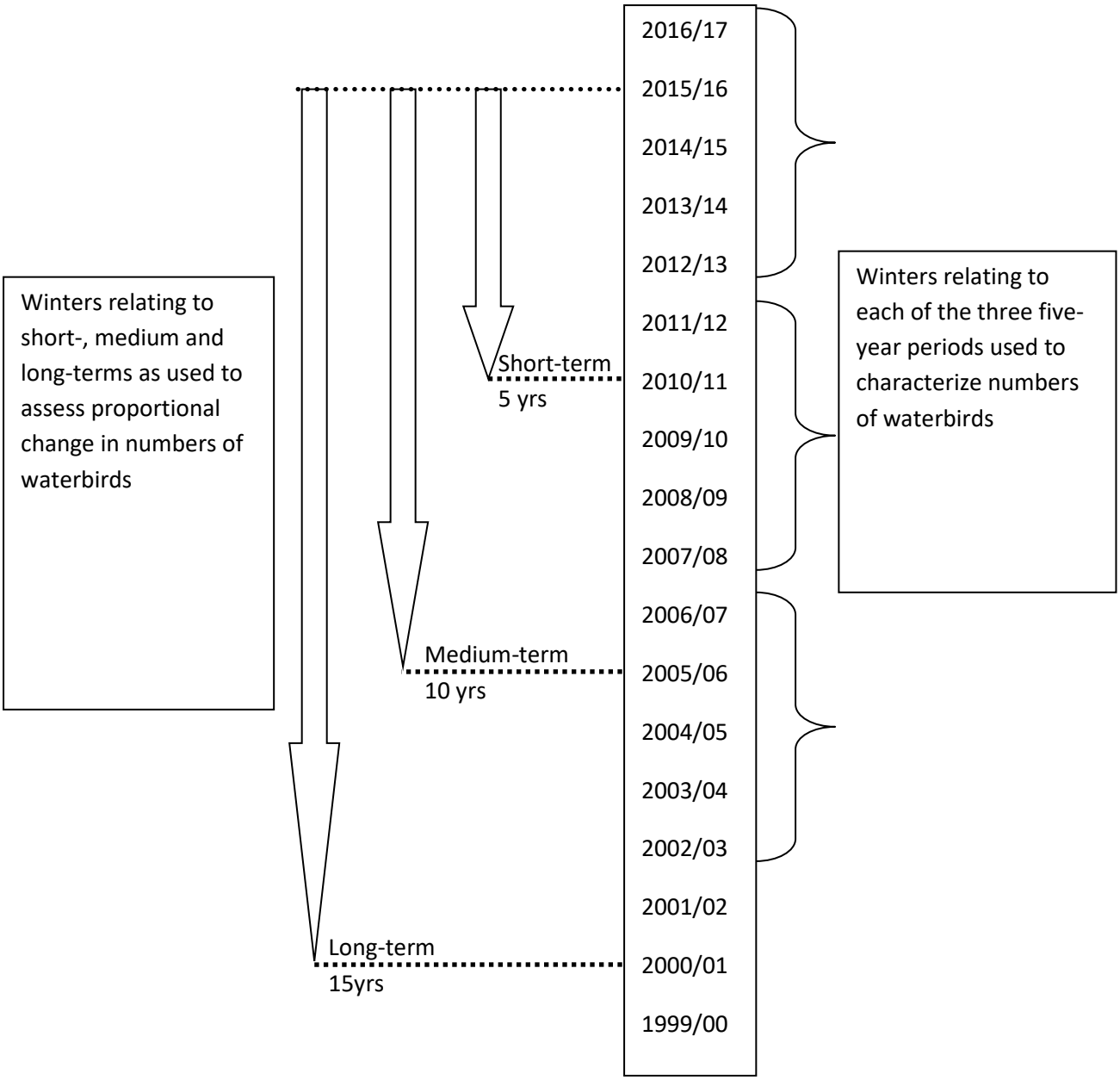


Figure 2.1.2.i: Schematic of reference winters used for reported waterbird numbers and change.

2.1.3. Comparing figures and tables with previous reports

The BTO has prepared a guidance document 'Guidance to interpretation of Wetland Bird Survey within-site trends' (Austin and Ross-Smith, 2014) to aid the interpretation of WeBS sector trend analyses. This document is also provided in the supplementary material accompanying this report. These guidelines give full details of analyses included in this report and the rationale behind them as an aid to the interpretations of numbers and trends on WeBS count sectors. In summary these include:

- proportional change in the numbers of each species assessed over the long-, medium- and short-terms (Overview: Tables 2 and 5 (A-D); for underlying values see sheet 'TableOfChange' in 'Carlingford Result Matrices.xls' and 'Strangford Lough Result Matrices.xls', supplied to NIEA digitally).

- underlying linear trend across the 15 winter period and the significance of this trend from zero (for underlying values see sheet 'TableOfProportions' in 'Carlingford Result Matrices.xls' and 'Strangford Lough Result Matrices.xls', supplied to NIEA digitally).

- means of peak counts of each species for the most recent five-winter period (Overview: Tables 3 and 6 (A-B), for underlying values together with equivalent values for the previous two five-winter periods and the peak value in the most recent winter, see sheets 'TableOf5yrPeaks' in 'Carlingford Result Matrices.xls' and 'Strangford Lough Result Matrices.xls').

- Peak counts of each species for the most recent winter period available (2016/17) (Overview: Tables 4 & 7 (A-B), for underlying values see sheet 'TableOfPeaks' 'Carlingford Result Matrices.xls' and 'Strangford Lough Result Matrices.xls').

- the proportion of species assessed as falling into each of the five categories from high decline through to high increase (mapped pie-charts: Figures 3.1.i to 3.i.v).

- for each species for each sector, graphs depicting both annual mean and annual peak numbers together with, where there is sufficient data, the smoothed trends through each. Accompanying each of these is a graph showing the proportional contribution of each sector to the overall numbers across the whole site. The equivalent graphs are also available for the whole sites relative to Northern Ireland (supplied to NIEA digitally).

- density plots for each species across all sectors which focus attention on the most important areas for each species (supplied to NIEA digitally).

2.2. Relating trends to aquaculture activity

Carlingford Lough holds four licenced intertidal oyster cultivation areas in a single sector, Mill Bay (01407, Figure 2.2.i) while only a single area is licenced in Strangford Lough, which spans two sectors, Paddy's Point to Sleepers (01A33) and Ringneill Point to Paddy's Point (01A32, Figure2.2.iii). It is important to note that the aquaculture polygons shown in Figure 2.2.i and Figure2.2.iii represent the total licenced area of each operator, rather than active trestle area, and therefore are not an indicator of yield or activity on the sites. Husbandry activity on the Carlingford Lough licenced areas, where data is available, appears to be very variable between operators and is recorded differently by each, varying between 60-70 hours per month, two hours per tide, 10 to 15 tides a month or even "a few hours/month". It is therefore difficult to assess how much disturbance might be caused by husbandry activity. Instead, tonnage of oysters produced can be used as a measurement of activity on the sites. Since 2010, when there was no intertidal oyster cultivation in Carlingford Lough, tonnage of oyster production has risen each year and reached a peak in 2017, there were 193 tonnes of oysters produced in Mill Bay across all licenced areas (Figure2.2.iv). The increase in tonnage is used here as a proxy for the level of activity, and hence potential disturbance and interference with access to foraging or roosting habitat. There is no tonnage information available for the licenced area in Strangford Lough currently, so trends in Paddy's Point to Sleepers and Ringneill Point to Paddy's Point are compared to the site-level trends without reference to activity levels. Short-term trends in the sectors with aquaculture will be considered in the context of the site trend, and the change in the percentage contribution of the sector to the site as a whole pre- and post- the initiation of oyster cultivation in 2010 (based on sites in Carlingford Lough) will be judged to be positive, negative or neutral using the proportional contribution graphs.

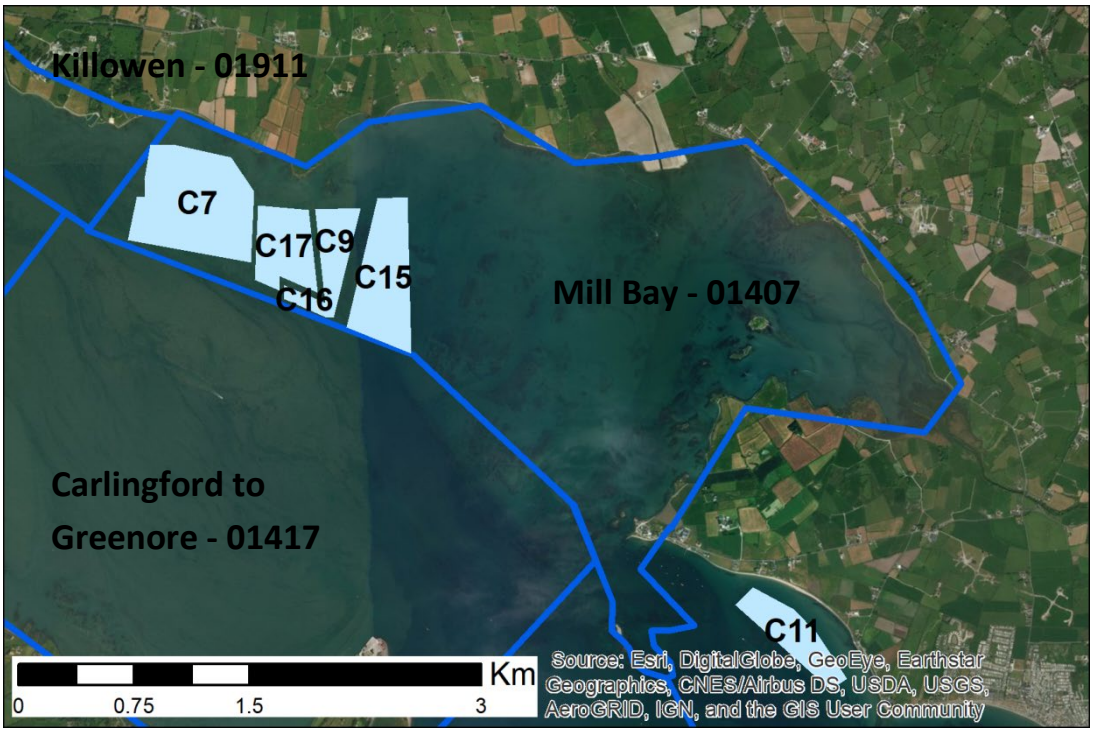


Figure 2.2.i: Map of licenced intertidal oyster cultivation areas (pale blue) in Carlingford Lough. Four of these (C16 and C9 belong to a single licence holder) are within the Mill Bay (01407) sector, and one lies outside the Carlingford Lough WeBS area (C11). Sector boundaries are shown in blue.

Figure 2.1.ii: Map of licenced intertidal oyster cultivation areas in Strangford Lough. This area (S7) spans two low-tide WeBS sectors, Strangford Lough LTC D50 (BS078) and Strangford Lough LTC D60 (BS079). Sector boundaries are shown in purple.

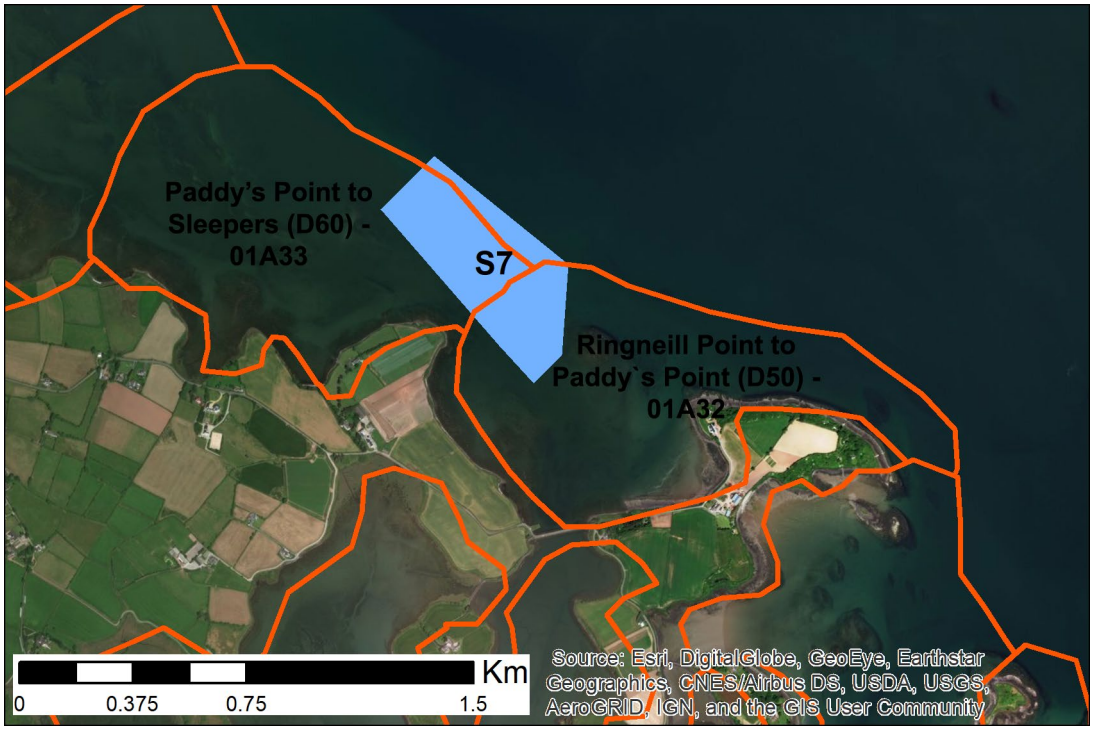


Figure 2.2.iii: Map of licenced intertidal oyster cultivation areas in Strangford Lough. This area (S7) spans two high-tide WeBS sectors, Paddy's Point to Sleepers (01A33) and Ringneill Point to Paddy's Point (01A32). Sector boundaries are shown in orange.

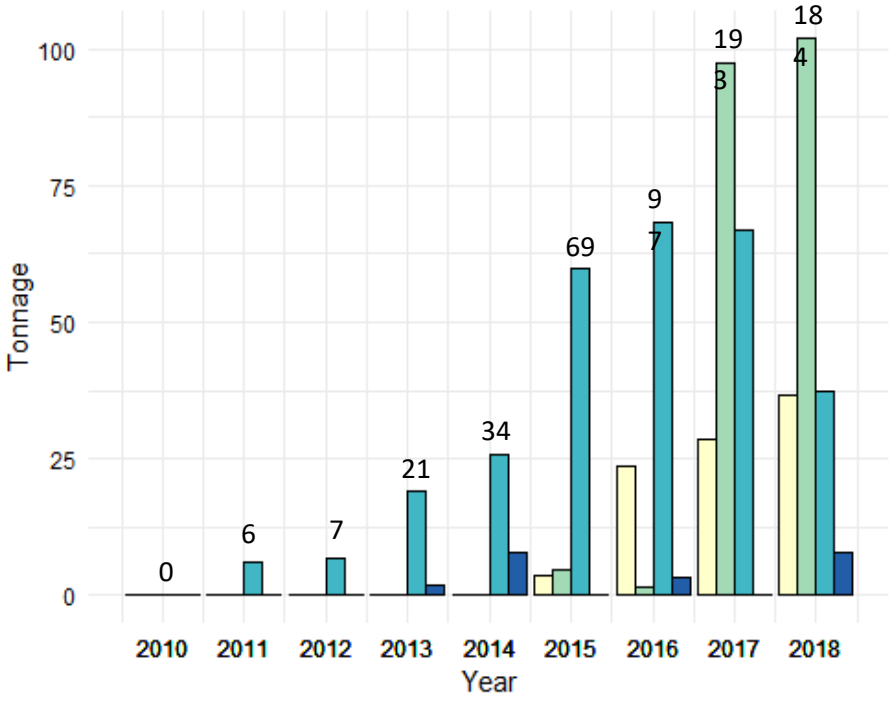


Figure 2.2.iv: Tonnage of trestle-cultured Pacific oysters *Crassostrea gigas* and small number of Native Oysters *Ostrea edulis* produced in Carlingford Lough since 2010. Bars coloured by licence area, but a legend is not included to preserve anonymity.

3. Results

3.1. Sector trend plots

The trends of each species on each WeBS sector are supplied digitally, together with plots comparing the count sector trends with the site trends for Strangford Lough and Carlingford Lough. This series of plots puts each sector into the context of trends of each of the loughs as a whole. Plots are grouped by sector and species presented in taxonomic order. This information is summarised below (Table 2 and Table 5) and the underlying values representing percentage change to Strangford and Carlingford Loughs are available in the accompanying Excel™ Workbooks ('Carlingford Lough High Tide Result Matrices.xls', 'Strangford Lough High Tide Result Matrices.xls' & ''Strangford Lough Low Tide Result Matrices.xls). Colour coding is used to represent declines or increases; species are listed in taxonomic order and sectors have been listed to represent their geographical proximity to each other. Caution is advisable in interpreting individual cells in these tables at face value. For example, a 50% decline (shown in red) could represent a decline from 10,000 to 5,000 birds or could be a decline from 20 to 10. Consequently, it is important to be aware of the numbers of birds involved (obtainable from the plots supplied digitally or the mean of peak numbers in the Excel Worksheet. However, consistency between adjacent cells would suggest that either a group of species or a group of adjacent sectors have similar trends even when numbers of individuals involved are relatively low. Where this is the case, this may suggest that the trends represent real ecological changes. Note that trend graphs have not been presented for Greenshank due to the very low numbers or intermittent occurrence during the winter on the loughs.

This information is further summarised in map format, which better facilitates a geographic interpretation of the trends (Figure 3.1.i - Figure 3.1.v) (see also digital supplementary materials).

The importance of individual sectors for given species can be determined by considering the five-year mean of peak counts (Table 3 and Table 6) and underlying values are available in the supporting material ('Carlingford Result Matrices.xls' and 'Strangford Lough Result Matrices.xls'); the importance of individual sectors to particular species clearly influences the level of concern regarding the characteristics of the trends. Peak counts from the most recent available winter (2016/17) are also provided in separate tables (Table 4 and Table 7, and supporting material). However, caution is advisable in interpreting these tables of peak counts to identify important sectors for given species rather than Table 3 and Table 6, as peaks from a single year are less robust against missing data or abnormal counts (e.g. caused by disturbance in an adjacent sector on the day of a count).

Table 2 Overview of population trends of waterbirds in Carlingford Lough based on high-tide counts over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data. *Light-bellied Brent Goose.

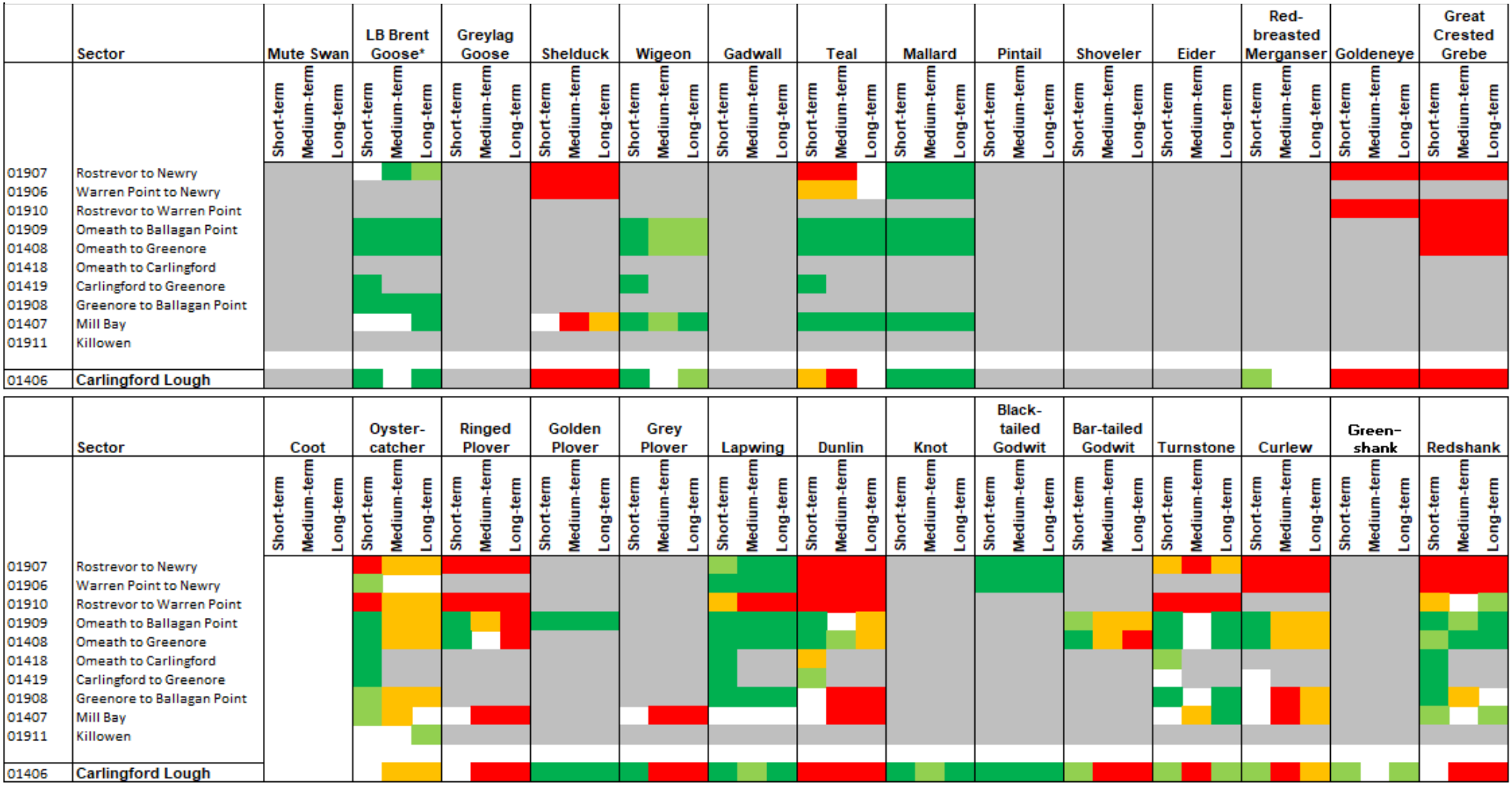


Table 3 The most important sectors for waterbirds in Carlingford Lough shown by colour: Dark Blue- sectors with a mean peak count over the last five winters (2012/13 – 2016/17) that is at least 20% of the total mean peak counts for Carlingford Lough over the same period; Light Blue – sites with a mean peak count over the last five winters that is between 10% and 20% of the total mean of peak count for Carlingford Lough over the same period.

Sector		Mute Swan	Light-bellied Brent Goose	Greylag Goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail	Shoveler	Eider	Red-breasted Merganser	Goldeneye	Great Crested Grebe	Coot	Oystercatcher	Ringed Plover	Golden Plover	Grey Plover	Lapwing	Dunlin	Knot	Black-tailed Godwit	Bar-tailed Godwit	Turnstone	Curlew	Greenshank	Redshank
01907	Rostrevor to Newry																												
01906	Warren Point to Newry																												
01910	Rostrevor to Warren Point																												
01909	Omeath to Ballagan Point																												
01408	Omeath to Greenore																												
01418	Omeath to Carlingford																												
01419	Carlingford to Greenore																												
01908	Greenore to Ballagan Point																												
01407	Mill Bay																												

Table 4 The most important sectors in the latest year (2016/17) for waterbirds in Carlingford Lough shown by colour: Dark Green – Sites with a peak count in the latest year that is at least 20% of the total peak count for Carlingford Lough in the same year; Light Green – sites with a peak count in the latest year that is between 10% and 20% of the total peak count for Carlingford Lough in the same year.

Sector		Mute Swan	Light-bellied Brent Goose	Greylag Goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail	Shoveler	Eider	Red-breasted Merganser	Goldeneye	Great Crested Grebe	Coot	Oystercatcher	Ringed Plover	Golden Plover	Grey Plover	Lapwing	Dunlin	Knot	Black-tailed Godwit	Bar-tailed Godwit	Turnstone	Curlew	Greenshank	Redshank
01907	Rostrevor to Newry																												
01906	Warren Point to Newry																												
01910	Rostrevor to Warren Point																												
01909	Omeath to Ballagan Point																												
01408	Omeath to Greenore																												
01418	Omeath to Carlingford																												
01419	Carlingford to Greenore																												
01908	Greenore to Ballagan Point																												
01407	Mill Bay																												

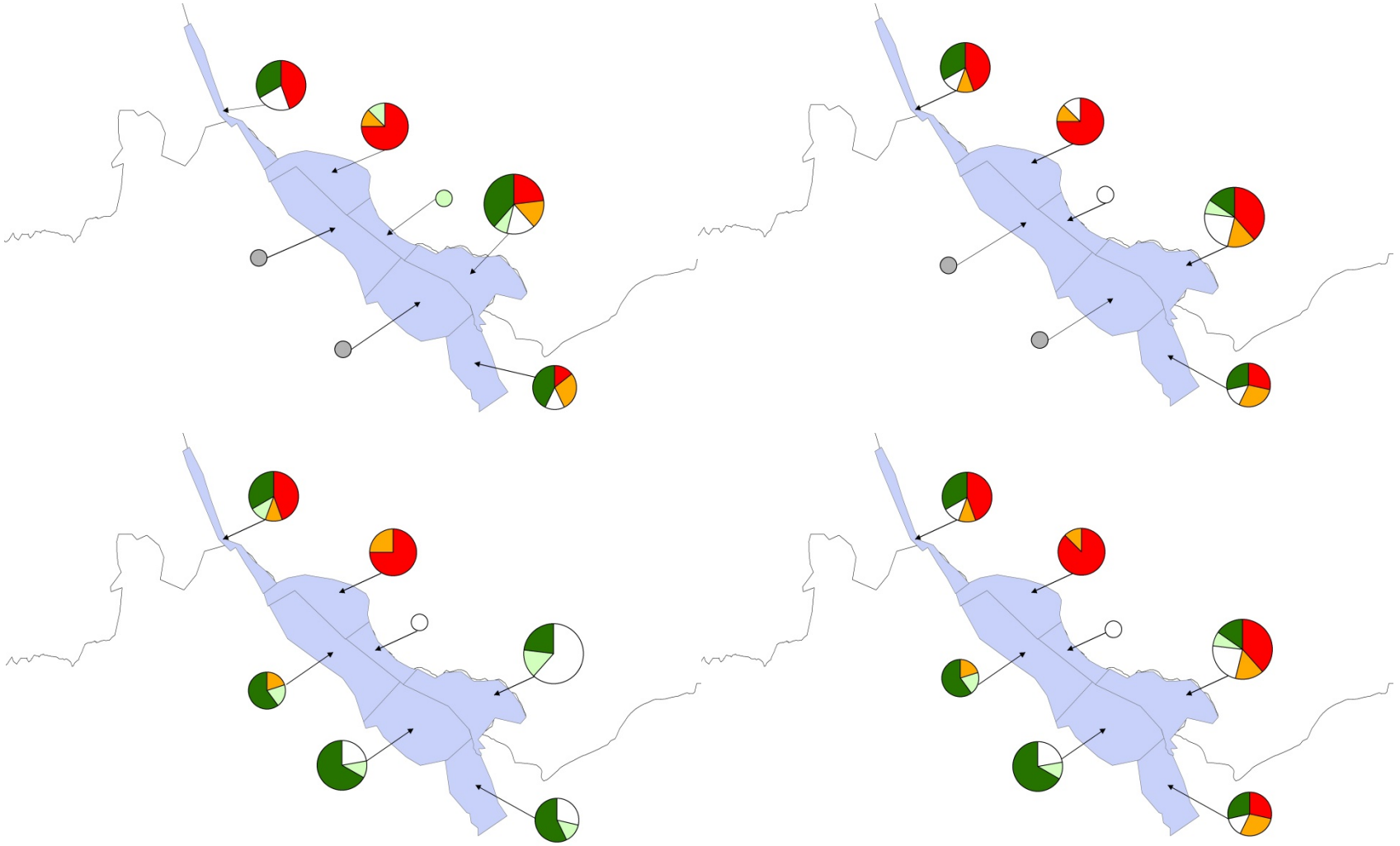


Figure 3.1.i: Population trends of waterbirds within Carlingford Lough over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16). The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

Table 5 Overview of population trends in Strangford Lough based on high-tide counts. (A): Overview of population trends of wildfowl of Strangford Lough based on high-tide counts over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Sectors 01A01 to 01A34 and 01A3. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data. *Light-bellied Brent Goose.

	Sector	Mute Swan			LB Brent Goose*			Greylag Goose			Shelduck			Wigeon			Gadwall			Teal			Mallard			Pintail			Shoveler			Eider			Red-breasted Merganser			Golden-eye			Great Crested Grebe			Coot		
		Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
01A01	Killard to Kilclief (A10)																																											
01A02	Kilclief to Church Point (A20)																																											
01A03	Church Point to Audley`s (A30)																																											
01A04	Audley`s to Hannah`s Hedge (A40)																																											
01A06	Hannah`s Hedge to Walshestown Quay (A60)																																											
01A07	Walshestown Quay to East Sloane (A70)																																											
01A08	Sloane`s Island Area (A80)																																											
01A09	West Sloane to Castle Island (A90)																																											
01A10	Castle Island to Hare Island (B10)																																											
01A11	Quoile Pondage (DOE) (B20)																																												
01A13	Hare`s Island to Nickey`s Point (B40)																																												
01A14	Salt Island and Green Island (B50)																																												
01A15	Nickey`s Point to Holme Bay (B60)																																											
01A17	Shringley Dam (B80)																																												
01A18	Holme Bay to South Ringdufferin (B90)																																											
01A19	South Ringdufferin to Pawle Island Black Rock (C10)																																											
01A20	Ringdufferin to Ballymacarron (C20)																																												
01A21	Ballymacarron to Ringhaddy (C30)																																											
01A22	Quaterland to Shamrock (C40)																																												
01A23	Shamrock to Braddock (C50)																																												
01A24	Braddock to Cadew (C60)																																											
01A25	Ardmillan West (C70)																																												
01A26	Ardmillan East (C80)																																											
01A27	Mahee Island (C90)																																											
01A28	Gull Rock (D10)																																											
01A29	Bird Island (D20)																																												
01A30	Mahee Point to Cross Island (D30)																																												
01A31	Cross Island to Ringneill Point (D40)																																											
01A32	Ringneill Point to Paddy`s Point (D50)																																											
01A33	Paddy`s Point to Sleepers (D60)																																											
01A34	Sleepers to Horse (D70)																																												
01A37	Castle Espie to Comber River (D90)																																												

Table 5 continued (B): Overview of population trends of wader species within sectors 01A01 to 01A34 and 01A37 of Strangford Lough based on high-tide counts over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

	Sector	Oyster-catcher			Ringed Plover			Golden Plover			Grey Plover			Lapwing			Dunlin			Knot			Black-tailed Godwit			Bar-tailed Godwit			Turn-stone			Curlew			Green-shank			Red-shank		
		Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
01A01	Killard to Kilclief (A10)																																					
01A02	Kilclief to Church Point (A20)																																					
01A03	Church Point to Audley`s (A30)																																					
01A04	Audley`s to Hannah`s Hedge (A40)																																					
01A05	Temple Water (A50)																																					
01A06	Hannah`s Hedge to Walshestown Quay (A60)																																					
01A07	Walshestown Quay to East Sloane (A70)																																					
01A08	Sloane`s Island Area (A80)																																					
01A09	West Sloane to Castle Island (A90)																																					
01A10	Castle Island to Hare Island (B10)																																					
01A11	Quoile Pondage (DOE) (B20)																																					
01A12	Finnebrogue (B30)																																					
01A13	Hare`s Island to Nickey`s Point (B40)																																					
01A14	Salt Island and Green Island (B50)																																					
01A15	Nickey`s Point to Holme Bay (B60)																																					
01A16	Clea Lakes (B70)																																					
01A17	Shringley Dam (B80)																																					
01A18	Holme Bay to South Ringdufferin (B90)																																					
01A19	South Ringdufferin to Pawle Island Black Rock (C10)																																					
01A20	Ringdufferin to Ballymacarron (C20)																																					
01A21	Ballymacarron to Ringhaddy (C30)																																					
01A22	Quaterland to Shamrock (C40)																																					
01A23	Shamrock to Braddock (C50)																																					
01A24	Braddock to Cadew (C60)																																					
01A25	Ardmillan West (C70)																																					
01A26	Ardmillan East (C80)																																					
01A27	Mahee Island (C90)																																					
01A28	Gull Rock (D10)																																					
01A29	Bird Island (D20)																																					
01A30	Mahee Point to Cross Island (D30)																																					
01A31	Cross Island to Ringneill Point (D40)																																					
01A32	Ringneill Point to Paddy`s Point (D50)																																					
01A33	Paddy`s Point to Sleepers (D60)																																					
01A34	Sleepers to Horse (D70)																																					
01A37	Castle Espie to Comber River (D90)																																					

Table 5 continued (C): Overview of population trends of wildfowl within sectors 01A35 to 01A68 (minus 01A37) of Strangford Lough based on high-tide counts over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data. *Light-bellied Brent Goose.

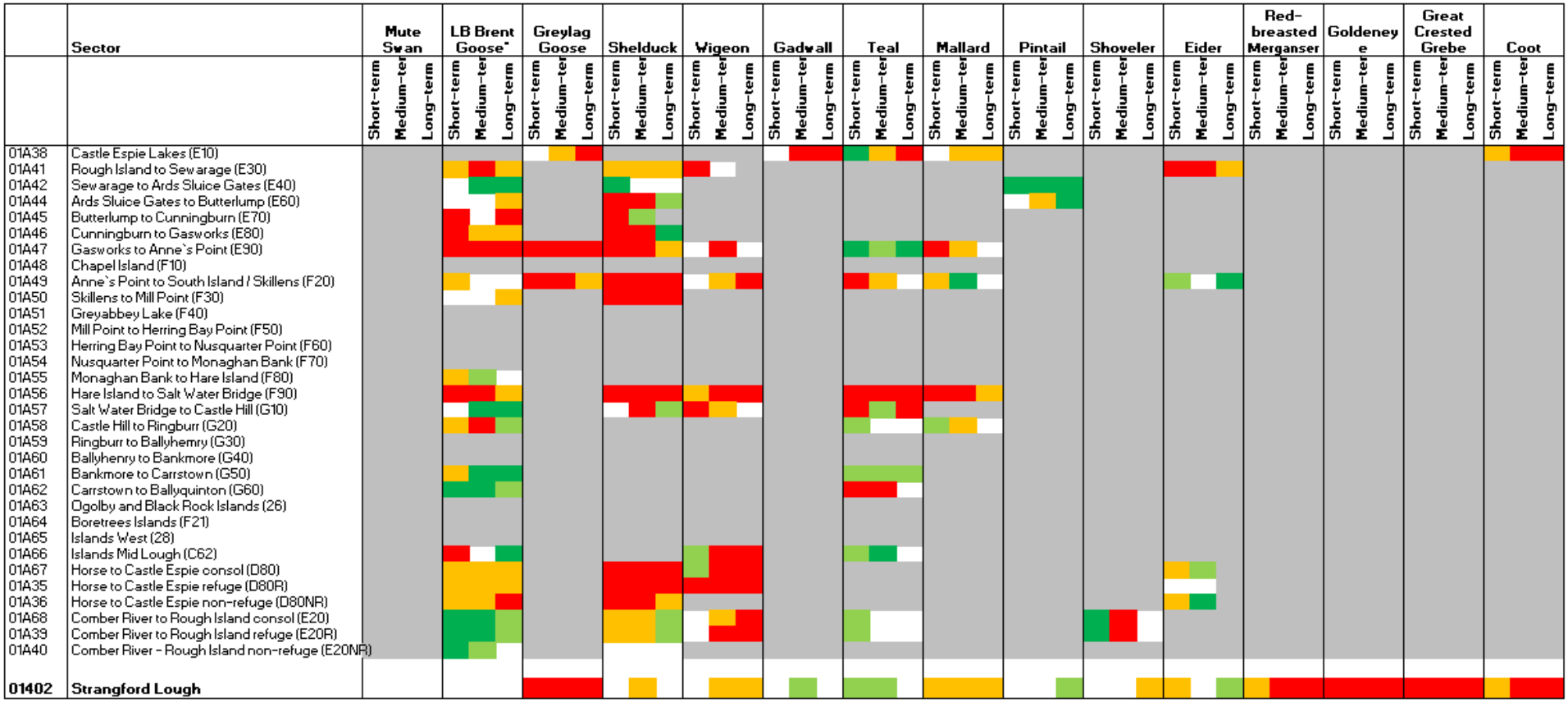


Table 5 continued (D): Overview of population trends of wader species within sectors 01A35 to 01A68 (minus 01A37) of Strangford Lough based on high-tide counts over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

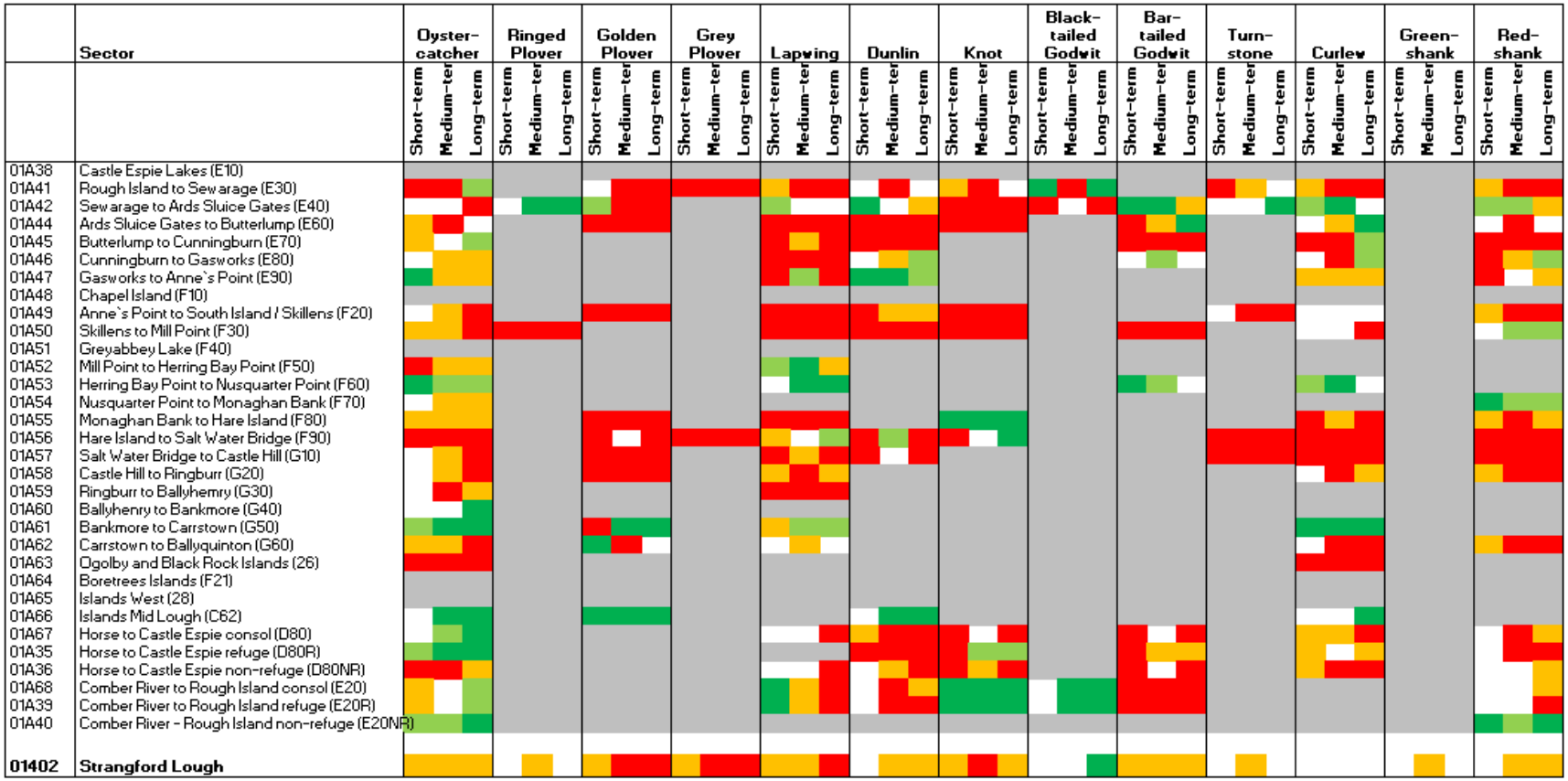


Table 6 The most important sectors for waterbirds in Strangford Lough. (A): Sectors 01A01 to 01A01 to 01A34 and 01A37 of Strangford Lough shown by colour: Dark Blue- sectors with a mean peak count over the last five winters (2012/13 – 2016/17) that is at least 20% of the total mean peak counts for Strangford Lough over the same period; Light Blue – sites with a mean peak count over the last five winters that is between 10% and 20% of the total mean of peak count for Strangford Lough over the same period.

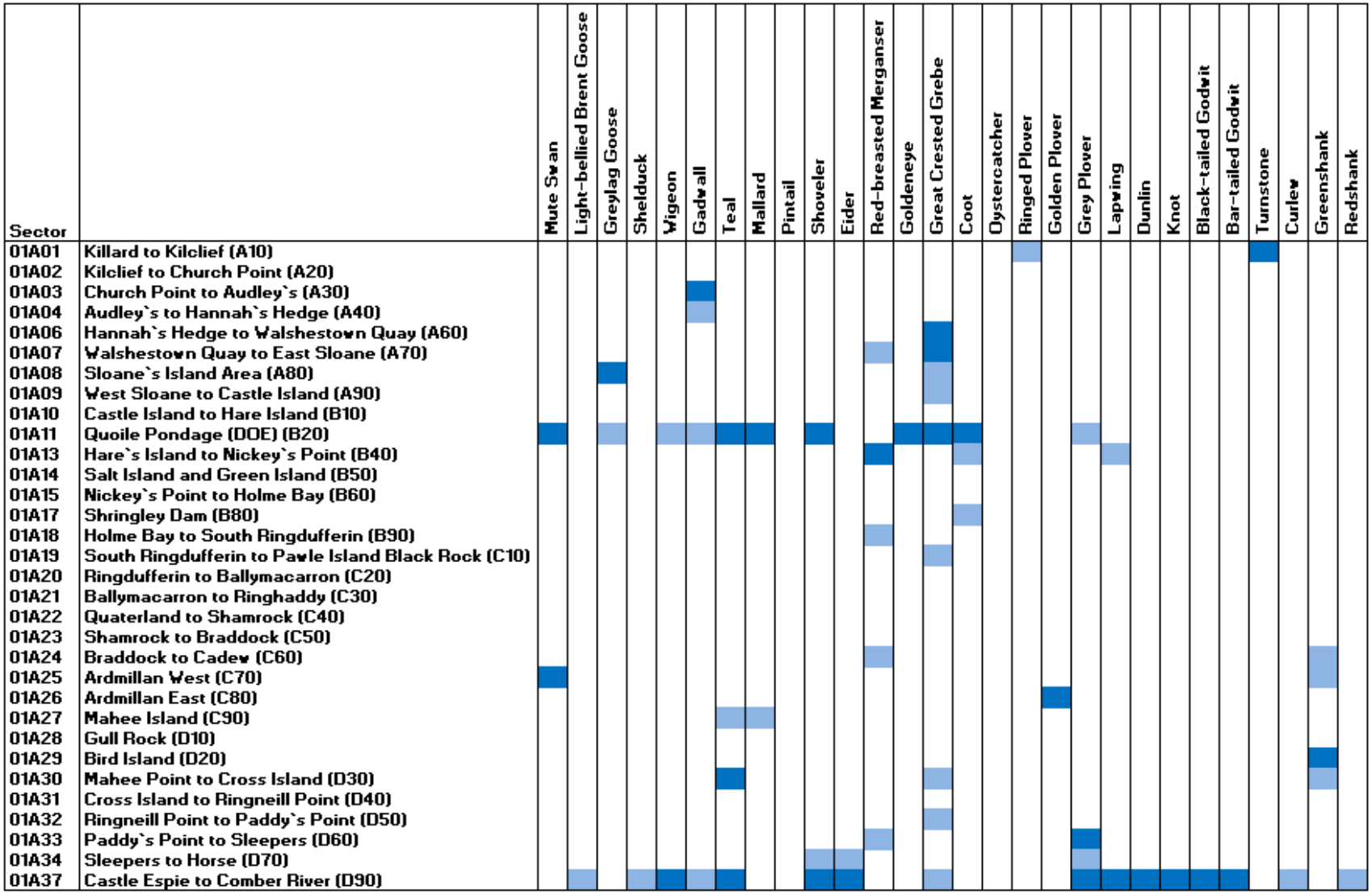
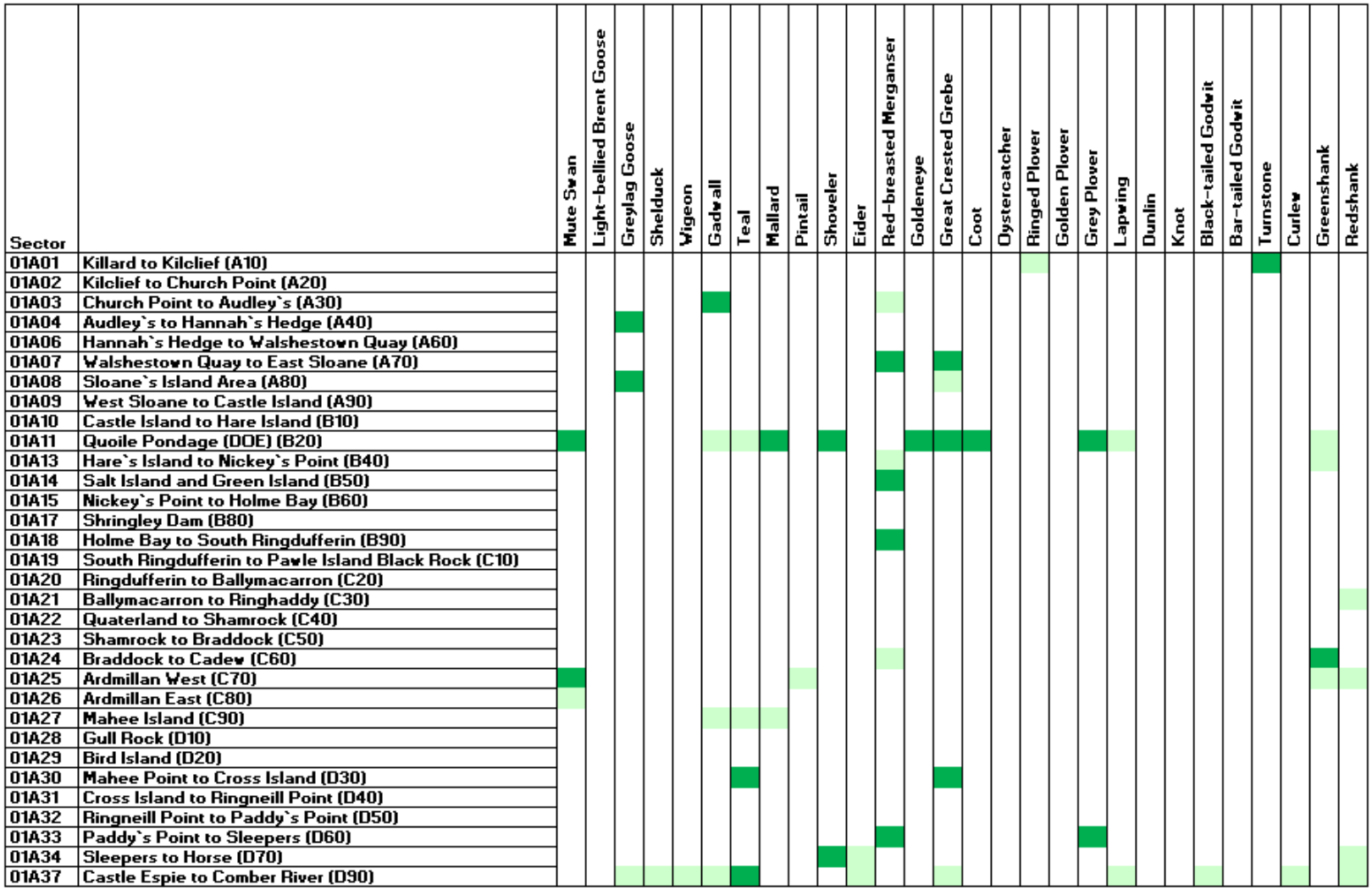


Table 6 continued (B): The most important sectors for waterbirds in sectors 01A35 to 01A68 (minus 01A37) of Strangford Lough shown by colour: Dark Blue- sectors with a mean peak count over the last five winters (2012/13 – 2016/17) that is at least 20% of the total mean peak counts for Strangford Lough over the same period; Light Blue – sites with a mean peak count over the last five winters that is between 10% and 20% of the total mean of peak count for Strangford Lough over the same period.

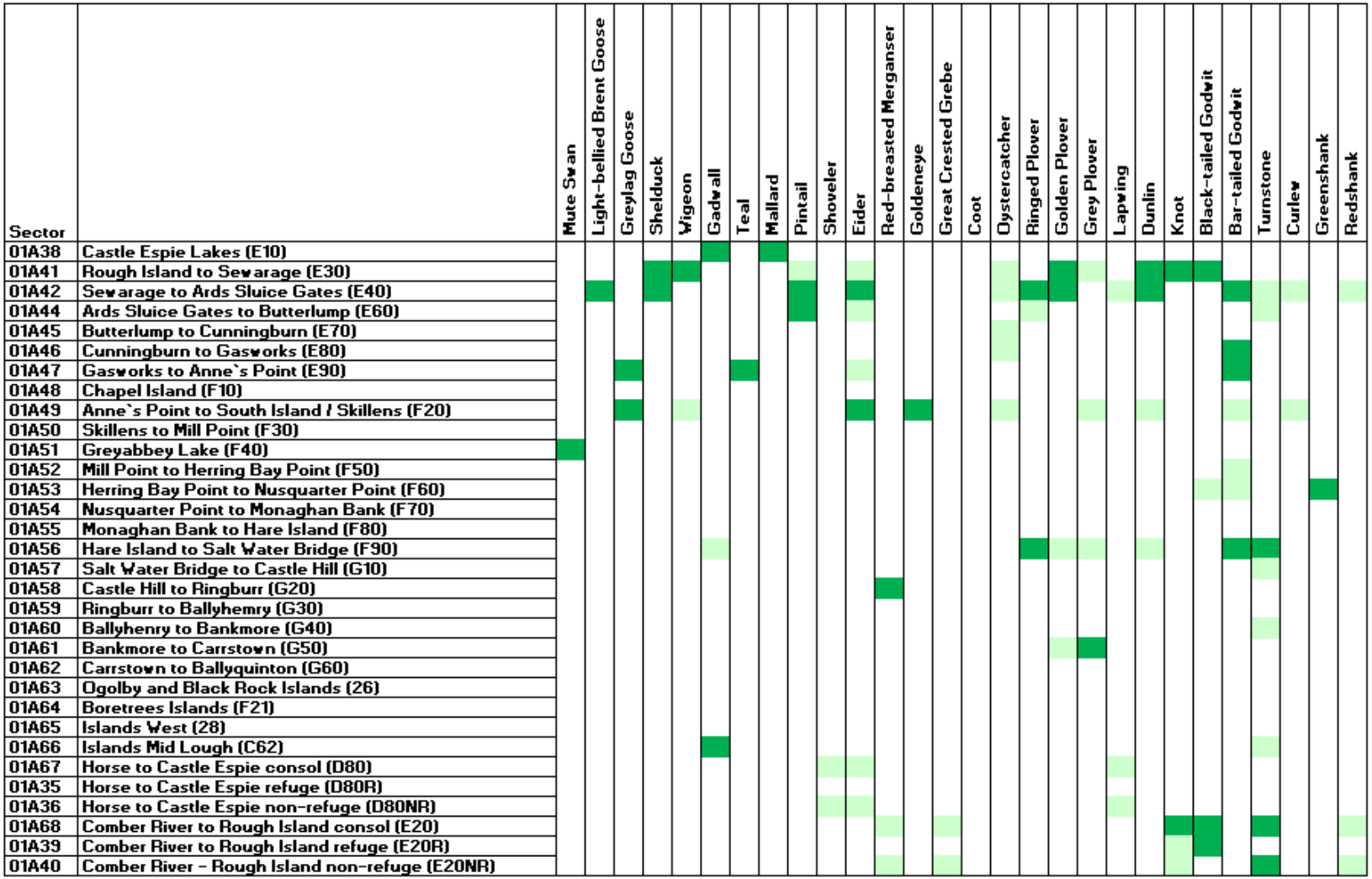
Sector		Mute Swan	Light-bellied Brent Goose	Greylag Goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail	Shoveler	Eider	Red-breasted Merganser	Goldeneye	Great Crested Grebe	Coot	Oystercatcher	Ringed Plover	Golden Plover	Grey Plover	Lapwing	Dunlin	Knot	Black-tailed Godwit	Bar-tailed Godwit	Turnstone	Curlew	Greenshank	Redshank
01A38	Castle Espie Lakes (E10)																												
01A41	Rough Island to Sewarage (E30)																												
01A42	Sewarage to Ards Sluice Gates (E40)																												
01A44	Ards Sluice Gates to Butterlump (E60)																												
01A45	Butterlump to Cunningburn (E70)																												
01A46	Cunningburn to Gasworks (E80)																												
01A47	Gasworks to Anne`s Point (E90)																												
01A48	Chapel Island (F10)																												
01A49	Anne`s Point to South Island / Skillens (F20)																												
01A50	Skillens to Mill Point (F30)																												
01A51	Greyabbey Lake (F40)																												
01A52	Mill Point to Herring Bay Point (F50)																												
01A53	Herring Bay Point to Nusquarter Point (F60)																												
01A54	Nusquarter Point to Monaghan Bank (F70)																												
01A55	Monaghan Bank to Hare Island (F80)																												
01A56	Hare Island to Salt Water Bridge (F90)																												
01A57	Salt Water Bridge to Castle Hill (G10)																												
01A58	Castle Hill to Ringburr (G20)																												
01A59	Ringburr to Ballyhemry (G30)																												
01A60	Ballyhenry to Bankmore (G40)																												
01A61	Bankmore to Carrstown (G50)																												
01A62	Carrstown to Ballyquinton (G60)																												
01A63	Ogolby and Black Rock Islands (26)																												
01A64	Boretrees Islands (F21)																												
01A65	Islands West (28)																												
01A66	Islands Mid Lough (C62)																												
01A67	Horse to Castle Espie consol (D80)																												
01A35	Horse to Castle Espie refuge (D80R)																												
01A36	Horse to Castle Espie non-refuge (D80NR)																												
01A68	Comber River to Rough Island consol (E20)																												
01A39	Comber River to Rough Island refuge (E20R)																												
01A40	Comber River – Rough Island non-refuge (E20NR)																												

Table 7 The most important sectors in the latest year (2016/17) for waterbirds. (A): Sectors 01A01 to 01A34 and 01A37 of Strangford Lough shown by colour: Dark Green – Sites with a peak count in the latest year that is at least 20% of the total peak count for Strangford Lough in the same year; Light Green – sites with a peak count in the latest year that is between 10% and 20% of the total peak count for Strangford Lough in the same year.



Sector		Mute Swan	Light-bellied Brent Goose	Greylag Goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail	Shoveler	Eider	Red-breasted Merganser	Goldeneye	Great Crested Grebe	Coot	Oystercatcher	Ringed Plover	Golden Plover	Grey Plover	Lapwing	Dunlin	Knot	Black-tailed Godwit	Bar-tailed Godwit	Turnstone	Curlew	Greenshank	Redshank
01A01	Killard to Kilclief (A10)																												
01A02	Kilclief to Church Point (A20)																												
01A03	Church Point to Audley`s (A30)																												
01A04	Audley`s to Hannah`s Hedge (A40)																												
01A06	Hannah`s Hedge to Walshestown Quay (A60)																												
01A07	Walshestown Quay to East Sloane (A70)																												
01A08	Sloane`s Island Area (A80)																												
01A09	West Sloane to Castle Island (A90)																												
01A10	Castle Island to Hare Island (B10)																												
01A11	Quoile Pondage (DOE) (B20)																												
01A13	Hare`s Island to Nickey`s Point (B40)																												
01A14	Salt Island and Green Island (B50)																												
01A15	Nickey`s Point to Holme Bay (B60)																												
01A17	Shringley Dam (B80)																												
01A18	Holme Bay to South Ringdufferin (B90)																												
01A19	South Ringdufferin to Pawle Island Black Rock (C10)																												
01A20	Ringdufferin to Ballymacarron (C20)																												
01A21	Ballymacarron to Ringhaddy (C30)																												
01A22	Quaterland to Shamrock (C40)																												
01A23	Shamrock to Braddock (C50)																												
01A24	Braddock to Cadew (C60)																												
01A25	Ardmillan West (C70)																												
01A26	Ardmillan East (C80)																												
01A27	Mahee Island (C90)																												
01A28	Gull Rock (D10)																												
01A29	Bird Island (D20)																												
01A30	Mahee Point to Cross Island (D30)																												
01A31	Cross Island to Ringneill Point (D40)																												
01A32	Ringneill Point to Paddy`s Point (D50)																												
01A33	Paddy`s Point to Sleepers (D60)																												
01A34	Sleepers to Horse (D70)																												
01A37	Castle Espie to Comber River (D90)																												

Table 7 continued (B): Sectors 01A35 to 01A68 (minus 01A37) of Strangford Lough shown by colour: Dark Green – Sites with a peak count in the latest year that is at least 20% of the total peak count for Strangford Lough in the same year; Light Green – sites with a peak count in the latest year that is between 10% and 20% of the total peak count for Strangford Lough in the same year.



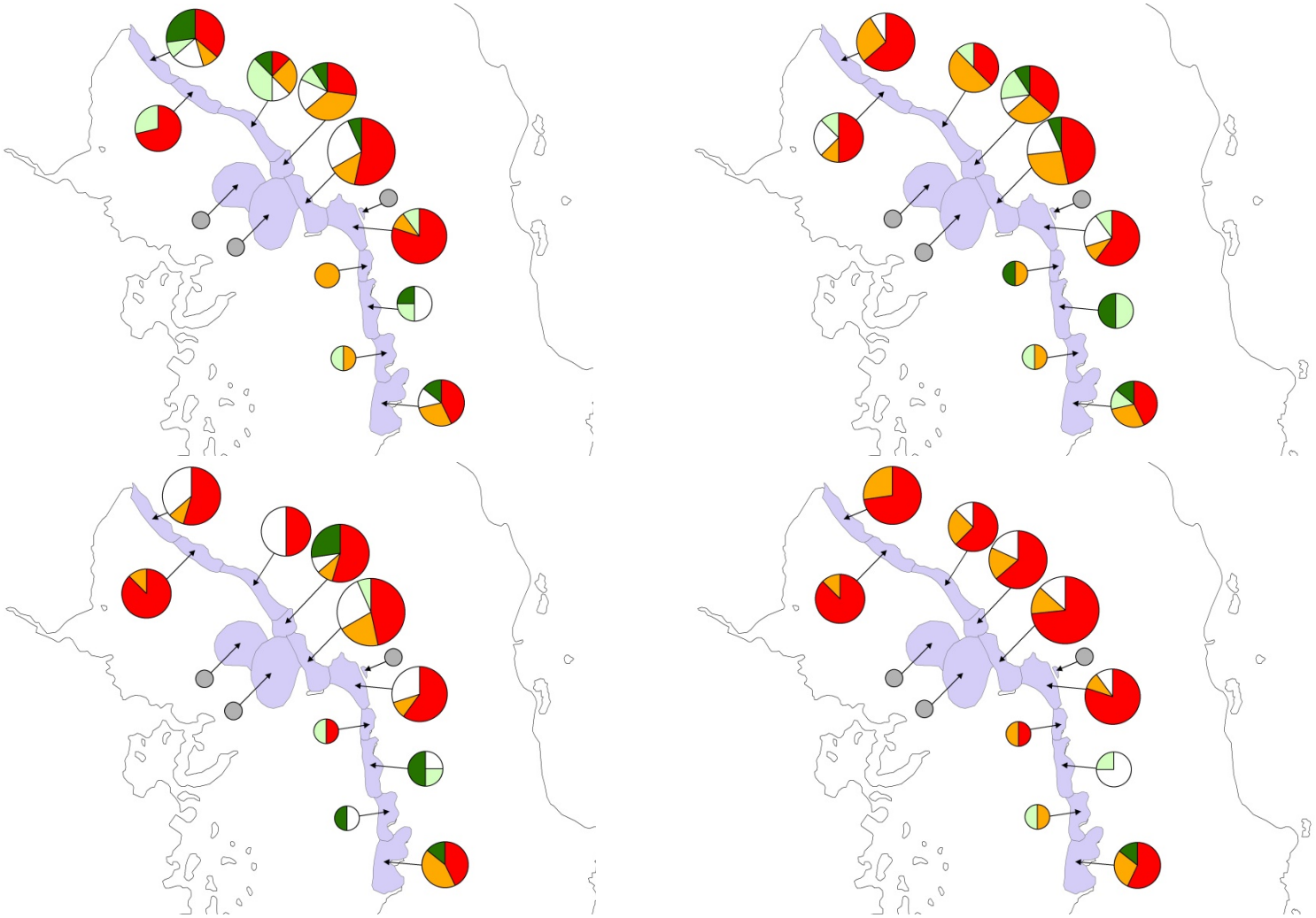


Figure 3.1.ii: Population trends of waterbirds within North-East Strangford Lough over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16). The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

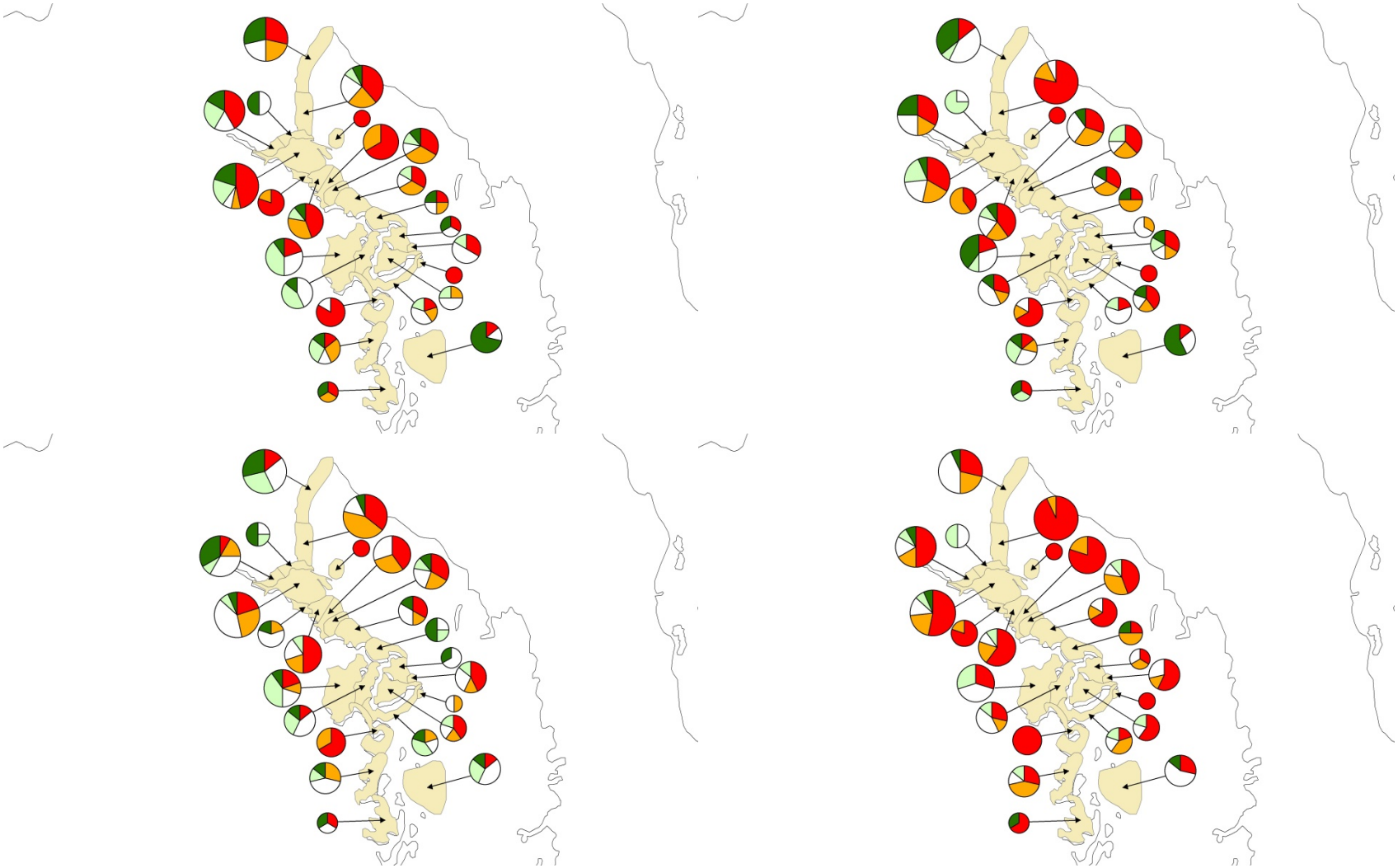


Figure 3.1.iii: Population trends of waterbirds within North-West Strangford Lough over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16). The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

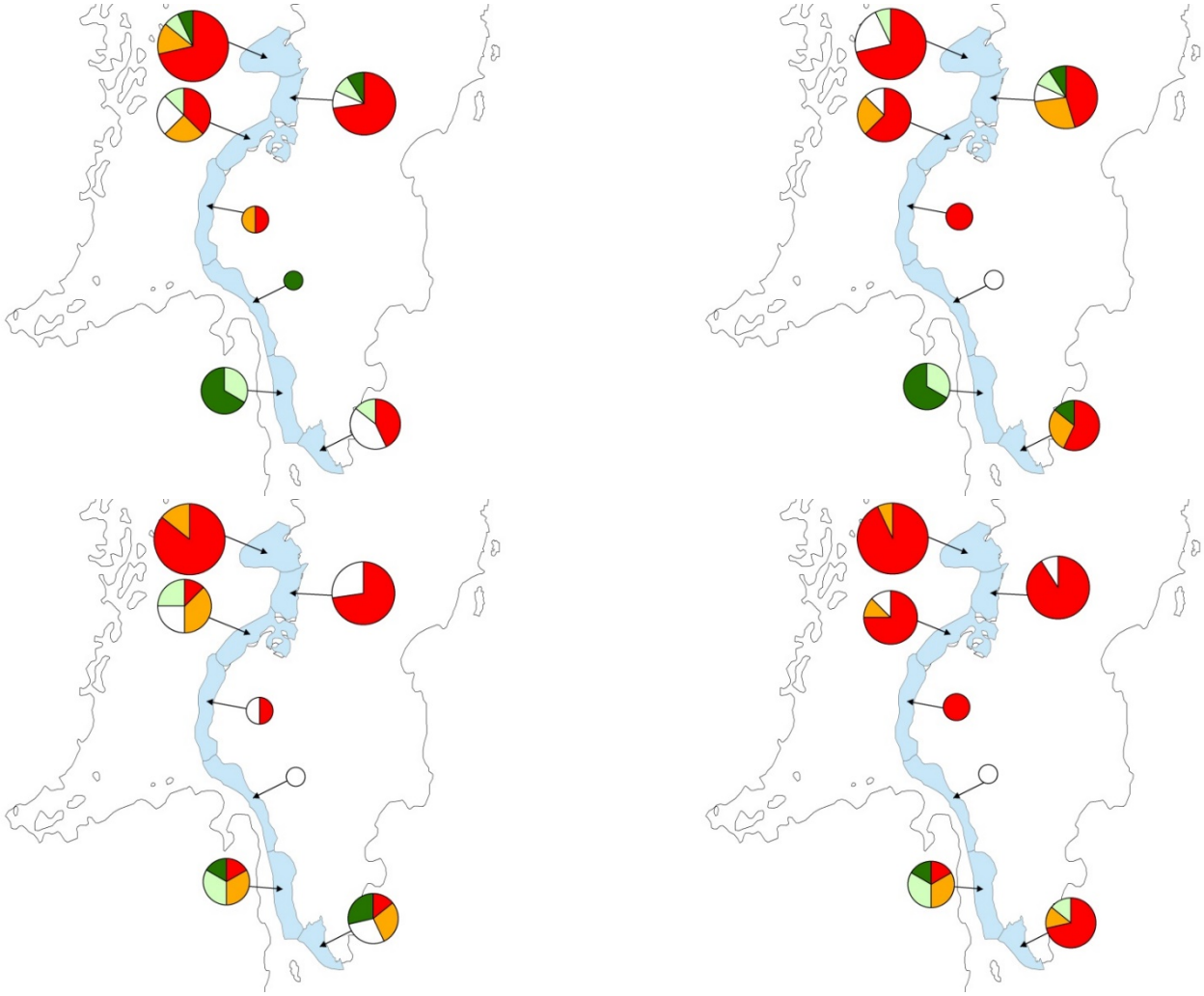


Figure 3.1.iv: Population trends of waterbirds within South-East Strangford Lough over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16). The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

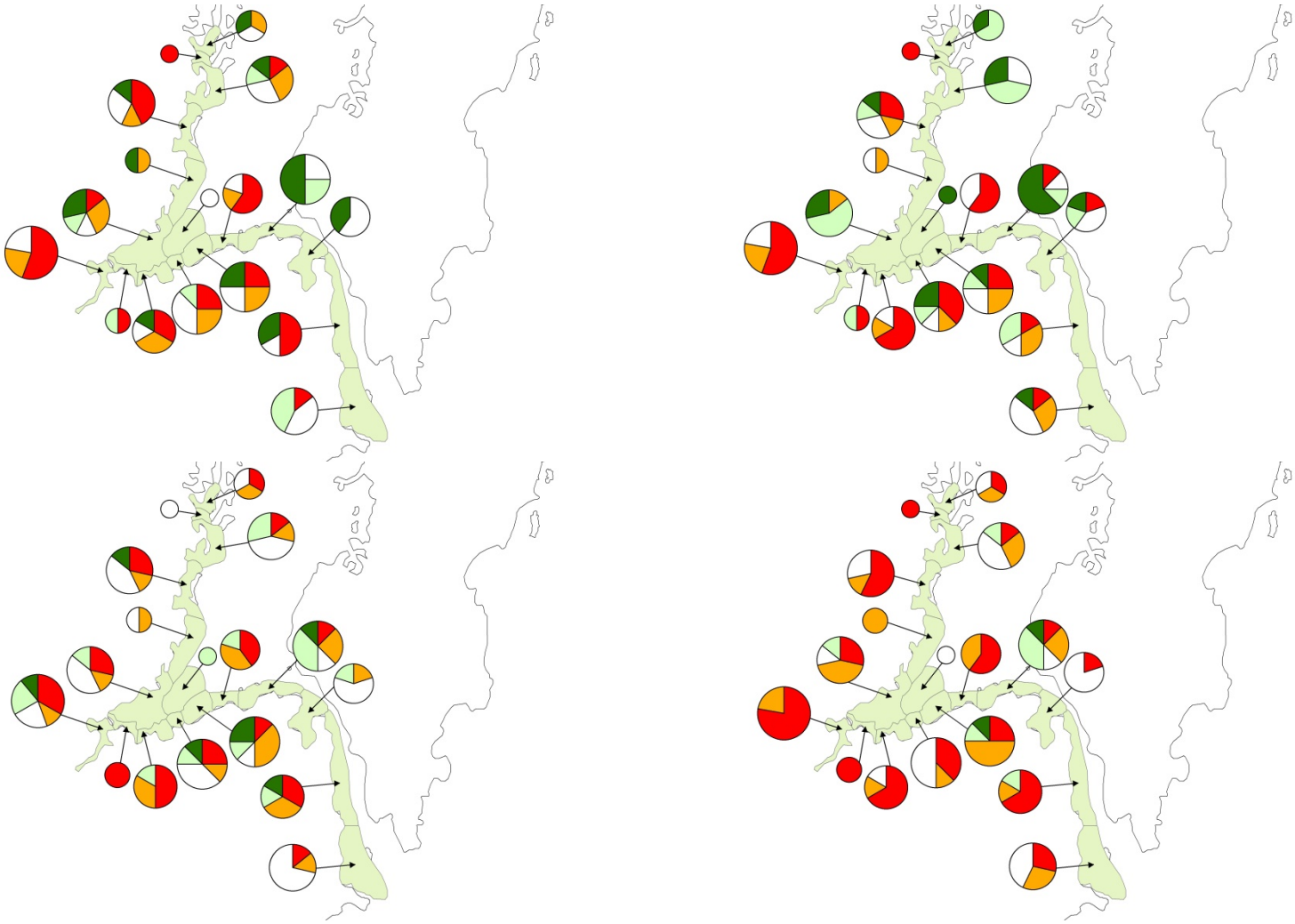


Figure 3.1.v: Population trends of waterbirds within South-East Strangford Lough over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16). The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

Table 8 Overview of population trends within low tide sectors in Strangford Lough. (A): Overview of population trends of wildfowl species within low-tide sectors BS001 to BS064 of Strangford Lough over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms.Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

Sector		Mute Swan			Light-bellied Brent Goose			Greylag Goose			Shelduck			Wigeon			Gadwall			Teal			Mallard			Pintail			Shoveler			Eider			Red-breasted Merganser			Goldeneye			Great Crested Grebe			Coot		
WeBS Code	Strangford Team Code	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
BS001	LTC A10 including Killard Point	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	x	Y	Z	x	o	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS006	LTC A20	-	-	-	o	y	z	-	-	-	-	-	-	-	-	-	-	-	-	o	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS007	LTC A30/1	-	-	-	X	M	o	-	-	-	-	-	-	o	M	z	o	M	L	x	Y	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS008	LTC A30/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS009	LTC A30/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS010	LTC A30/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS011	LTC A40/1	-	-	-	s	o	o	-	-	-	-	-	-	-	-	-	-	-	-	X	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS012	LTC A40/2	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS013	LTC A40/3	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS014	LTC A40/4	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS015	LTC A70	-	-	-	o	m	l	-	-	-	X	o	o	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS018	LTC A80	-	-	-	x	m	o	-	-	-	x	M	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS024	LTC A90	-	-	-	x	o	z	-	-	-	-	-	-	x	m	L	-	-	-	x	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS028	LTC B10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS029	LTC B40/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS030	LTC B40/3	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	X	y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS031	LTC B40/2 and 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS032	LTC B40/1	-	-	-	S	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS033	LTC B40/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS034	LTC B90/1 North of Dodds Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS035	LTC B90/2 South of Dodds Island	-	-	-	o	y	Z	-	-	-	-	-	-	-	-	-	-	-	-	o	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS036	LTC C10/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS037	LTC C10/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS038	LTC C10/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS039	LTC C10/4	-	-	-	x	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS040	LTC C10/5	-	-	-	S	M	o	-	-	-	-	-	-	-	-	-	-	-	-	x	o	o	x	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS041	LTC C20	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS042	LTC C30/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS043	LTC C30/2	-	-	-	o	m	o	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS044	LTC C30/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS047	LTC C40	-	-	-	o	m	o	-	-	-	o	o	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS051	LTC C50	-	-	-	x	M	l	-	-	-	o	Y	Z	x	o	l	-	-	-	x	Y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS052	LTC C60/1	-	-	-	o	y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS053	LTC C60/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS054	LTC C60/3	-	-	-	o	o	L	-	-	-	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS055	LTC C60/4	-	-	-	s	M	L	-	-	-	-	-	-	o	Y	Z	-	-	-	o	Y	Z	-	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS057	LTC C62/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS058	LTC C62/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS059	LTC C62/3	-	-	-	S	M	L	-	-	-	o	M	L	s	m	L	-	-	-	x	y	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS060	LTC C62/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS061	LTC C70/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS062	LTC C70/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS063	LTC C70/3	-	-	-	o	o	o	-	-	-	x	y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS064	LTC C70/4	o	o	l	s	o	l	-	-	-	S	M	L	o	o	l	-	-	-	x	o	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8 continued (B): Overview of population trends of wader species within low-tide sectors BS001 to BS064 of Strangford Lough over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

Sector		Oystercatcher			Ringed Plover			Golden Plover			Grey Plover			Lapwing			Dunlin			Knot			Black-tailed Godwit			Bar-tailed Godwit			Turnstone			Curlew			Greenshank			Redshank		
WeBS Code	Strangford Team Code	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
BS001	LTC A10 including Killard Point	o	o	z	x	o	L	S	o	L	-	-	-	o	o	L	o	o	l	-	-	-	-	-	-	-	-	-	o	m	o	o	o	l	-	-	-	s	o	l
BS006	LTC A20	o	o	o	-	-	-	s	M	L	-	-	-	S	M	L	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	o	o	L	-	-	-	o	o	o
BS007	LTC A30/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	l	-	-	-	S	M	L
BS008	LTC A30/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L
BS009	LTC A30/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS010	LTC A30/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS011	LTC A40/1	s	M	L	-	-	-	-	-	-	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	M	L
BS012	LTC A40/2	-	-	-	-	-	-	-	-	-	-	-	-	S	m	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS013	LTC A40/3	S	o	o	-	-	-	s	y	l	-	-	-	S	M	L	o	Y	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	o	L
BS014	LTC A40/4	o	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS015	LTC A70	x	o	o	-	-	-	o	Y	Z	-	-	-	-	-	-	s	y	Z	-	-	-	-	-	-	-	-	-	-	-	-	o	y	o	-	-	-	s	M	o
BS018	LTC A80	x	M	L	-	-	-	-	-	-	-	-	-	-	-	-	x	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	x	o	o	-	-	-	-	-	-
BS024	LTC A90	o	o	o	-	-	-	-	-	-	-	-	-	s	m	l	x	o	l	-	-	-	s	o	Z	-	-	-	-	-	-	x	Y	Z	-	-	-	o	y	Z
BS028	LTC B10	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	M	L
BS029	LTC B40/2	s	M	L	-	-	-	-	-	-	-	-	-	s	M	l	o	m	o	-	-	-	-	-	-	-	-	-	-	-	-	s	m	l	-	-	-	o	m	l
BS030	LTC B40/3	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS031	LTC B40/2 and 3	-	-	-	-	-	-	-	-	-	-	-	-	S	y	Z	s	m	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS032	LTC B40/1	o	y	o	-	-	-	-	-	-	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	Y	o	-	-	-	-	-	-
BS033	LTC B40/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	m	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS034	LTC B90/1 North of Dodds Island	s	o	o	-	-	-	-	-	-	-	-	-	-	-	-	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	s	m	o
BS035	LTC B90/2 South of Dodds Island	x	y	Z	-	-	-	o	M	Z	-	-	-	o	o	z	s	m	z	-	-	-	-	-	-	-	-	-	-	-	-	o	y	z	-	-	-	o	o	z
BS036	LTC C10/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L
BS037	LTC C10/2	-	-	-	-	-	-	-	-	-	-	-	-	s	y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS038	LTC C10/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS039	LTC C10/4	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS040	LTC C10/5	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	M	L	-	-	-	o	o	l
BS041	LTC C20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS042	LTC C30/1	x	o	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS043	LTC C30/2	s	o	o	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	S	M	l
BS044	LTC C30/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS047	LTC C40	s	o	l	-	-	-	-	-	-	-	-	-	-	-	-	o	Y	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	o	l
BS051	LTC C50	o	Y	z	-	-	-	-	-	-	-	-	-	o	o	o	X	y	z	-	-	-	-	-	-	-	-	-	-	-	-	o	o	L	-	-	-	o	o	o
BS052	LTC C60/1	-	-	-	-	-	-	X	o	L	-	-	-	s	M	L	x	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS053	LTC C60/2	o	m	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS054	LTC C60/3	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	L	-	-	-	s	M	L
BS055	LTC C60/4	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	S	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	s	M	l
BS057	LTC C62/1	s	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS058	LTC C62/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS059	LTC C62/3	o	o	o	-	-	-	o	m	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	o	o	-	-	-	-	-	-
BS060	LTC C62/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS061	LTC C70/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS062	LTC C70/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS063	LTC C70/3	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS064	LTC C70/4	-	-	-	-	-	-	-	-	-	-	-	-	o	m	L	S	M	L	-	-	-	S	m	Z	-	-	-	-	-	-	s	M	L	-	-	-	s	M	L

Table 8 continued (C): Overview of population trends of wildfowl species within low-tide sectors BS065 to BS124 of Strangford Lough over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms.Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

Sector		Mute Swan			Light-bellied Brent Goose			Greylag Goose			Shelduck			Wigeon			Gadwall			Teal			Mallard			Pintail			Shoveler			Eider			Red-breasted Merganser			Goldeneye			Great Crested Grebe			Coot		
WeBS Code	Strangford Team Code	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
BS065	LTC C80/1	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS066	LTC C80/2	-	-	-	X	Y	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS067	LTC C80/3	-	-	-	s	o	l	-	-	-	X	y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS068	LTC C90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS069	LTC D10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS070	LTC D20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS074	LTC D30	-	-	-	X	Y	Z	-	-	-	o	m	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS075	LTC D40/1 North of X-Is	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS076	LTC D40/2 X-is	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS077	LTC D40/3 Duck Rock/Reagh Point	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS078	LTC D50	-	-	-	x	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS079	LTC D60	-	-	-	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS082	LTC D70	-	-	-	s	M	L	-	-	-	x	o	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	y	Z	-	-	-	-	-	-	-	-	-	-	-	-
BS085	LTC D80/1 whole	-	-	-	s	o	l	-	-	-	X	o	z	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS088	LTC D80/2 whole	-	-	-	x	o	L	-	-	-	x	M	o	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	Y	-	-	-	-	-	-	-	-	-	-	-	-
BS089	LTC D90/1	-	-	-	x	M	L	-	-	-	o	M	L	o	M	L	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS093	LTC D90/2	-	-	-	S	m	L	-	-	-	o	y	z	o	o	l	-	-	-	X	Y	Z	-	-	-	-	-	-	x	o	o	o	m	Z	-	-	-	-	-	-	-	-	-	-	-	-
BS094	LTC E20/1	-	-	-	s	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS095	LTC E20/2	-	-	-	S	o	L	-	-	-	x	m	o	o	o	L	-	-	-	o	M	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS096	LTC 96	-	-	-	S	M	L	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS097	LTC E30	-	-	-	x	Y	Z	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS101	LTC E60/1	-	-	-	s	o	l	-	-	-	S	y	L	-	-	-	-	-	-	-	-	-	-	-	-	o	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS102	LTC E60/2	-	-	-	S	m	l	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	X	y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS103	LTC E60/3	-	-	-	o	y	o	-	-	-	x	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	X	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS104	LTC E60/4	-	-	-	S	y	o	-	-	-	x	M	o	-	-	-	-	-	-	-	-	-	-	-	-	X	y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS105	LTC E60/5	-	-	-	S	M	L	-	-	-	o	M	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS106	LTC E60/6	-	-	-	S	M	L	-	-	-	o	M	l	-	-	-	-	-	-	-	-	-	-	-	-	X	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS107	LTC E60/7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS108	LTC E60/8	-	-	-	S	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS109	LTC E70/1	-	-	-	S	o	L	-	-	-	x	M	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS110	LTC E70/2	-	-	-	S	o	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS111	LTC E70/3	-	-	-	S	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS113	LTC E80/1	-	-	-	S	M	L	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS114	LTC E80/2	-	-	-	S	y	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS115	LTC E80/3	-	-	-	S	M	L	-	-	-	x	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS117	LTC E90/1	-	-	-	S	M	L	-	-	-	s	Y	Z	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS118	LTC E90/2	-	-	-	S	M	L	-	-	-	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS119	LTC E90/3	-	-	-	S	M	L	-	-	-	o	m	z	x	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS120	LTC F20/4	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS121	LTC F20/5	-	-	-	s	M	L	S	y	z	-	-	-	s	M	o	-	-	-	o	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS122	LTC F20/6	-	-	-	S	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS123	LTC F20/7	-	-	-	S	m	L	S	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS124	LTC F20/8	-	-	-	s	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8 continued (D): Overview of population trends of wader species within low-tide sectors BS065 to BS124 of Strangford Lough over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

Sector		Oystercatcher			Ringed Plover			Golden Plover			Grey Plover			Lapwing			Dunlin			Knot			Black-tailed Godwit			Bar-tailed Godwit			Turnstone			Curlew			Greenshank			Redshank		
WeBS Code	Strangford Team Code	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
BS065	LTC C80/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o
BS066	LTC C80/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	m	l
BS067	LTC C80/3	x	m	Z	-	-	-	-	-	-	-	-	-	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	-	-	-
BS068	LTC C90	x	y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS069	LTC D10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS070	LTC D20	o	o	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS074	LTC D30	o	o	o	-	-	-	s	Y	Z	-	-	-	-	-	-	X	Y	Z	-	-	-	x	Y	Z	-	-	-	-	-	-	o	y	o	-	-	-	o	y	o
BS075	LTC D40/1 North of X-ls	X	o	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS076	LTC D40/2 X-is	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS077	LTC D40/3 Duck Rock/Reagh Point	S	y	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS078	LTC D50	s	m	L	-	-	-	X	-	Z	-	-	-	-	-	-	S	Y	Z	S	M	L	-	-	-	x	y	o	-	-	-	-	-	-	-	-	-	x	m	l
BS079	LTC D60	s	m	l	-	-	-	-	-	-	-	-	-	S	M	L	s	Y	L	o	m	L	-	-	-	s	y	L	-	-	-	-	-	-	-	-	-	o	M	L
BS082	LTC D70	s	m	o	-	-	-	-	-	-	-	-	-	o	Y	L	o	o	l	o	Y	l	-	-	-	S	m	L	-	-	-	o	m	o	-	-	-	o	M	L
BS085	LTC D80/1 whole	S	M	L	-	-	-	-	-	-	-	-	-	S	m	l	o	m	o	S	M	L	-	-	-	o	Y	L	-	-	-	o	o	o	-	-	-	s	m	l
BS088	LTC D80/2 whole	s	o	o	-	-	-	-	-	-	-	-	-	X	y	Z	o	m	o	S	o	L	-	-	-	o	y	o	-	-	-	x	o	o	-	-	-	s	m	l
BS089	LTC D90/1	X	M	L	-	-	-	s	M	L	-	-	-	s	M	L	X	Y	o	-	-	-	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L
BS093	LTC D90/2	s	m	L	-	-	-	S	m	L	o	M	L	o	m	o	o	o	o	S	M	L	S	m	z	o	Y	L	-	-	-	o	o	o	-	-	-	o	M	L
BS094	LTC E20/1	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	s	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS095	LTC E20/2	s	o	o	-	-	-	x	m	Z	-	-	-	s	M	l	X	m	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L
BS096	LTC 96	s	M	l	-	-	-	o	M	l	-	-	-	s	m	L	o	m	l	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	l
BS097	LTC E30	o	M	L	o	m	L	s	Y	o	-	-	-	x	Y	-	o	o	o	S	M	L	-	-	-	-	-	-	-	-	-	s	M	L	-	-	-	o	M	l
BS101	LTC E60/1	-	-	-	-	-	-	S	M	Z	-	-	-	o	M	o	-	-	-	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	o	Z
BS102	LTC E60/2	S	o	Z	-	-	-	S	M	L	-	-	-	S	M	l	S	y	Z	S	M	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	Z
BS103	LTC E60/3	o	Y	Z	-	-	-	-	-	-	-	-	-	S	m	o	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS104	LTC E60/4	X	y	Z	-	-	-	-	-	-	-	-	-	-	-	-	X	Y	-	o	M	L	-	-	-	-	-	-	-	-	-	X	Y	Z	-	-	-	X	o	Z
BS105	LTC E60/5	S	o	Z	-	-	-	x	m	L	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS106	LTC E60/6	s	o	Z	-	-	-	-	-	-	-	-	-	-	-	-	X	Y	Z	S	M	o	-	-	-	X	Y	Z	-	-	-	X	Y	Z	-	-	-	x	y	Z
BS107	LTC E60/7	o	o	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS108	LTC E60/8	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	X	Y	Z	x	M	Z	-	-	-	X	Y	Z	-	-	-	x	m	Z	-	-	-	x	y	Z
BS109	LTC E70/1	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	X	m	Z	-	-	-	-	-	-	X	o	Z	-	-	-	-	-	-	-	-	-	x	M	l
BS110	LTC E70/2	S	o	l	-	-	-	-	-	-	-	-	-	o	Y	Z	X	M	z	-	-	-	-	-	-	o	M	L	-	-	-	X	Y	Z	-	-	-	o	m	o
BS111	LTC E70/3	o	o	o	-	-	-	-	-	-	-	-	-	o	o	Z	S	Y	Z	-	-	-	-	-	-	s	y	o	-	-	-	s	y	z	-	-	-	o	Y	Z
BS113	LTC E80/1	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	S	o	o	-	-	-	-	-	-	-	-	-	-	-	-	s	o	Z	-	-	-	s	m	o
BS114	LTC E80/2	x	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	z
BS115	LTC E80/3	x	o	o	-	-	-	-	-	-	-	-	-	-	-	-	X	M	L	-	-	-	-	-	-	o	y	z	-	-	-	-	-	-	-	-	-	X	o	z
BS117	LTC E90/1	s	m	L	-	-	-	x	m	o	-	-	-	S	m	L	s	o	L	x	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS118	LTC E90/2	s	m	L	-	-	-	-	-	-	-	-	-	S	y	o	X	M	L	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L
BS119	LTC E90/3	s	m	l	-	-	-	x	M	Z	-	-	-	S	m	l	o	o	o	S	y	L	-	-	-	-	-	-	-	-	-	o	m	z	-	-	-	s	M	L
BS120	LTC F20/4	s	m	L	-	-	-	o	Y	Z	-	-	-	s	y	z	-	-	-	x	m	-	-	-	-	-	-	-	-	-	-	o	y	Z	-	-	-	-	-	-
BS121	LTC F20/5	s	o	z	-	-	-	X	M	Z	-	-	-	s	M	o	o	y	Z	o	M	-	-	-	-	-	-	-	-	-	-	o	o	Z	-	-	-	s	o	o
BS122	LTC F20/6	s	y	o	-	-	-	-	-	-	-	-	-	-	M	L	S	y	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	z
BS123	LTC F20/7	s	y	L	-	-	-	-	-	-	-	-	-	-	-	-	o	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	o	L
BS124	LTC F20/8	s	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8 continued (E): Overview of population trends of wildfowl species within low-tide sectors BS125 to BS183 of Strangford Lough over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

Sector		Mute Swan			Light-bellied Brent Goose			Greylag Goose			Shelduck			Wigeon			Gadwall			Teal			Mallard			Pintail			Shoveler			Eider			Red-breasted Merganser			Goldeneye			Great Crested Grebe			Coot		
WeBS Code	Strangford Team Code	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
BS125	LTC F20/9	-	-	-	S	M	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS126	LTC F20/10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS127	LTC F20/11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS128	LTC F30/1	-	-	-	S	m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS129	LTC F30/2	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS130	LTC F30/3	-	-	-	S	M	L	-	-	-	o	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS131	LTC F30/4	-	-	-	s	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS132	LTC F50	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS140	LTC F60	-	-	-	S	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS143	LTC F70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS144	LTC F80/1 Drs Bay	-	-	-	s	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS145	LTC F80/2 Horse Island	-	-	-	o	o	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS146	LTC F80 Whole	-	-	-	X	o	o	-	-	-	-	-	-	-	-	-	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS149	LTC G10/1 and 2 combined	-	-	-	o	Y	o	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS152	LTC G10/3 and 4 combined	-	-	-	o	M	L	-	-	-	o	M	L	x	o	l	-	-	-	o	Y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS155	LTC G10/5 and 6 combined	-	-	-	o	m	L	-	-	-	x	M	L	S	M	L	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS156	LTC G20/1	-	-	-	o	y	L	-	-	-	-	-	-	-	-	-	-	-	-	x	y	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS157	LTC G20/2	-	-	-	o	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	s	Y	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS158	LTC G20/3	-	-	-	s	M	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS159	LTC G20 whole	-	-	-	o	m	L	-	-	-	o	m	l	-	-	-	-	-	-	x	o	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS160	LTC G30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS161	LTC G40 whole	-	-	-	o	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS163	LTC G40A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS164	LTC G40B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS165	LTC G40C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS166	LTC G50 Granaugh Bay	-	-	-	x	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	x	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS167	LTC G60 Bar Hall Bay	-	-	-	o	o	z	-	-	-	-	-	-	-	-	-	-	-	-	s	M	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS168	LTC 168	-	-	-	S	m	L	-	-	-	o	m	l	-	-	-	-	-	-	s	o	o	-	-	-	X	o	Z	-	-	-	s	o	Z	o	M	o	-	-	-	-	-	-	-	-	-
BS170	LTC APOINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS171	LTC E70	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-
BS172	LTC E80	-	-	-	S	M	L	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-
BS173	LTC E40/N	-	-	-	s	M	L	-	-	-	X	o	o	-	-	-	-	-	-	-	-	-	-	-	-	X	y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS174	LTC E40/C	-	-	-	S	M	L	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS175	LTC E40/S	-	-	-	S	M	L	-	-	-	o	M	l	-	-	-	-	-	-	x	m	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS176	LTC E40/2	-	-	-	o	o	o	-	-	-	x	M	o	-	-	-	-	-	-	-	-	-	-	-	-	x	o	Z	-	-	-	X	o	Z	-	-	-	-	-	-	-	-	-	-	-	-
BS178	LTC A40/3 and A40/4 combined	-	-	-	s	M	L	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS179	LTC C30/2 and C30/3 combined	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	s	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS180	Low Tide Sector E60/5 and 6 combined	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS181	Low Tide Sector E60/7 and 8 combined	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS182	Low Tide Sector E60/3 and 4 combined	-	-	-	s	M	L	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS183	LTC G10/1 to G10/4 combined	-	-	-	s	M	L	-	-	-	o	M	l	o	M	L	-	-	-	o	o	z	s	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8 continued (F): Overview of population trends of wader species within low-tide sectors BS125 to BS183 of Strangford Lough over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms. Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%; Grey – insufficient data.

Sector		Oystercatcher			Ringed Plover			Golden Plover			Grey Plover			Lapwing			Dunlin			Knot			Black-tailed Godwit			Bar-tailed Godwit			Turnstone			Curlew			Greenshank			Redshank		
WeBS Code	Strangford Team Code	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
BS125	LTC F20/9	s	y	z	-	-	-	X	m	Z	-	-	-	s	o	z	s	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	o	Z
BS126	LTC F20/10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS127	LTC F20/11	s	y	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS128	LTC F30/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS129	LTC F30/2	o	M	l	-	-	-	-	-	-	-	-	-	-	-	-	x	m	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS130	LTC F30/3	o	M	l	X	M	o	x	Y	L	-	-	-	-	-	-	o	m	Z	-	-	-	-	-	-	o	o	z	-	-	-	-	-	-	-	-	-	-
BS131	LTC F30/4	o	m	L	-	-	-	x	Y	L	-	-	-	-	-	-	o	m	l	-	-	-	-	-	-	o	o	Z	-	-	-	-	-	-	-	-	-	-
BS132	LTC F50	x	o	z	-	-	-	-	-	-	-	-	-	X	Y	Z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS140	LTC F60	o	m	l	-	-	-	-	-	-	-	-	-	S	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	y	o	-	-	-	-
BS143	LTC F70	x	y	z	o	o	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	y	Z	-	-	-	-	-	-	-	x	o	z
BS144	LTC F80/1 Drs Bay	s	m	l	-	-	-	o	M	L	-	-	-	s	m	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS145	LTC F80/2 Horse Island	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	o	Z	-	-	-	-	-	-	-	s	M	L
BS146	LTC F80 Whole	o	o	o	-	-	-	-	-	-	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	o	-	-	-	x	o	o
BS149	LTC G10/1 and 2 combined	-	-	-	-	-	-	X	o	o	-	-	-	o	y	o	s	Y	z	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	s	M	L
BS152	LTC G10/3 and 4 combined	s	M	L	-	-	-	-	-	-	-	-	-	o	M	l	s	o	z	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	M	L
BS155	LTC G10/5 and 6 combined	o	y	z	-	-	-	s	M	l	-	-	-	o	o	o	x	o	o	S	o	L	-	-	-	S	Y	z	-	-	-	S	M	L	-	-	-	S	M	L
BS156	LTC G20/1	-	-	-	-	-	-	x	y	Z	-	-	-	s	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	L	-	-	-	o	m	L
BS157	LTC G20/2	s	M	L	-	-	-	-	-	-	-	-	-	S	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L
BS158	LTC G20/3	s	M	L	-	-	-	-	-	-	-	-	-	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	M	L
BS159	LTC G20 whole	s	m	l	-	-	-	S	M	L	-	-	-	s	M	L	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-	o	o	l	-	-	-	s	M	L
BS160	LTC G30	o	M	l	-	-	-	-	-	-	-	-	-	X	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS161	LTC G40 whole	o	o	o	-	-	-	-	-	-	-	-	-	S	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	y	o
BS163	LTC G40A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS164	LTC G40B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS165	LTC G40C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS166	LTC G50 Granaugh Bay	o	o	o	-	-	-	o	o	Z	-	-	-	s	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	y	o	-	-	-	-	-	-
BS167	LTC G60 Bar Hall Bay	o	M	l	-	-	-	o	m	z	-	-	-	s	m	l	S	m	z	-	-	-	-	-	-	-	-	-	-	-	-	o	m	L	-	-	-	s	M	L
BS168	LTC 168	s	m	l	-	-	-	-	-	-	-	-	-	s	M	L	o	M	o	S	M	L	-	-	-	o	o	l	-	-	-	s	m	l	-	-	-	s	M	L
BS170	LTC APOINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	s	M	L
BS171	LTC E70	s	m	L	-	-	-	o	M	L	-	-	-	s	M	l	o	m	o	-	-	-	-	-	-	o	o	l	-	-	-	s	m	l	-	-	-	o	M	l
BS172	LTC E80	s	M	l	o	o	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	s	M	L
BS173	LTC E40/N	X	y	Z	-	-	-	X	m	z	-	-	-	X	m	l	o	M	o	X	y	Z	-	-	-	-	-	-	-	-	-	x	m	o	-	-	-	X	m	l
BS174	LTC E40/C	S	M	l	-	-	-	X	Y	Z	-	-	-	X	m	l	X	Y	o	-	-	-	-	-	-	-	-	-	-	-	-	s	M	L	-	-	-	s	M	L
BS175	LTC E40/S	x	m	o	-	-	-	-	-	-	-	-	-	X	y	z	o	M	L	S	M	L	-	-	-	-	-	-	-	-	-	S	M	L	-	-	-	S	M	L
BS176	LTC E40/2	s	M	L	-	-	-	S	M	L	-	-	-	S	o	-	s	M	l	S	M	L	-	-	-	o	o	L	-	-	-	o	o	o	-	-	-	o	o	o
BS178	LTC A40/3 and A40/4 combined	s	m	l	-	-	-	o	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	l	-	-	-	-	-	-	-	-	-	s	M	L
BS179	LTC C30/2 and C30/3 combined	s	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o	l	-	-	-	-	-	-
BS180	Low Tide Sector E60/5 and 6 combined	s	m	l	o	o	L	-	-	-	-	-	-	o	M	l	o	m	o	S	M	L	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	s	M	L
BS181	Low Tide Sector E60/7 and 8 combined	s	m	l	o	o	L	-	-	-	-	-	-	-	-	-	o	m	o	S	M	L	-	-	-	o	o	o	-	-	-	s	m	l	-	-	-	s	M	L
BS182	Low Tide Sector E60/3 and 4 combined	s	m	l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	o	M	L
BS183	LTC G10/1 to G10/4 combined	s	M	L	-	-	-	-	-	-	-	-	-	S	M	L	o	m	o	S	M	L	-	-	-	-	-	-	-	-	-	o	m	l	-	-	-	s	M	L

4. Discussion and conclusions

4.1 Species trends - Carlingford Lough

4.1.1 Light-bellied Brent Goose *Branta bernicla hrota*

Overwintering numbers of Light-bellied Brent Geese have increased over the short- and long-term in Carlingford Lough. Although they occur in insufficient numbers to generate trends on four sectors of the lough, Light-bellied Brent Geese appear to be doing well on all other sectors, and no sectors saw a decrease in numbers. In particular, numbers increased substantially at the short-, medium- and long-term on Omeath to Ballagan Point (01909), Omeath to Greenore (01408) and Greenore to Ballagan Point (01908). The long-term trend in Mill Bay (01417) increased by over 100%, and in particular peak and mean counts increased in 2016/2017. Light-bellied Brent Geese have only been counted on Carlingford to Greenore (01419) since 2009/2010, but have increased dramatically on the sector since then. Five-year mean peaks were highest for Light-bellied Brent Geese on Omeath to Ballagan Point (01909), Omeath to Greenore (01408), Greenore to Ballagan Point (01908) and Mill Bay (01417), each containing a mean count at over the last five winters (2012/13 – 2016/17) that was at least 20% of the total mean peak counts for Carlingford Lough over the same period.

4.1.2 Greylag Goose *Anser anser*

No Greylag Geese have been recorded in Carlingford Lough during WeBS counts since 1999/2000, when six were recorded.

4.1.3 Mute Swan *Cygnus olor*

There were insufficient data to generate short, medium or long-term trends for Mute Swans in the sectors of Carlingford Lough. The highest count for this species occurred in the 2003/2004 winter, consisting of 50 individuals. In the past five winters (2012/13 to 2016/17), Mute Swans were only recorded on site in 2014/2015, when there were 16 individuals. Rostrevor to Newry (01907) and Warren Point to Newry (01906) both had a mean of peak count over the last five winters that was between 10% and 20% of the total mean of peak count for the lough over the same period, making these the most important sectors for Mute Swan in Carlingford Lough. However, no sectors had a peak count in the latest year higher than 10% of the total peak count of Carlingford Lough for the latest year (2016/17).

4.1.4 Common Shelduck *Tadorna tadorna*

Numbers of wintering Shelduck have declined across Northern Ireland as a whole, but have also dropped dramatically in Carlingford Lough, leading to the proportion of the Northern Ireland total held in the lough declining from around 8% to 1-2% in the last five years. In the three sectors with sufficient Shelduck for analysis, Rostrevor to Newry (01907) and Warren Point to Newry (01906) both had short-, medium- and long-term declines of over 50%. In Mill Bay, the short-term trend was stable, but declines occurred in the medium- and long-term. These three sectors were the most important in the lough when considering the five-year peaks, each containing at least 20% of the total mean peak counts for Carlingford Lough over the last five winters (2012/13 – 2016/17). In the

winter of 2016/2017 the peak count in Mill Bay was at least 20% of the total peak count for the lough.

4.1.5 Northern Shoveler *Spatula clypeata*

No Shoveler have been recorded during WeBS counts in Carlingford Lough since 2004/2005, when one was recorded.

4.1.6 Gadwall *Mareca strepera*

No Gadwall have been recorded during WeBS counts in Carlingford Lough since 2005/2006, when two were recorded.

4.1.7 Eurasian Wigeon *Mareca penelope*

Wigeon appeared to thrive on Carlingford Lough during the period of analysis, with the overall site generally seeing an increase at the short- and long-terms. Omeath to Ballagan Point (01909), Omeath to Greenore (01408), Carlingford to Greenore (01419) and Mill Bay (01417) all experienced short-term increases of over 100%. These sites also supported at least 20% of the total mean peak counts for Carlingford Lough over the last five winters (2012/13 – 2016/17) and had peak counts in the winter of 2016/2017 that were over 20% of the total peak count for the lough in that winter.

4.1.8 Mallard *Anas platyrhynchos*

While winter numbers of Mallard are in decline across Northern Ireland as a whole, Mallard are increasing across Carlingford Lough, and the proportion of the Northern Irish total occurring on Carlingford Lough has increased from 1 or 2% to around 5% in the most recent five years. In particular Rostrevor to Newry (01907, including Warren Point to Newry (01906)), Omeath to Ballagan Point (01909, including Omeath to Greenore (01408)) and Mill Bay (01407) showed increases of over 100% in the short-, medium- and long-term. The most important sectors in the lough in terms of both five-year mean peaks and mean winter peaks are Rostrevor to Newry, particularly the sub-sector Warren Point to Newry, and Mill Bay, which hold over 20% of Mallard in Carlingford Lough for these metrics.

4.1.9 Northern Pintail *Anas acuta*

No Pintail have been recorded during WeBS counts in Carlingford Lough since 2008/2009, when three were recorded.

4.1.10 Eurasian Teal *Anas crecca*

There is a mixed picture for Teal on Carlingford Lough. The species has undergone a decline in numbers of between 25% and 50% in the short term, and of over 50% in the medium term. Rostrevor to Newry (01907) previously held around 95% of the site total of Teal up until 2011/2012 (almost all of these within the Warren Point to Newry (01906) sub-sector), after which there was crash which bottomed out at less than 60% and has since partially recovered (Figure 4.1.10). However, numbers have grown by over 100% in Omeath to Ballagan Point (01909), Omeath to Greenore (01408) and Omeath to Carlingford (01418) over all time scales. Numbers also increased dramatically in Mill Bay (01407) between the winters of 2012/2013 and 2014/2015, but have since

dropped. The most important sector in the lough in terms of five-year mean peaks and winter peaks are Rostrevor to Newry, particularly including the sub-sector Warren Point to Newry.

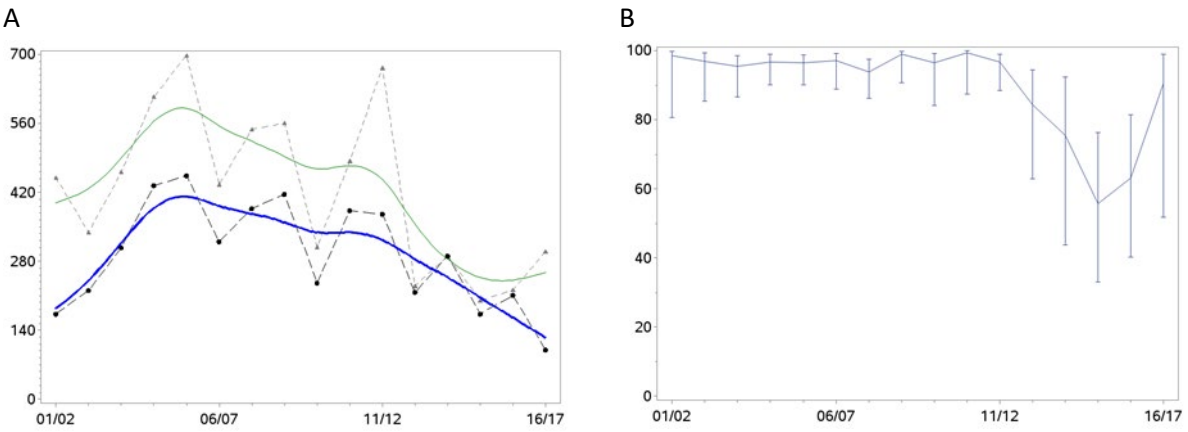


Figure 4.1.10: A: The trend in the number of Teal on Rostrevor to Newry, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Teal on Carlingford Lough that have been recorded on the Rostrevor to Newry count sector between the winters of 2001/2002 and 2016/2017.

4.1.11 Common Eider *Somateria mollissima*

Insufficient Eider were counted on Carlingford Lough for analysis. Four individuals were counted annually between the winters of 2014/2015 and 2016/2017.

4.1.12 Common Goldeneye *Bucephala clangula*

Goldeneye have undergone a dramatic decline in numbers on Carlingford Lough, reflecting a Northern Ireland-wide decline. Just four were recorded in 2016/2017, down from a high of 163 in 2000/2011. Prior to numbers dropping to between zero and four individuals on the lough (since 2012/2013), around 50% of the lough's population was recorded in Rostrevor to Warren Point (01910) and it is this sector and hence its parent, Rostrevor to Newry (01907) that have seen declines of at least 50% across all time scales. No sectors held over 10% of the total mean peak counts for the lough over the last five winters (2012/2013 – 2016/2017). Rostrevor to Newry, including Rostrevor to Warren Point had mean peak counts in the winter of 2016/2017 that were over 20% of the total peak count for the lough in that winter, but as mentioned the numbers counted were negligible (four).

4.1.13 Red-breasted Merganser *Mergus serrator*

There were insufficient data to generate short, medium or long-term trends for Red-breasted Mergansers in the sectors of Carlingford Lough, although across the lough as a whole the species underwent a slight increase in the short-term. The highest count for this species occurred in the 2006/2007 winter, and consisted of 171 individuals. Rostrevor to Newry (01907, including Rostrevor to Warren Point (01910)), Omeath to Ballagan Point (01909, including Omeath to Greenore (01408) and Greenore to Ballagan Point (01908)) and Mill Bay (01407) all held pop had five-year mean peaks that were over 20% of the total mean of peak count for the lough over the same period, making

these the most important sectors for Red-breasted Merganser in Carlingford Lough. Rostrevor to Newry, including Rostrevor to Warren Point had mean peak counts in the winter of 2016/2017 that were over 20% of the total peak count for the lough in that winter.

4.1.14 Great Crested Grebe *Podiceps cristatus*

Numbers of Great Crested Grebes have been declining throughout Northern Ireland, and this is reflected in the drop in numbers in Carlingford Lough. Rostrevor to Newry (01907, including Rostrevor to Warren Point (01910)) and Omeath to Ballagan Point (01909, including Omeath to Greenore (01408)) have declined by 50% or more over all time scales. This is particularly concerning in Rostrevor to Newry, which formerly held 70-90% of the Great Crested Grebes in the lough. Rostrevor to Newry, and in particular the sub-sector Rostrevor to Warren Point had five-year mean peaks that were over 20% of the total mean of peak count for the lough over the same period, and had mean peak counts in the winter of 2016/2017 that were over 20% of the total peak count for the lough in that winter.

4.1.15 Eurasian Coot *Fulica atra*

No Coot have been recorded during WeBS counts in Carlingford Lough during the period of study.

4.1.16 Eurasian Oystercatcher *Haematopus ostralegus*

Oystercatchers have declined in Carlingford Lough between 25%- 50% in the medium- and long-term, and this is also reflected in the trend for the majority of sectors and at the country level. In the short-term, there has been no significant change in the number of Oystercatcher within the lough as a whole, however there have been significant increases and decreases in different sectors, suggesting a redistribution. For example, numbers in Rostrevor to Newry (01907, including Rostrevor to Warren Point (01910)) have declined by over 50% in the short term, whereas numbers in Warren Point to Newry (01906), also within the parent sector Rostrevor to Newry have increased moderately. Other sectors have increased by over 100% in the short term: Omeath to Ballagan Point (01909, including Omeath to Greenore (01408), Omeath to Carlingford (01418) and Carlingford to Greenore (01419)). Examining the trend plots for two contrasting sectors in Carlingford Lough (Figure 4.1.16Figure), both sectors appear to be increasing in the number of Oystercatcher. Although both Rostrevor to Newry and Omeath to Ballagan Point both appear to have had a recent increase, the increase has been going on for longer in Omeath to Ballagan Point, whereas there has been a steep decline within the last five winters on Rostrevor to Newry followed by a more recent recovery, explaining the difference in trends. It is interesting however that both sectors experienced a steep decline, but the decline was later and steeper in Rostrevor to Newry than in Omeath to Ballagan Point, which may possibly reflect an environmental cause.

The only sectors in the lough not to hold five-year mean peaks that were over 10% of the total mean of peak count of Oystercatchers for the lough were Warren Point to Newry (01906) and Killowen (01911).

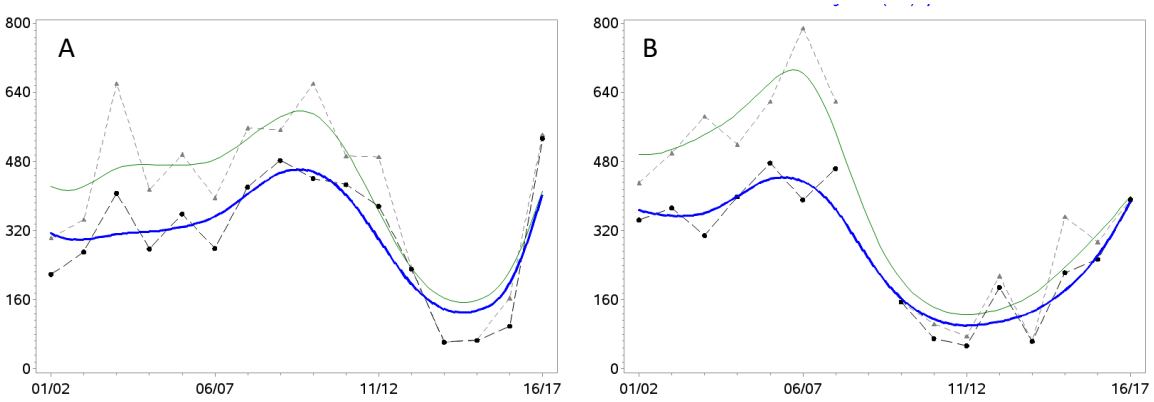


Figure 4.1.16: A: The trend in the number of Oystercatchers on the Rostrevor to Newry sector, Carlingford Lough. B: The trend in the number of Oystercatchers on the Omeath to Ballagan Point sector, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.1.17 Northern Lapwing *Vanellus vanellus*

Lapwing have significantly increased in number at across all time scales in Carlingford Lough, and have also increased in all sectors except for Mill Bay (01407), which remained stable, Killowen (01911), where there were insufficient birds to create a trend, and Rostrevor to Warren Point (01910), where there were declines at all time scales, contrary to the trend of the lough. However, declines were in small numbers of birds compared with increases in Omeath to Ballagan Point (01909) for example (Figure 14.1.17), and therefore had little impact on the trend for the lough as a whole. Rostrevor to Newry (01907, including Warren Point to Newry (01906)), Omeath to Ballagan Point (including Omeath to Greenore (01408) and Carlingford to Greenore (01419)) and Mill Bay all had mean peak counts over the last five winters (2012/13 – 2016/17) that were at least 20% of the total mean peak counts for Carlingford Lough, making these sites the most significant for Lapwing in Carlingford Lough. All sectors but Killowen (01911) and Rostrevor to Warren Point (01910) had peak counts in winter 2016/2017 that were over 10% of the total peak count for Carlingford Lough in the same year.

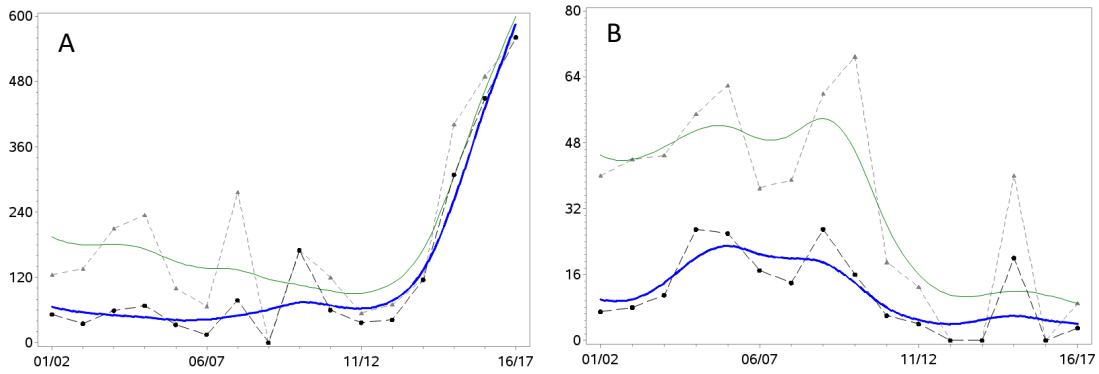


Figure 4.1.17: A: The trend in the number of Lapwing on the Omeath to Ballagan Point sector, Carlingford Lough. B: The trend in the number of Lapwing on the Rostrevor to Warren Point sector, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.1.18 European Golden Plover *Pluvialis apricaria*

Wintering Golden Plover have recently increased in Carlingford Lough, bucking the Northern Ireland trend, which has been generally decreasing since 2005/2006. The majority of the Golden Plover counted in Carlingford Lough are found in Omeath to Ballagan Point (01909, including Omeath to Greenore (01408) and Carlingford to Greenore (01419)) and Mill Bay (01407). However, only Omeath to Ballagan Point has sufficient data to generate a trend, which shows increases of over 100% over all time scales. Omeath to Ballagan Point (including Omeath to Greenore and Carlingford to Greenore) had mean peak counts in the winter of 2016/2017 that were over 20% of the total peak count for the lough in that winter.

4.1.19 Grey Plover *Pluvialis squatarola*

Grey Plover have been declining steadily across Northern Ireland and few Grey Plover have been counted in Carlingford Lough since 2008/2009. Prior to the winter of 2010/2011, Mill Bay (01407) supported around 90% of the Grey Plover of Carlingford Lough (although numbers were small: between 12 and 35 individuals), and since their numbers have been much lower, but stable. This is reflected in the trends, which show medium- and long-term declines for Grey Plover in Mill Bay, but stability over the short-term. The winter of 2016/2017 count of Grey Plover for Carlingford Lough was 21 individuals; therefore small increases in Mill Bay and Omeath to Ballagan Point (01909) and the sub-sectors within this in the short-term have led to the trend showing a significant increase in the lough as a whole.

4.1.20 Common Ringed Plover *Charadrius hiaticula*

Ringed Plover have declined by at least 50% over the medium- and long-term in Carlingford Lough, but have recently stabilised, following the trend for Northern Ireland as a whole. Within the lough Rostrevor to Newry (01907, including Rostrevor to Warren Point (01910)) experienced large declines over all time scales, although the decline was particularly steep between winter 2008/2009 and 2013/2014. In contrast, Omeath to Ballagan Point (01909, including Omeath to Greenore (01408)) declined less steeply, although still experienced a strong decline in the long-term and medium decline in the medium-term, but have had a short-term increase in numbers. Mill Bay followed the overall pattern in Carlingford Lough, declining by over 100% in the medium- and long-term, but remaining stable over the short-term. As a result, the proportion of Carlingford Lough's Ringed

Plovers supported by this section has not significantly changed. The only sectors in the lough not to hold five-year mean peaks that were over 10% of the total mean of peak count for the lough, or mean peak counts in the winter of 2016/2017 that were over 10% of the total peak count for the lough were Warren Point to Newry (01906) and Killowen (01911).

4.1.21 Eurasian Curlew *Numenius arquata*

Although the trend for wintering Curlew in Northern Ireland has maintained a steady decline since 2001/2002, Curlew in Carlingford Lough declined very steeply in the medium-term followed by a slight increase over the short-term, resulting in a moderate decline (at least 25% but less than 50%) over the long-term. The trend within the sectors varies. Warren Point to Newry (01906), which holds the majority of the Curlew in the parent sector Rostrevor to Newry (01907), suffered declines of over 100% over all time scales. Over the long- and medium-term, Curlew in the Omeath to Greenore (01408) underwent a moderate decline. However, since 2010/2011 Curlew have been counted in increasing numbers in the sub-sector Carlingford to Greenore (01419), causing the trend Omeath to Greenore to increase by at least 100% in the short-term. Mill Bay (01407) also experienced a steep decline in the medium-term, but the population has now stabilised. Mill Bay held a significant proportion of the total mean peak counts for Carlingford Lough, with a mean peak count over the last five winters (2012/13 – 2016/17) that was over 20% of the total. It also was the only sector with a peak count in the winter of 2016/2017 that was at least 20% of the total peak count for Carlingford Lough.

4.1.22 Bar-tailed Godwit *Limosa lapponica*

Numbers of Bar-tailed Godwit on Carlingford Lough have always been quite small (highest core peak was 117 in winter 2001/2002) and over the medium- and long-term, they have declined by at least 50%, despite an increase at the national level. Omeath to Ballagan Point (01909, including sub-sector Omeath to Greenore (01408)) has seen an increase over the short-term, but numbers remain very small in this sector overall (winter mean counts <20 individuals). Mill Bay (01407) and sectors within Omeath to Ballagan Point were the most important sectors in terms of numbers, holding mean peak counts over the last five winters (2012/13 – 2016/17) that were at least 20% of the total mean peak counts for Carlingford Lough. Mill Bay and Omeath to Ballagan Point also had peak counts in the latest year that were over 10% (and in the case of Omeath to Ballagan Point , over 20%) of the total peak count for the lough in the same year.

4.1.23 Black-tailed Godwit *Limosa limosa*

Although they represent a very small (~5-8%) of the growing wintering population of Northern Ireland, the numbers of Black-tailed Godwit have increased over all time scales in Carlingford Lough. This has been driven by increases in Warren Point to Newry (01906), which until 2012/2013 held 100% of the Black-tailed Godwit in the lough. The five-year mean of winter peaks in Warren Point to Newry, Omeath to Greenore (01408), Carlingford to Greenore (01419), and hence their parent sectors, were at least 20% of the total mean peak counts for Carlingford Lough, making these the most important sectors in the lough for Black-tailed Godwit over the last five winters (2012/13 – 2016/17). The spread of Black-tailed Godwit to new sectors, combined with an increasing national trend may suggest that increasing numbers of Black-tailed Godwit are visiting Carlingford Lough and all the more suitable habitat in Warren Point to Newry is already at carrying capacity.

4.1.24 Ruddy Turnstone *Arenaria interpres*

Turnstone had a very mixed trend across Carlingford Lough. Overall the lough experienced an increase in numbers of at least 33% but less than 100% over the long- and short-terms, but declined by over 100% in the medium term. Rostrevor to Warren Point (01910) had a steep decline across all time scales, whereas sub-sectors within Omeath to Ballagan Point (01909) generally increased in the long- and short-terms. All sectors excluding Killowen (01911) and Warren Point to Newry (01906) held significant proportions of the Turnstone population of the lough in terms of five-year mean peak counts, and likewise Killowen, Warren Point to Newry and Carlingford to Greenore (01419) did not support a significant proportion of Turnstones when considering in the latest year (2016/17).

4.1.25 Red Knot *Calidris canutus*

There were insufficient Knot recorded on Carlingford Lough to create sector trends. There have however been increases in numbers of at least 100% over the short- and long-terms in Carlingford Lough. The five-year mean of winter peaks in Mill Bay (01407) was at least 20% of the total mean peak counts for Carlingford Lough, making this the most important sector in the lough for Knot.

4.1.26 Dunlin *Calidris alpina*

Numbers of Dunlin have dropped in Carlingford Lough in between the winters of 2010/2011 and 2011/2012. Declines at the long-, medium- and short-term have all been at least 50%. The most important sectors in terms of five-year-mean peaks for Dunlin were Rostrevor to Newry (01907; both sub-sectors within it held over 10% of the total mean peak counts for Carlingford Lough), Omeath to Greenore (01408) and Carlingford to Greenore (01419; and hence the parent sector Omeath to Ballagan Point (01909)) and Mill Bay (01407). Of these, Rostrevor to Newry and the sub-sectors within it all underwent steep declines at all time scales. Mill Bay stabilised in the short-term after steep declines in the medium- and long-term. However, sectors within Omeath to Ballagan Point experienced contrasting trends. Omeath to Greenore had a long-term moderate decline but numbers increased moderately in the medium-term and by over 100% in the short-term, mostly driven by a large increase in the Carlingford to Greenore sub-sector (Figure 4.1.26). As a result, this sector has become one of the most significant sectors in the lough, supporting around 45% of the Dunlin. Greenore to Ballagan Point (01908) stabilised in the short-term after medium- and long-term declines. All sectors but Greenore to Ballagan Point and Killowen (01911) had had peak counts in winter 2016/2017 that were over 10% of the total peak count for Carlingford Lough in the same year.

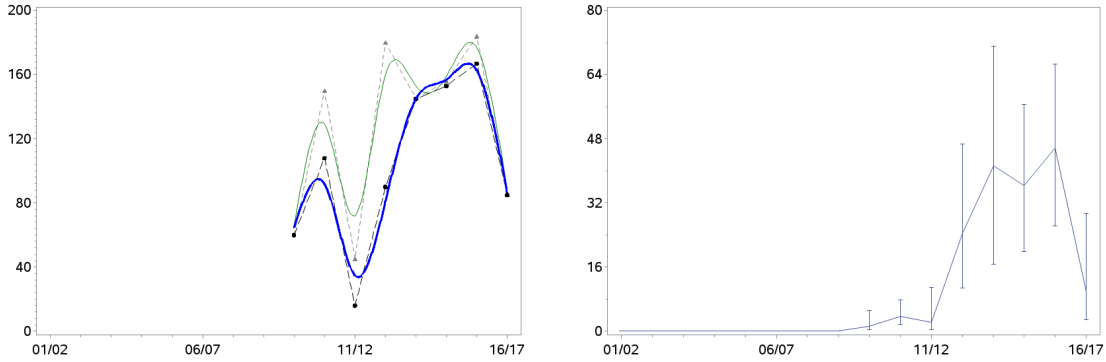


Figure 4.1.26: A: The trend in the number of Dunlin on Carlingford to Greenore, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Dunlin on Carlingford Lough that have been recorded on the Carlingford to Greenore count sector between the winters of 2001/2002 and 2016/2017.

4.1.27 Common Redshank *Tringa totanus*

The negative trend in the wintering population of Redshank on Carlingford Lough appears to be following the national trend, although numbers in Carlingford have stabilised slightly more over the short-term. Long- and medium-term trends show a decline in numbers of at least 50% however. Declines have been greatest in Warren Point to Newry (01906, and hence parent sector Rostrevor to Newry (01907)), which formerly held the majority of Carlingford Lough's Redshank (Figure 4.1.27). However, steep declines (by at least 50%) over all time scales, combined with increases in the sectors within Omeath to Ballagan Point (01909) and Mill Bay (01407), have led to this sector holding a lower proportion of the Redshank of the lough. Since numbers have been increasing in other sectors of the lough, there may be pressures in the environment of Warren Point to Newry that have caused the Redshank to decline in this particular sector. Rostrevor to Newry, Omeath to Ballagan Point (01909, including sub-sectors Omeath to Greenore (01408) and Carlingford to Greenore (01419)) and Mill Bay all held mean peak count over the last five winters (2012/13 – 2016/17) that were at least 20% of the total mean peak counts for Carlingford Lough, and likewise had peak counts in the winter 2016/2017 that were at least 20% of the total peak count.

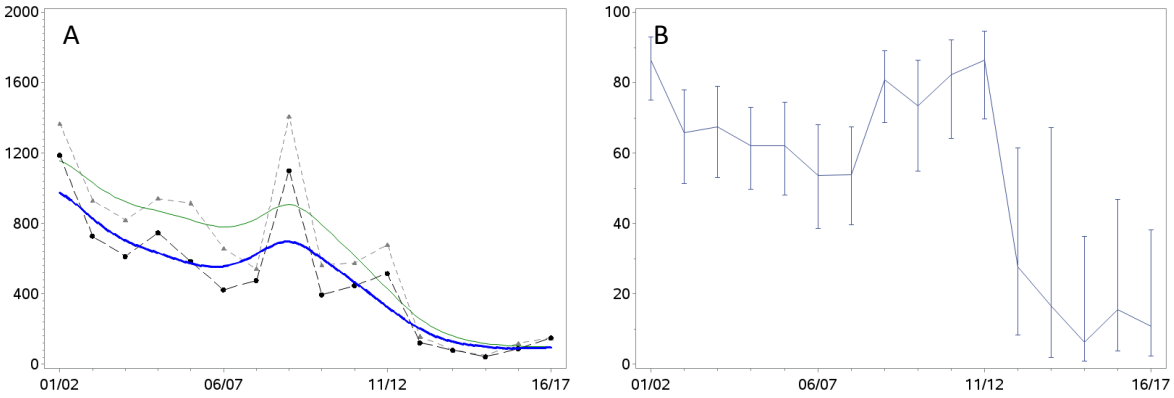


Figure 4.1.27: A: The trend in the number of Redshank on Warren Point to Newry, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Redshank on Carlingford Lough that have been recorded on the Warren Point to Newry count sector between the winters of 2001/2002 and 2016/2017.

4.1.28 Common Greenshank *Tringa nebularia*

Few Greenshank were counted in Carlingford Lough annually, and as a result there were no trends calculated for individual sectors. Over the long- and short-term, moderate increases (at least 33% but less than 100%) in numbers were recorded. Carlingford to Greenore (01419) and Mill Bay (01407) held the greatest proportion of the lough's Greenshank in the latest year (2016/17) by peak count, and also had mean peak counts over the last five winters (2012/13 – 2016/17) that were at least 20% of the total mean peak counts for Carlingford Lough. However, the overall numbers were low per sector.

4.2 Species trends - Strangford Lough Core Counts (high tide)

4.2.1 Light-bellied Brent Goose *Branta bernicula hrota*

Numbers of Light-bellied Brent Goose have remained stable across the lough throughout all time scales, reflecting the national trend. However, trends vary between sectors. The most important sectors in terms of mean peak count over the last five winters (2012/2013 – 2016/2017) were Castle Espie to Comber River (D90) (01A37) and Sewarage to Ards Sluice Gates (E40) (01A42). Both of these sectors saw increases in the long- and medium-terms, and remained stable in the short-term. Numbers of Light-bellied Brent Goose in Kilclief to Church Point (A20) (01A02), Carrstown to Ballyquinton (G60) (01A62) and Comber River to Rough Island consol (E20) (01A68) (including Comber River to Rough Island refuge (E20R) (01A39)) increased across all time scales, while declines of at least 50% occurred across all time scales in Hannah's Hedge to Walshestown Quay (A60) (01A06) and Gasworks to Anne's Point (E90) (01A47).

4.2.2 Greylag Goose *Anser anser*

Numbers of Greylag Goose have been declining in Northern Ireland, and this is reflected by declines of over 50% across all time scales in Strangford Lough. All sectors with sufficient numbers of Greylag Goose to calculate trends show declines across one or more time scales, with only Clea Lakes (B70) (01A16) experiencing a moderate increase over the long-term, followed by a steep decline over the short-term. Sloane's Island Area (A80) (01A08), Clea Lakes (B70) (01A16) and Anne's Point to South Island / Skillens (F20) (01A49) were the most important sectors in terms of mean peak count over the last five winters (2012/2013 – 2016/2017), each supporting at least 20% of the total mean peak counts for Strangford Lough over the period.

4.2.3 Mute Swan *Cygnus olor*

There have been insufficient numbers of Mute Swan recorded on all but two sectors of Strangford Lough upon which to base an analysis of trends. Numbers on both Quoile Pondage (01A11) and Ardmillan West (01A26) have been relatively stable over the most recent winters in the time series, following periods of medium decline on the former and increase on the latter. The only other sector on which Mute Swan are regularly recorded, although in trivial numbers, has been Greyabbey Lake (01A51).

4.2.4 Common Shelduck *Tadorna tadorna*

The trend for wintering Shelduck in Strangford Lough closely follows that of Northern Ireland as a whole, showing short- and long-term stability, but moderate declines in the medium-term. More

sectors declined than increased over all time scales, but declines were more common in the short-term. Sites between Ards Sluice Gates to Butterlump (E60) (01A44) and Skillens to Mill Point (F30) (01A50) generally declined by at least 50% over the short- and medium-terms. The only sector to show increases of over 100% at all time scales was Quaterland to Shamrock (C40) (01A22), and this site had low numbers of Shelduck until 2016/2017, when there was a sudden increase. Rough Island to Sewarage (E30) (01A41) and Sewarage to Ards Sluice Gates (E40) (01A42) both held at least 20% of the total mean peak of Shelduck in Strangford Lough, and also at least 20% of the total peak count for Strangford Lough in 2016/2017. However these sites experienced differences in their population trends for Shelduck, with Rough Island to Sewarage declining moderately over all time scales, whereas and Sewarage to Ards Sluice Gates was stable over the long- and medium-terms, but saw an increase of at least 100% over the short-term.

4.2.5 Northern Shoveler *Spatula clypeata*

Although Shoveler remained stable at the short- and medium-terms in Strangford Lough, they experienced a long-term, moderate decline. Between 2001/2002 and 2016/2017, the proportion of the Northern Ireland population found in Strangford Lough has declined from around 70% to 50%, although this may be linked to an increase in numbers at a different location. Only two sectors had sufficient data to calculate trends: Comber River to Rough Island refuge (E20R) (01A39, within Comber River to Rough Island consol (E20) (01A68)) and Castle Espie to Comber River (D90) (01A37). Numbers of Shoveler fluctuated in Comber River to Rough Island refuge over time; the long-term trend was stable, but there were steep declines in the medium-term and in the short-term the sector experienced increases of at least 100%. In contrast, the trends at Castle Espie to Comber River were negative across all time scales, and at least 50% over the long- and short-term. The other significant site for Shoveler in Strangford Lough was Quoile Pondage (DOE) (B20) (01A11), which also had a mean peak count over the last five winters (2012/2013 – 2016/2017) was at least 20% of the total for Strangford Lough. In addition to Quoile Pondage, Sleepers to Horse (D70) (01A34) had a peak count in the latest year that was at least 20% of the total peak count for Strangford Lough.

4.2.6 Gadwall *Mareca strepera*

The population of Gadwall in Strangford Lough, which represents approximately 20-30% of the total wintering population of Northern Ireland, underwent a population increase between 2009/2010 and 2013/2014, but have since returned to previous numbers. Only in two sectors in Strangford Lough were Gadwall counted in sufficient numbers to produce trends: Church Point to Audley's (A30) (01A03) and Castle Espie Lakes (E10) (01A38). The trends for these two sectors contrast; in Church Point to Audley's, Gadwall increased by at least 100% over the medium- and long-term (Figure 4.2.6.i), while in the Castle Espie Lakes Gadwall dropped by at least 50% in the medium- and long-term (Figure 4.2.6.ii). As a result, the proportion of the total Gadwall population of Strangford Lough in the Church Point to Audley's sector increased, while the proportion in the Castle Espie Lakes sector decreased. The sectors are not neighbouring, so this suggests a broader redistribution of Gadwall in the lough, and may indicate problems for Gadwall in the Castle Espie Lakes.

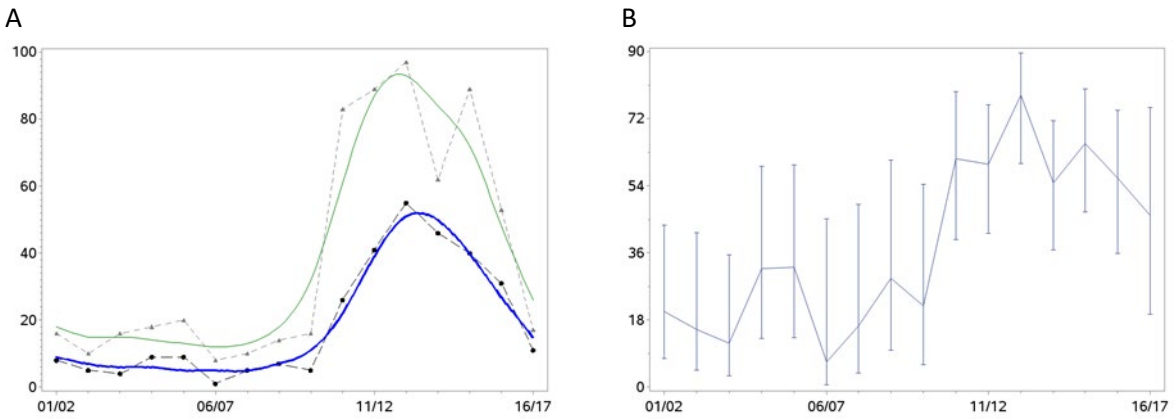


Figure 4.2.6.i: A: The trend in the number of Gadwall on Church Point to Audley's (A30), Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Gadwall on Strangford Lough that have been recorded on the Church Point to Audley's (A30) count sector between the winters of 2001/2002 and 2016/2017.

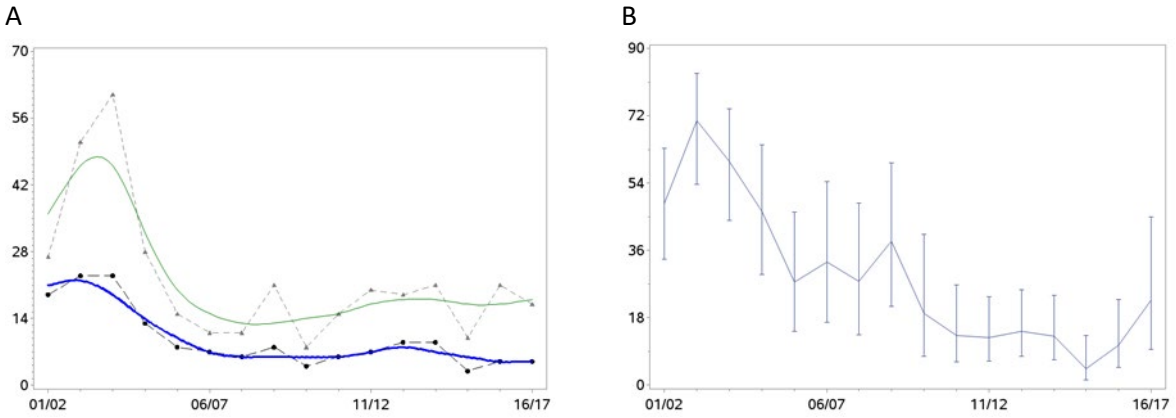


Figure 4.2.6.ii: A: The trend in the number of Gadwall on Castle Espie Lakes (E10), Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Gadwall on Strangford Lough that have been recorded on the Castle Espie Lakes (E10) count sector between the winters of 2001/2002 and 2016/2017.

4.2.7 Eurasian Wigeon *Mareca penelope*

The population of wintering Wigeon in Northern Ireland underwent a large decline between 2003/2004 and 2012/2013, after which it began to increase. However, the proportion of the Northern Ireland population supported by Strangford Lough dropped slightly after 2010/2011, since the population in the lough remained stable as populations at other sites in Northern Ireland increased. Within the lough, sectors appear to have experienced steep declines over the long- and medium-terms, and mostly have been increasing or stable over the short-term. The most important sectors for Wigeon were Castle Espie to Comber River (D90) (01A37), Rough Island to Sewarage (E30) (01A41) and Anne's Point to South Island / Skillens (F20) (01A49), each holding at least 20% of Strangford Lough's total mean peak count over the last five winters (2012/2013 – 2016/2017). Despite low or zero-counts in previous years, Rough Island to Sewarage had the highest proportion of the Strangford Lough total peak count in 2016/2017. Numbers at Castle Espie to Comber River declined by at least 50% over the medium- and long-term, and have since stabilised at a lower

annual mean. Likewise, Anne's Point to South Island also stabilised over the short-term after longer-term declines.

4.2.8 Mallard *Anas platyrhynchos*

Mallards have undergone a moderate declines over all time scales in Strangford Lough, in line with declines across Northern Ireland as a whole. Trends are mixed between sectors. The only sector to have increasing trends across all time scales was Audley's to Hannah's Hedge (A40) (01A04), whereas the Mallard numbers at the neighbouring site, Temple Water (A50) (01A05) declined by at least 50% across all time scales. The most important sites in terms of mean peak count over the last five winters (2012/2013 – 2016/2017) were Quoile Pondage (DOE) (B20) (01A11), Mahee Island (C90) (01A27) and Castle Espie Lakes (E10) (01A38). While Mallard at Mahee Island have remained stable throughout the years surveyed, numbers at Quoile Pondage declined in the short-term, and at the Castle Espie Lakes in the medium- and long-terms although these two sites contained at least 20% of the total peak count for Strangford Lough in 2016/2017.

4.2.9 Northern Pintail *Anas acuta*

The majority of Northern Ireland's Pintail were counted in Strangford Lough (80-90%), and while numbers in Strangford Lough increased moderately over the long-term, Pintail populations have remained stable in the medium- and short-terms. Within the lough, most Pintail were found in Sewarage to Ards Sluice Gates (E40) (01A42) and Ards Sluice Gates to Butterlump (E60) (01A44). These sectors had mean peak counts over the last five winters (2012/2013 – 2016/2017) and peak counts in the 2016/2017 that were at least 20% of the total for Strangford Lough as a whole. Numbers at Sewarage to Ards Sluice Gates increased by at least 100% over all time scales, whereas an initial long-term increase in Ards Sluice Gates to Butterlump was succeeded by a medium-term, moderate decline and a period of stability over the short-term (Figure 4.2.9).

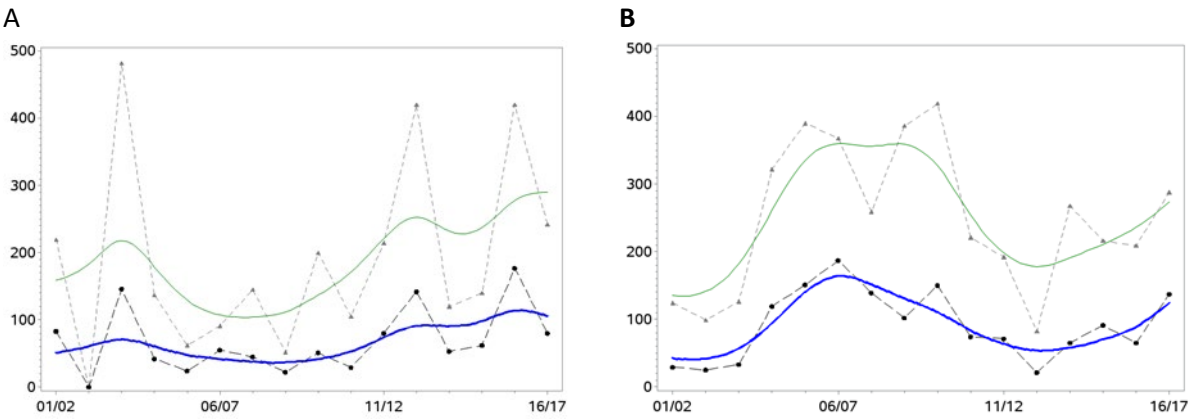


Figure 4.2.9: A: The trend in the number of Pintail on Sewarage to Ards Sluice Gates, Strangford Lough. B: The trend in the number of Pintail on Ards Sluice Gates to Butterlump, Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.2.10 Eurasian Teal *Anas crecca*

Teal have increased moderately (by at least 33% but less than 100%;) over the medium- and short-term in Strangford Lough, but trends are very variable between different sectors. The most important sectors in terms of peak counts over the last five winters (2012/13 – 2016/17) were Quoile Pondage (DOE) (B20) (01A11), Mahee Point to Cross Island (D30) (01A30), Castle Espie to Comber River (D90) (01A37) and Gasworks to Anne's Point (E90) (01A47). Of these, Castle Espie to Comber River (D90) and Gasworks to Anne's Point (E90) had positive trends over all time scales, Quoile Pondage (DOE) (B20) had moderate declines over the medium- and long-terms and there were too few Teal counted on Mahee Point to Cross Island until 2014/2015 to create a trend. The only sector with declines of 50% or greater over all time scales in Strangford Lough was Hare Island to Salt Water Bridge (F90) (01A56). The most important sectors in the latest year (2016/17), considering peak counts were Mahee Point to Cross Island (D30), Castle Espie to Comber River (D90) and Gasworks to Anne's Point (E90).

4.2.11 Common Eider *Somateria mollissima*

Although wintering Eider have been consistently increasing in Northern Ireland, their trends have been mixed in Strangford Lough. Over the short-term, numbers moderately declined, but in the long-term, numbers increased moderately. Eider were predominantly counted in sectors in the western region of the lough, and sectors with the highest proportion of the total mean peak count over the last five winters (2012/2013 – 2016/2017) for the lough were Castle Espie to Comber River (D90) (01A37), Rough Island to Sewarage (E30) (01A41), Anne's Point to South Island / Skillens (F20) (01A49) and Horse to Castle Espie consol (D80) (01A67). In Castle Espie to Comber River and Rough Island to Sewarage, short- and medium-term trends were strongly negative, whereas Anne's Point to South Island / Skillens experienced increases of at least 100% over the long-term and moderate increases in the short-term. Sewarage to Ards Sluice Gates (E40) (01A42) and Anne's Point to South Island / Skillens had peak counts in 2016/2017 that were at least 20% of the total peak count for the lough.

4.2.12 Common Goldeneye *Bucephala clangula*

Although the proportion of the total Northern Ireland population in Strangford Lough has remained constant, the lough itself experienced declines of at least 50% over all time scales. The only sectors in the lough with sufficient data to create trends were Quoile Pondage (DOE) (B20) (01A11) and Clea Lakes (B70) (01A16), and these were the most important sectors by mean peak count over the last five winters (2012/2013 – 2016/2017). Both of these sectors experienced declines in Goldeneye; numbers in Quoile Pondage declined moderately over the long-term and by at least 50% over the short-term, and by at least 50% over all time scales in Clea Lakes. Anne's Point to South Island / Skillens (F20) (01A49) a peak count in the latest year that was at least 20% of the total peak count for Strangford Lough, although this was only eight individuals.

4.2.13 Red-breasted Merganser *Mergus serrator*

Red-breasted Merganser declined by at least 50% in Strangford Lough over the medium- and long-term, and declined across Northern Ireland as a whole. The proportion of the Northern Ireland population held by Strangford Lough dropped slightly from 2011/2012, from around 20% to 30%. No sectors in Strangford Lough had sufficient data to produce trends, but Hare's Island to Nickey's Point

(B40) (01A13) had the highest proportion of the total mean peak count over the last five winters (2012/2013 – 2016/2017) for the lough, and Walshestown Quay to East Sloane (A70) (01A07), Salt Island and Green Island (B50) (01A14), Holme Bay to South Ringdufferin (B90) (01A18), Paddy's Point to Sleepers (D60) (01A33) and Castle Hill to Ringburr (G20) (01A58) had the highest proportions of the total peak count for Strangford Lough in 2016/2017.

4.2.14 Great Crested Grebe *Podiceps cristatus*

Fewer than 10% of Northern Ireland's Great Crested Grebes are counted in Strangford Lough, and no sectors had sufficient data to create trends. However, the lough as a whole has experienced steep declines over all time periods. Hannah's Hedge to Walshestown Quay (A60) (01A06), Walshestown Quay to East Sloane (A70) (01A07) and Quoile Pondage (DOE) (B20) (01A11) were the most important sectors by mean peak count over the last five winters (2012/2013 – 2016/2017).

4.2.15 Eurasian Coot *Fulica atra*

Coot declined in Strangford Lough at a faster rate than across Northern Ireland as a whole, experiencing steep declines over the medium- and long-terms and a moderate decline over the short-term. Declines of at least 50% over all time scales occurred in Clea Lakes (B70) (01A16) and Shringley Dam (B80) (01A17), and in the medium- and long-term in Quoile Pondage (DOE) (B20) (01A11) and Castle Espie Lakes (E10) (01A38). Quoile Pondage and Clea Lakes had mean peak counts over the last five winters (2012/13 – 2016/17) that were at least 20% of the total mean peak counts for Strangford Lough (Figure 4.2.15.) and Quoile Pondage also had the greatest proportion of the total peak count for Strangford Lough in 2016/2017.

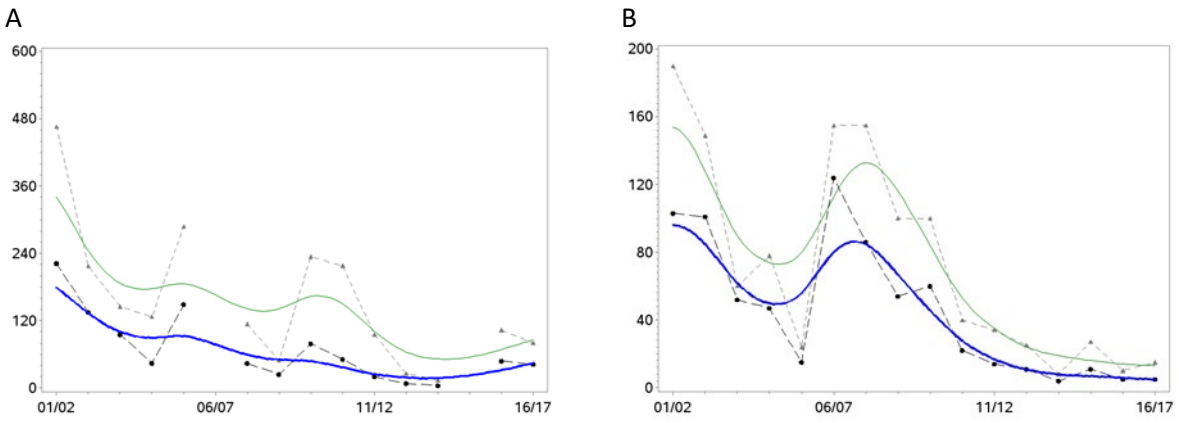


Figure 4.2.15: A: The trend in the number of Coot on Quoile Pondage (DOE), Strangford Lough. B: The trend in the number of Coot on Clea Lakes (B70), Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.2.16 Eurasian Oystercatcher *Haematopus ostralegus*

Oystercatcher underwent moderate declines across all time scales in Strangford Lough, and the proportion of the Northern Ireland population supported by the site began to decline in 2009/2010, falling from around 40% to around 30% in 2016/2017. Oystercatcher were widespread throughout the sectors of the lough, and trends were calculated for most sectors and these were vary variable between time scales and sectors. Due to the dispersed population in Strangford Lough, no sectors

had a concentration of over 20% of the total mean peak counts for the lough over the last five winters (2012/2013 – 2016/2017), but Rough Island to Sewarage (E30) (01A41), Anne's Point to South Island / Skillens (F20) (01A49), Skillens to Mill Point (F30) (01A50) and Ogolby and Black Rock Islands (26) (01A63) all held between 10% and 20% of the total mean of peak count, making these the most important sectors for Oystercatcher in Strangford Lough. Oystercatcher declined across all these sectors, and in particular in Ogolby and Black Rock Islands (26) (01A63), which saw declines of at least 50% across all time scales. Ringneill Point to Paddy's Point (D50) (01A32) was the only sector where Oystercatcher increased by over 100% across all time scales.

4.2.17 Northern Lapwing *Vanellus vanellus*

Wintering Lapwing steadily declined across Strangford Lough, experiencing a steep decline over the long-term and more moderate declines over the medium- and short-terms. The species was widely distributed across sectors of the lough, with sufficient numbers in the majority of sectors for trends to be calculated. Overall, trends are broadly negative, with many sectors suffering declines of at least 50% over all time scales. The most important sector, in terms of the proportion of the total mean peak count over the last five winters (2012/2013 – 2016/2017) for Strangford Lough, was Castle Espie to Comber River (D90) (01A37). Numbers of Lapwing declined steeply over the long-term and moderately over the short-term in this sector. Not all sectors had a negative trend however; Paddy's Point to Sleepers (D60) (01A33) increased in number by at least 100% over the medium-and short-terms, and Herring Bay Point to Nusquarter Point (F60) (01A53) grew by the same magnitude over the medium- and long-terms.

4.2.18 European Golden Plover *Pluvialis apricaria*

Golden Plover have declined steeply in the medium- and long-term in Strangford Lough, and continued to decline at a more moderate rate in the short-term. The majority of sectors where trends were generated experienced declines of at least 50% over all time scales. However, this was not always the case; Bankmore to Carrstown (G50) (01A61), Carrstown to Ballyquinton (G60) (01A62) and Islands Mid Lough (C62) (01A66) all had increasing trends. Ardmillan East (C80) (01A26), Sewarage to Ards Sluice Gates (E40) (01A42) and Comber River to Rough Island refuge (E20R) (01A39, within Comber River to Rough Island consol (E20) (01A68)) were the most important sectors for numbers of Golden Plover in the last five years in terms of proportion of mean peak count. Of these Ardmillan East (C80) increased over the long-term but Sewarage to Ards Sluice Gates (E40) had a steep long-term decrease. Rough Island to Sewarage (E30) (01A41) and Sewarage to Ards Sluice Gates (E40) had the highest peak counts in 2016/2017.

4.2.19 Grey Plover *Pluvialis squatarola*

Grey Plover have declined steeply over the medium- and long-terms in Strangford Lough, and moderately over the short-term, largely in proportion with declines across Northern Ireland. Only two sectors in the site had sufficient data to produce trends: Rough Island to Sewarage (E30) (01A41) and Hare Island to Salt Water Bridge (F90) (01A56). Both these sites experienced steep declines over all time scales. Paddy's Point to Sleepers (D60) (01A33), Castle Espie to Comber River (D90) (01A37) and Bankmore to Carrstown (G50) (01A61) contained at least 20% of the total mean peak counts for the lough over the last five winters (2012/2013 – 2016/2017), although numbers were low even in these sectors. In addition to Paddy's Point to Sleepers (D60) and Bankmore to

Carrstown (G50), Quoile Pondage (DOE) (B20) had a peak count in the winter of 2016/2017 that was at least 20% of the total peak count of Strangford Lough.

4.2.20 Common Ringed Plover *Charadrius hiaticula*

Although in the medium-term, Ringed Plover declined moderately in Strangford Lough, in the short- and long-terms, numbers have remained stable. Only two sectors had sufficient data to create trends, and in these sectors trends are opposing. Numbers of Ringed Plover increased by at least 100% in Sewarage to Ards Sluice Gates (E40) (01A42) in the medium- and long terms, whereas number in Skillens to Mill Point (F30) (01A50) declined by at least 50% across all time scales. Sectors that held at least 20% of the total mean peak count for the lough over the last five winters and at least 20% of the total peak count in 2016/2017 were Sewarage to Ards Sluice Gates (E40) (01A42) and Hare Island to Salt Water Bridge (F90) (01A56).

4.2.21 Eurasian Curlew *Numenius arquata*

The proportion of the total Northern Irish population of wintering Curlew remained stable in Strangford Lough, as did total numbers across all time-scales. Curlew were widely distributed around sectors of the lough, and trends between sectors and across time scales were very mixed. Numbers of Curlew counted at Bankmore to Carrstown (G50) (01A61) increased by at least 100% over all time scales, whereas Ogolby and Black Rock Islands (26) (01A63) declined by at least 50% across all time scales. The two sectors that hosted the highest proportion of the five-year mean peak of the lough were Castle Espie to Comber River (D90) (01A37), which declined moderately over the long-term (Figure 4.2.21), and Anne's Point to South Island / Skillens (F20) (01A49), which remained stable over all time scales (Table 5).

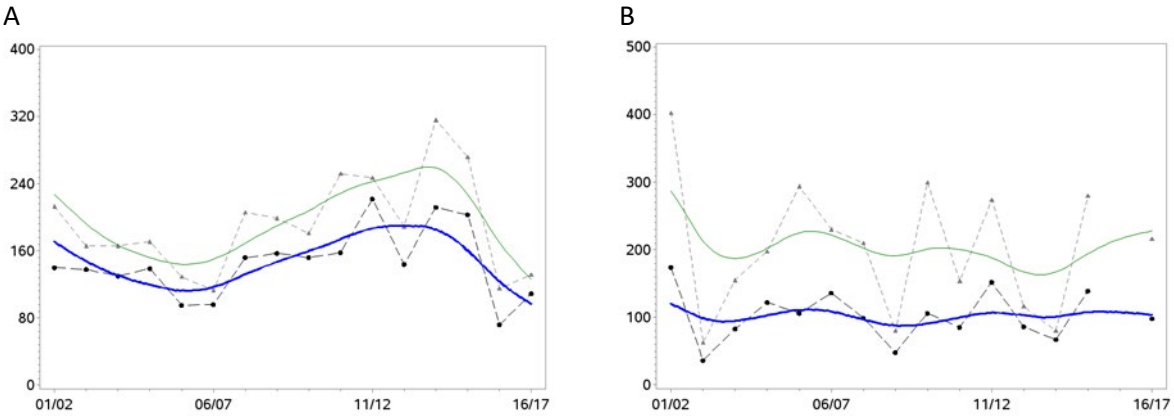


Figure 4.2.21: A: The trend in the number of Curlew on Castle Espie to Comber River (D90), Strangford Lough. B: The trend in the number of Curlew on Anne's Point to South Island / Skillens (F20), Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.2.22 Bar-tailed Godwit *Limosa lapponica*

Numbers of Bar-tailed Godwit increased across Northern Ireland, but there were moderate declines in Strangford Lough across all time scales. Population trends for Bar-tailed Godwit were mixed across

the sectors. The most important sectors in terms of proportion of the total five-year mean peak for the lough were Castle Espie to Comber River (D90) (01A37), Sewarage to Ards Sluice Gates (E40) (01A42) and Horse to Castle Espie consol (D80) (01A67). Horse to Castle Espie consol (D80), Comber River to Rough Island consol (E20) (01A68) and the sub-sectors within them had steep declines in Bar-tailed Godwit over the long- and short-terms, whereas Castle Espie to Comber River (D90) increased in number by at least 100% across all time scales. Over the long-term, Bar-tailed Gotwit decreased moderately in Sewarage to Ards Sluice Gates (E40), but numbers rose over the medium- and short-terms. Outside the sectors with the highest proportion of the five-year mean peak for the lough, Cunningburn to Gasworks (E80) (01A46), Gasworks to Anne's Point (E90) (01A47) and Hare Island to Salt Water Bridge (F90) (01A56) all had peak counts in the winter of 2016/2017 that were at least 20% of the total peak count for Strangford Lough.

4.2.23 Black-tailed Godwit *Limosa limosa*

Black-tailed Godwit increased in Northern Ireland and in Strangford Lough. The proportion of the total Northern Irish population supported by the lough varied during the count period, but has generally remained around 10-30%. In the long-term, Black-tailed Godwit increased by at least 100% in the lough as a whole, but trends across sectors varied at different time scales. The majority of sectors for which trends could be calculated experienced strong increases over the long-term; the only sector to decline over the long-term was Sewarage to Ards Sluice Gates (E40) (01A42). Castle Espie to Comber River (D90) (01A37) and Rough Island to Sewarage (E30) (01A41) had mean peak counts that were at least 20% of the total mean count for the site. Rough Island to Sewarage (E30) and Comber River to Rough Island consol (E20) (01A68, including sub-sector Comber River to Rough Island refuge (E20R) (01A39)) had peak counts in the winter of 2016/2017 that were at least 20% of the total peak count for Strangford that winter. Numbers of Black-tailed Godwit increased over the long-and medium-terms in Comber River to Rough Island refuge (E20R) (and its parent sector), and remained stable over the short-term.

4.2.24 Ruddy Turnstone *Arenaria interpres*

Although there was a moderate decline in Turnstone numbers over the medium-term in Strangford Lough, the population has largely remained stable, although since 2006/2007 the population has declined slightly across Northern Ireland as a whole. Within the lough, only Sewarage to Ards Sluice Gates (E40) (01A42) has experienced a positive trend in Turnstone numbers, increasing by at least 100% in the long-term. Killard to Kilclief (A10) (01A01), which was the only sector to support at least 20% of the total mean peak count for Strangofrd Lough over the last five winters (2012/2013 – 2016/2017), reflected the site trend with stable numbers over the long- and short-terms, but declines over the medium-term. Killard to Kilclief (A10), Hare Island to Salt Water Bridge (F90) (01A56) and Comber River to Rough Island consol (E20) (01A68, including sub-sector Comber River - Rough Island non-refuge (E20NR) (01A40)) all held at least 20% of the total peak count for Strangford Lough in 2016/2017.

4.2.25 Red Knot *Calidris canutus*

Strangford Lough hosts around 70% of Northern Ireland's population of Knot, and these are mostly found in the north of the lough. Knot declined across the lough moderately over the short- and long-terms, experiencing a steeper decline over the medium-term. Steep losses were observed across the

majority of sectors for which trends were available, many of these spanning all time scales. Two of the most important sectors for Knot in the lough were Rough Island to Sewarage (E30) (01A41) and Sewarage to Ards Sluice Gates (E40) (01A42). Rough Island to Sewarage (E30) remained stable over the long-term, but suffered a loss of at least 50% of Knot numbers in the medium-term, and a shallower decline in the short-term (Figure 4.2.25). Sewarage to Ards Sluice Gates (E40) declined steeply across all time scales. Rough Island to Sewarage (E30) and Comber River to Rough Island consol (E20) (01A68) had peak counts in 2016/2017 that were at least 20% of the total peak count for Strangford Lough.

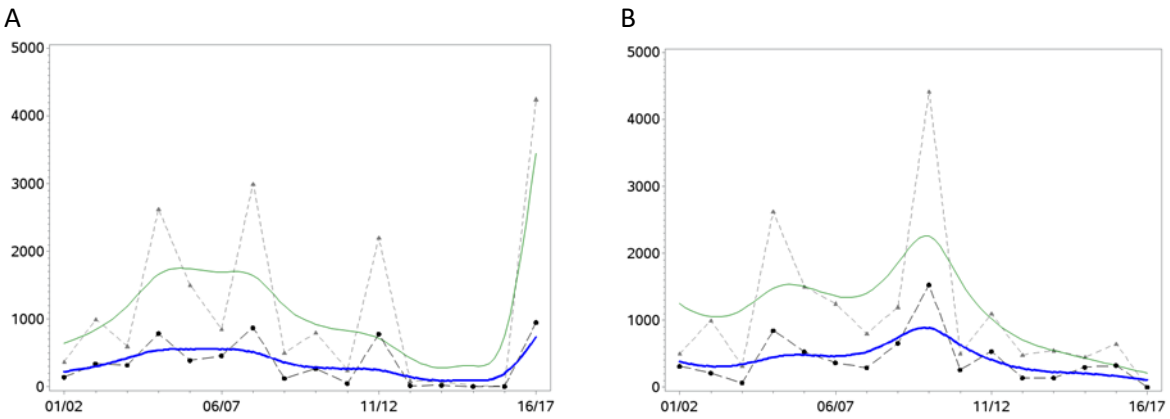


Figure 4.2.25: A: The trend in the number of Knot on Rough Island to Sewarage (E30), Strangford Lough. B: The trend in the number of Knot on Sewarage to Ards Sluice Gates (E40), Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.2.26 Dunlin *Calidris alpina*

The proportion of the Northern Irish population of wintering Dunlin supported by Strangford Lough remained stable through the count period, but the lough experienced moderate declines over the medium- and long-terms. The most important sites in terms of five-winter mean of peaks were Castle Espie to Comber River (D90) (01A37), Rough Island to Sewarage (E30) (01A41) and Sewarage to Ards Sluice Gates (E40) (01A42), and the trends for these were mixed. Numbers of Dunlin in Castle Espie to Comber River (D90) declined across all time scales, but over the long-term, numbers declined by at least 50% (Figure 4.2.26). Rough Island to Sewarage (E30) remained stable in the long- and short-terms, but in the medium-term, numbers declined by at least 50%. While in the short-term, numbers of Dunlin in Sewarage to Ards Sluice Gates (E40) increased by at least 100%, over the long-term the sector experienced a decline in numbers of at least 25% but less than 50% (Figure 4.2.26). Rough Island to Sewarage (E30) and Sewarage to Ards Sluice Gates (E40) both held at least 20% of the total peak count for Strangford Lough in the winter of 2016/2017.

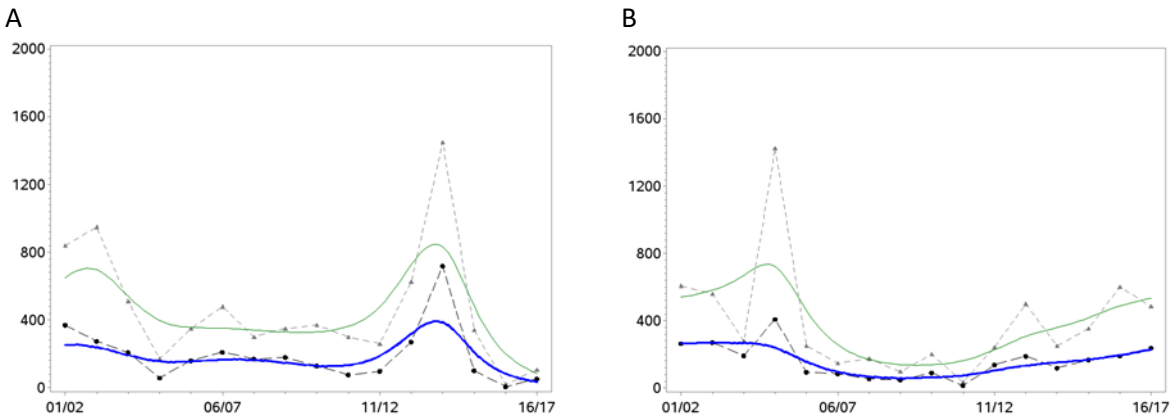


Figure 4.2.26: A: The trend in the number of Dunlin on Castle Espie to Comber River (D90), Strangford Lough. B: The trend in the number of Dunlin on Sewarage to Ards Sluice Gates (E40), Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts.

4.2.27 Common Greenshank *Tringa nebularia*

Few Greenshank were counted in Strangford Lough, but numbers remained stable over the long- and short-terms, but declined moderately over the medium-term. No sectors had sufficient data to generate trends, but Bird Island (D20) (01A29) had the highest proportion of the total mean peak count for Strangford Lough over the last five winters (2012/2013 – 2016/2017). Braddock to Cadew (C60) (01A24) and Mount Stewart to Kiltonga (E50) (01A43) held at least 20% of the total peak count for Strangford Lough in the winter of 2016/2017.

4.2.28 Common Redshank *Tringa totanus*

Wintering Redshank underwent declines between 2001/2002 and 2016/2017 across the whole of Northern Ireland, and these declines were proportional in Strangford Lough, where numbers dropped by at least 25% but less than 50% over the long- and medium-terms. Redshank were widely dispersed across the lough, but the majority of trends were negative. Redshank appeared to be particularly declining in the areas of south-west shoreline between Hannah's Hedge to Walshestown Quay (A60) (01A06) and Castle Island to Hare Island (B10) (01A10) and the east shoreline between Monaghan Bank to Hare Island (F80) (01A55) and Castle Hill to Ringburr (G20) (01A58), where declines were experienced across all time scales. Sewarage to Ards Sluice Gates (E40) (01A42) was the most important sector in terms of mean peak counts, supporting at least 20% of the total mean peak count for Strangford Lough over the last five winters (2012/2013 – 2016/2017). Although Redshank declined at this sector over the long-term, there were moderate increases over the medium- and short-terms.

4.3 Species trends - Strangford Lough LowTide Counts (low tide)

4.3.1 Light-bellied Brent Goose *Branta bernicula hrota*

As was the case with the core counts, the trends for the low tide counts varied between sectors. The most important sectors based on the mean peak low-tide counts over the last five winters (2012/2013–2016/2017) were at Castle Espie to Comber River (D90/2) (BS093) and combined counts

at Sewarage to Ards Sluice Gates (E40/N,E40/C,E40/S) (BS173-BS175), all of which have seen declines occur over all three time periods, and at Rough Island to Sewarage (E30) (BS097) which has seen increases over all three periods. The variation in trends in the Sewarage area suggests slight changes in favoured foraging areas at low tide have occurred, and the variable trends suggest similar very local changes in low tide distribution may have occurred elsewhere, including Audley's to Hannah's Hedge (A40/1-A40/4)(BS011-BS014), South Ringdufferin to Pawle Island Black Rock (C10/4 & C10/5)(BS039 & BS040) and Cross Island to Ringneill Point (D40/1 & D40/2)(BS075 & BS076). Although most areas across Strangford Lough showed variable low tide trends across different sectors, the trends were much more consistent in the north-east between Ards Sluice Gates and Nusquarter Point (E60/1 – F60) (BS101-BS140). In this area, Light-bellied Brent Goose declined across almost all sectors for all time periods.

4.3.2 Greylag Goose *Anser anser*

There have been insufficient numbers recorded to produce low tide count trends for Greylag Goose on all but two sectors, both within the Anne's Point to South Island / Skillens Core Count area (F20/5 & F20/7) (BS121 & BS123). In both cases, increases were observed in the short- and medium-terms but a steep decline occurred in the short-term. These results should be treated with strong caution however as this species only recorded very occasionally on these sectors and the trends almost certainly reflect random variability in the occurrence and size of flocks of Greylag Geese rather than real sector level changes. This species does not appear to consistently use any of the WeBS low tide sectors and therefore the results from the Core Counts and the overall Core Count trend for Strangford Lough are likely to better represent the trends for this species.

4.3.3 Mute Swan *Cygnus olor*

There have been insufficient numbers recorded to produce trends for Mute Swan on all but one low tide count sector, Ardmillan West (D70/4) (BS064). On this sector, numbers were stable in the short- and medium-term, but a moderate decline occurred over the long-term period. Peak counts of greater than ten Mute Swans were recorded in the early 2000s at Cunningburn to Gasworks (E80/3) (BS115) and at Gasworks to Anne's Point (E90/1) (BS117), but few or no birds have been present on these sectors over the last ten years and trends could not be produced.

4.3.4 Common Shelduck *Tadorna tadorna*

The low tide count trends for Shelduck are variable, but sector level declines occurred in the majority of sectors in medium- and long-terms. In contrast, numbers were stable or increased over the short-term period in almost all sectors, with declines over this period occurring in only five of the 44 sectors for which low tide sector trends could be produced for this species. In the low tide sectors where the greatest numbers of Shelduck occurred during the most recent five years (2012/2013 – 2016/2017), numbers were stable in the short-term and increased in the medium- and long-term at Castle Espie to Comber River (D90/2) (BS093), but results were more variable at Sewarage to Ards Sluice Gates (E40/N, E40/C, E40/S, E402) (BS173-176) with the trends suggesting there has been recent movement from the south towards the north of this area. The results also show variability at Rough Island to Sewarage (E30) (BS096), with increases over all three time periods in sector BS097, but moderate decreases in the adjacent sector BS096, suggesting that Shelduck are now foraging

further offshore in this area, although it should be noted that the trends for the latter sector are based on imputed counts as this sector has not been covered recently.

4.3.5 Northern Shoveler *Anas clypeata*

There have been insufficient numbers recorded to produce trends for Shoveler on all but one low tide count sector, Castle Espie to Comber River (D90/2) (BS093). On this sector, an increase of between 33% and 100% occurred in the short-term and numbers were stable in the medium- and long-terms. The only other sector to record double figure mean peak counts in one or more of the last five years was at Comber River to Rough Island consol (E20/2) (BS095). Numbers have been low but relatively stable on this sector through most of the period covered by this report, but trends could not be fitted because numbers involved were too low . Some of the other more important sectors for Shoveler during the core counts were on freshwater sites which are not covered during the low tide counts.

4.3.6 Gadwall *Mareca strepera*

Low tide count trends for Gadwall could only be produced for one sector, Church Point to Audley's (A30/1) (BS007). This showed stability in the short-term but strong declines in the medium- and long-term. This contrasts with increases of more than 100% recorded in the same area during the WeBS Core counts over the medium- and long-term periods. The difference may be partly accounted for by the fact that Gadwall are present during low tide at the other low tide sectors within the Church Point to Audley's Core count sector, e.g. A30/2 (BS008) but in insufficient numbers to produce trends for these sectors. Another explanation for the differing trends may be that other movements are occurring at low tide.

4.3.7 Eurasian Wigeon *Mareca penelope*

Overall, the low tide sector trends broadly match the results from the Core Counts, with declines occurring in the medium- and long-term periods across the majority of sectors, and numbers appearing to be relatively stable over the short-term, with five of the 20 low tide sectors for which trends could be produced showing increases, six recording decreases and the remainder stable over this period. The trends for two sectors contrast notably with trends elsewhere, as both show strong increases over both the medium- and long-term: Walshestown Quay to East Sloane (A70) (BS015) and Braddock to Cadew (C60/4) (BS055). However, the four sectors supporting the highest numbers of Wigeon at low tide are all in line with the overall site trend, and show long-term declines but stability or a moderate increase in the short-term: West Sloane to Castle Island (A90) (BS024), Ardmillan West (C70/4) (BS064), Castle Espie to Comber River (D90/2) (BS093) and Comber River to Rough Island (E20/2) (BS095). One other low tide sector, Gasworks to Anne's Point (E90/3) (BS119), held high numbers in the early 2000s but experienced strong declines in both the medium- and long-term and no longer does so.

4.3.8 Mallard *Anas platyrhynchos*

Trends for Mallard could only be produced for seven low tide count sectors, with declines being recorded across all three time periods for four of these sectors: Church Point to Audley's (A30/1) (BS007), Gull Rock (D10) (BS069), Ballymacarron to Ringhaddy (C30/2 & C30/3 combined) (BS179) and Salt Water Bridge to Castle Hill (G10/1 to G10/4 combined) (BS183). Declines also occurred in

the long-term at South Ringdufferin to Pawle Island Black Rock (C10/4) (BS039), where numbers were stable over the other two timeframes, although the adjacent sector within the same core count area (C10/5) (BS040) recorded moderate increases in the short-term following stability in the medium- and long-term. Moderate increases also occurred at Killard to Kilclief (A10) (BS001) in both the short- and long-terms – this is the most important sector in terms of mean peak counts over the last five winters (2012/2013 – 2016/2017).

4.3.9 Northern Pintail *Anas acuta*

Trends for Pintail could only be produced for nine low tide count sectors and were mostly positive with increases being recorded in one or more time periods in eight sectors and declines recorded over one or more time periods in just two sectors. Seven of the nine sectors fell within the two core count sectors in the Ards Sluice Gates area within which most Pintail were recorded during the WeBS core counts. Increases of more than 100% occurred over all three timeframes at Braddock to Cadew (C60/4) (BS055), and either increases or stability occurred over all timeframes at two sectors within the Sewarage to Ards Sluice Gates core count area (E40/N & E40/2) (BS173 & BS176), at low tide sector LTC 168 (BS168), and at three sectors within the Ards Sluice Gates to Butterlump core count area (E60/2, E60/4 & E60/6) (BS102, BS104 & BS106). The two low tide sectors which recorded declines in one or more periods also fell within this same core count sector suggesting these declines were caused by changes of distribution at a local level. At E60/1 (BS101), declines were recorded in the medium- and long-term and stability in the short-term. At E60/3, declines occurred in the medium-term but increases in the short-term.

4.3.10 Eurasian Teal *Anas crecca*

Increasing or stable trends have occurred over all time periods at 24 of the 32 low tide sectors for which trends could be produced. The most notable exceptions were Gull Rock (D10) (BS069) which recorded declines of greater than 50% over all three time periods, and the two Carrstown sectors (G50 & G60) (BS166 & BS167) which both showed declines over two of the three time periods. Declines over all three time periods were also observed at Salt Water Bridge to Castle Hill (G10/5&6) (BS155) but this seems to relate to a local redistribution of relatively small numbers of birds and increases were recorded in the adjacent sectors. The most important sectors over the last five winters (2012/13 – 2016/17), in terms of peak counts, were the two sectors at Castle Espie to Comber River (D90/1 & D90/2) (BS089 & BS093) which respectively recorded stable trends and increases of greater than 100% over all three time periods, and Anne's Point to South Island / Skillens (F20/5) (BS121) and Ardmillan West (C70/4) (BS064), which both showed increases over two of the three time periods and stability over the other.

4.3.11 Common Eider *Somateria mollissima*

Trends for Eider could only be produced for seven low tide count sectors with increases of more than 100% occurring in six of these sectors in the long-term and declines recorded in three of the sectors in the short-term, indicating that numbers peaked on these sectors during the midpoint of the period covered, including the sector which recorded the highest low tide mean peak counts over the last five winters (2012/13 – 2016/17), Sleepers to Horse (D70) (BS082). The other sectors recording increases followed by declines were at, Castle Espie to Comber River (D90/2) (BS093), low tide sector LTC 168 (BS168) and Cunningburn to Gasworks (E80) (BS172).No decreases were

recorded over any of the three time periods on the other three sectors, with increases being recorded in two of the three timeframes in each case. These were at Horse to Castle Espie consol (D80/2 whole) (BS088), Butterlump to Cunningburn (E70) (BS171) and Sewarage to Ards Sluice Gates (E40/2) (BS176).

4.3.12 Common Goldeneye *Bucephala clangula*

The most important sectors for Goldeneye during the core counts were on freshwater sectors which are not covered during the low tide counts, and there were insufficient numbers of Goldeneye recorded to produce trends for any of the low tide count sectors. Four sectors recorded mean peak count of greater than ten during at least one winter out of the last five (2012/2013 – 2016/2017): Braddock to Carew (C60/3) (BS054), Butterlump to Cunningburn (E70/3) (BS111), and two sectors within the Anne's Point to South Island / Skillens core count sector (F20/6 & F20/7) (BS122 & BS123).

4.3.13 Red-breasted Merganser *Mergus serrator*

Trends for Red-breasted Merganser could only be produced on one low tide count sector, LTC Sector 168 (BS168). On this sector, numbers were stable in the short- and long-terms but declined by greater than 100% over the medium-term. However, the trends for this sector should be treated with caution as they are based mostly on imputed counts. There were insufficient numbers recorded to produce trends on all other sectors: however four sectors recorded mean peak count of 15 or more during at least one winter out of the last five (2012/2013 – 2016/2017), at Ringneill Point to Paddy's Point (D50) (BS078), Anne's Point to South Island / Skillens (F20/9) (BS125), Mill Point to Herring Bay Point (F50) (BS132) and Monaghan Bank to Hare Island (F80) (BS146).

4.3.14 Great Crested Grebe *Podiceps cristatus*

There were insufficient numbers of Great Crested Grebe to produce trends for any of the low tide count sectors. None of the low tide sectors recorded any counts of greater than five during the last five winters (2012/2013 – 2016/2017), in contrast to previous five year periods which saw mean peak counts of greater than five recorded on 12 different low tide count sectors, including three counts of more than 20. Two of these were during the period 2002/2003 – 2006/2007, at Horse to Castle Espie consol (D80) (BS177) and at Castle Espie to Comber River (D90/2) (BS093), and the third was during the period 2007/2008 – 2011/2012, at Audley's to Hannah's Hedge (A40/4) (BS014).

4.3.15 Eurasian Coot *Fulica atra*

There were insufficient numbers of Coot recorded to produce trends for any of the low tide count sectors. This reflects the fact that Coot is normally recorded on freshwater sites around Strangford Lough rather than tidal areas. These freshwater sites are not covered by the low tide counts.

4.3.16 Eurasian Oystercatcher *Haematopus ostralegus*

Oystercatcher low tide count trends were very variable between the time scales and sectors, as was the case with the Core count trends. However, there were more declines than increases with, for each of the three time periods, just over half of the sectors for which trends could be calculated showing decreases compared with 15% to 20% of sectors showing increases. As with the core counts, Oystercatcher were widely dispersed across Strangford Lough, but most of the sectors which recorded high mean peak counts over the last five winters (2012/2013 – 2016/2017) recorded

declines over most or all time periods. An exception was at Ards Sluice Gate to Butterlump (E60/4) where increases were recorded over all three time periods. In fact, increases of greater than 100% were recorded over the long-term for six out of seven low tide sectors within this core count sector for which trends could be produced (E60/2-E60/7) (BS102-BS107), although the short-term trends for these sectors were variable. The variable results here and elsewhere perhaps suggest that some local re-distribution during low tide periods has occurred in some areas, but some declines have also occurred more consistently across wider areas. Numbers decreased across all time periods in the north-west on sectors between Ringneill Point and Sewarage (D50-E30) (BS078-BS097) with the exception of short-term increases at Castle Espie to Comber River (D90/1) (BS089). Moderate short-term declines have also occurred in the north-east on all sectors between Gasworks and Skillens (E90/1-F20/11) (BS117-BS127), and declines have occurred also on most sectors for which trends could be produced on the eastern shore of the lough to the south of Monaghan Bank to Hare Island (F80/1) (BS144).

4.3.17 Northern Lapwing *Vanellus vanellus*

The low tide sector counts for Lapwing reflect the general declines observed by the WeBS Core counts, with around two thirds of the sectors for which trends could be produced showing declines over all three time periods, and only around 10% to 17% of sectors showing increases. Among the exceptions, there were increases over all three timescales at Horse to Castle Espie consol (D80/2 whole) (BS088), Mill Point to Herring Bay Point (F50) (BS132) and Sewarage to Ards Sluice Gates (E40/S) (BS175) and increases in both the short- and medium-terms at Rough Island to Sewarage (E30) (BS097) (long-terms trends could not be produced for this sector). Two of the other sectors within the Sewarage to Ards Sluice Gates core count sector (E40/N & E40/C) (BS173 & BS174) were among the three most important low tide count sectors, for Lapwing, in terms of mean peak counts over the last five winters (2012/2013 – 2016/2017). Both showed increases of more than 100% in the short-term but moderate decreases in both the medium- and long-terms. At the other important sector in terms of recent peak counts, Comber River to Rough Island consol (E20/2), declines of greater than 25% were recorded over all three time periods, with declines of more than 50% recorded in the medium-term.

4.3.18 European Golden Plover *Pluvialis apricaria*

Low tide trends for Golden Plover have been very variable across the 37 sectors for which trends could be reported, with around 25% and 40% of sectors recording increases in the medium- and long-terms respectively, compared with 60% and 46% of sectors showing declines in each of those two time periods. The short-term trends are more positive, with increases recorded on 38% and decreases on only 19% of the sectors. The most important sectors, in terms of mean peak counts over the last five winters (2012/2013 – 2016/2017) were at Sewarage to Ards Sluice Gates (E40/N & E40/C) (BS173 & BS174) and Comber River to Rough Island consol (E20/2) (BS095). All three sectors showed increases in the short- and long-term, with E40C (BS174) also showing increases in the medium-term when the other two sectors showed moderate decreases. Note however that numbers declined over all three time periods at another sector within the Sewarage to Ards Sluice Gates core count area which previously held important numbers (E40/2) (BS176), so the increases in the other two sectors may have been caused by local re-distribution.

4.3.19 Grey Plover *Pluvialis squatarola*

Low tide count trends for Grey Plover could only be produced for one sector, Castle Espie to Comber River (D90/2) (BS093. Declines of greater than 100% were also recorded here in the medium- and long-terms, with numbers being stable over the short-term. There have been insufficient numbers recorded to produce trends on all other sectors, including two sectors where mean peak counts of 50 or greater were recorded on one or more years in the early 2000s, Butterlump to Cunningburn (E70/1) (BS109) and Salt Water Bridge to Castle Hill (G10/5&6) (BS155). No birds have been recorded at BS109 in the last ten years and only very small numbers at BS155.

4.3.20 Common Ringed Plover *Charadrius hiaticula*

Low tide count trends for Ringed Plover could only be produced for seven sectors, with Nusquarter Point to Monaghan Bank (F70) (BS143) being the only sector which did not show decreases over any of the three time periods (moderate long-term increase and short-term and long-term stability). Rough Island to Sewarage (E30) (BS097), Cunningburn to Gasworks (E80) (BS172) and two sectors at Ard Sluice Gates to Butterlump (E60/5&6 & E60/7&8) (BS180 & BS181) all recorded declines of greater than 50% in the long-term, stability or moderate decline in the medium-term and stability in the short-term. The remaining two sectors for which trends could be produced, Killard to Kilclief (A10) (BS001) and Skillens to Mill Point (F30) (BS130) both recorded a mixture of declines and increases, with the increases occurring in the short-term in both cases. Trends could not be produced for Sewarage to Ards Sluice Gates (E40/N) (BS173), another site which has recorded high mean peak counts over the last five winters (2012/2013 – 2016/2017).

4.3.21 Eurasian Curlew *Numenius arquata*

The low tide count trend have been mixed across Strangford Lough, but around 50% of the 54 sectors for which trends could be produced showed declines in the medium- and long-terms, with only around 20% of sectors showing increases over the same time periods. The short-term trends were better, with 22% of sectors recording decreases compared with 15% showing increases and the remainder being stable. The sectors showing most increases were mostly in the Butterlump area (E60/4, E60/6, E60/8, E70/2 & E70/3) (BS104, BS106, BS108, BS110 & BS111). In addition, West Sloane to Castle Island (A90) (BS024) recorded increases across all three time periods and several other widely scattered sectors showed a mixture of increases or stable trends with no decreases. These included the only sector which recorded a mean peak count of greater than 100 over the last five winters (2012/2013 – 2016/2017), at Castle Espie to Comber River (D90/2) (BS093) which showed stability over all three timeframes. However, widespread declines occurred between South Ringdufferin (C10/5) (BS040) and Ardmillan East (C80/3) (BS067), where decreases were observed in most of the sectors for which trends could be produced, and the same was true on the eastern shore of the lough on all sectors from and to the south of Salt Water Bridge to Castle Hill (G10/1&2) (BS149).

4.3.22 Black-tailed Godwit *Limosa limosa*

Trends for Black-tailed Godwit could only be produced for five low tide count sectors, with increases generally occurring over the long-term but decreases over the short- and medium-term. The most important sectors for this species, based on the mean peak counts over the last five winters (2012/2013 – 2016/2017) were at Braddock to Cadew (C60/4) (BS055), for which trends could not be

produced, and at Mahee Point to Cross Island (D30) (BS074), which showed increases over all three timeframes. The two low tide sectors within the Castle Espie to Comber River core count area (D90/1 & D90/2) (BS089 & BS093) showed contrasting trends suggesting some local redistribution, with steep declines in the medium- and long-term and stability in the short-term occurring at BS089, and a long-term increase but short-term declines occurring at BS093. The latter trend pattern was matched at the other two low tide sectors for which trends were produced: West Sloane to Castle Island (A90) (BS024) and Ardmillan West (C70/4) (BS064).

4.3.23 Bar-tailed Godwit *Limosa lapponica*

As was the case with the core counts, population trends for Bar-tailed Godwit were variable across the 22 sectors for which trends could be produced. In the medium-term, the vast majority of sectors increased or were stable, with only two sectors showing declines, but in both the short- and long-term there was a more even split, with similar numbers of declines and increases recorded in both cases. Most of the important sectors for this species are towards the northern end of the lough. The most important sectors for Bar-tailed Godwit, based on the mean peak counts over the last five winters (2012/2013 – 2016/2017), showed variable trends: Sewarage to Ards Sluice Gates (E40/2) (BS176) and Paddy's Point to Sleepers (D60) (BS079) both remain important despite steep declines in the long-term. At BS079, moderate declines also occurred in the short-term but were offset by moderate increases in the medium-term. The other two most important sectors, at Ards Sluice Gates to Butterlump (E60/6) (BS106) and Butterlump to Cunningburn (E70/1) (BS109), both showed steep increases in all time periods apart from in the medium-term at the latter site where numbers were stable. Steep increases also occurred over all three time periods on one of the other low tide sectors at Ards Sluice Gates to Butterlump (E60/8) (BS108). In contrast, three other sectors recorded important numbers in the previous five-year period (2007/2008 – 2011/2012) but no longer do so: Nusquarter Point to Monaghan Bank (F70) (BS143), Monaghan Bank to Hare Island (F80/2 Horse Island) (BS145) and Salt Water Bridge to Castle Hill (G10/5&6) (BS155). Numbers on these three sectors peaked during the middle of the period covered by this report and steep declines have occurred in the short-term.

4.3.24 Ruddy Turnstone *Arenaria interpres*

There have been insufficient numbers recorded to produce trends for Turnstone on all but one low tide count sector, Killard to Kilclief (A10 including Killard Point) (BS001). On this sector, there were moderate declines in the medium-term with numbers stable for the other two time periods. Although trends could not be produced elsewhere, Turnstone are recorded in very low numbers on many sectors across the lough, and two other sectors recorded mean peak counts of greater than 20 in one of the last five winters (2012/2013 – 2016/2017): Sleepers to Horse (D70) (BS082) and Anne's Point to South Island / Skillen (F20/5) (BS121).

4.3.25 Red Knot *Calidris canutus*

The low tide counts for Knot showed a similar pattern to those carried out at high tide, with declines being observed across the vast majority of the 27 sectors for which trends could be produced. Declines occurred on 70% to 80% of low tide count sectors in each of the three time periods, and only six sectors showed increases in one or more timeframes. Increases occurred across all three periods in one sector at Sewarage to Ards Sluice Gates (E40/N) (BS173), although steep declines

occurred over all periods on two of the other low tide count sectors within the same core count area. One of the sectors within Ards Sluice Gates to Butterlump (E60/6) (BS108) was the only other sector to show increases over more than one time period (the short- and long-terms), but showed a steep decline in the medium-term and declines again occurred on other low tide sectors within the same core count area. The four most important sectors for Knot, based on the mean peak counts over the last five winters (2012/2013 – 2016/2017) are all in the north-west of Strangford Lough. Three of these remain important despite steep declines over all three timeframes: Horse to Castle Espie consol (D80/1 whole) (BS085), Castle Espie to Comber River (D90/2) (BS093) and Sewarage to Ards Sluice Gates (E40/2) (BS176). The fourth important sector, Sleepers to Horse (D70) (BS082) recorded moderate declines over the long-term, but a steep increase in the medium-term and stability in the short-term.

4.3.26 Dunlin *Calidris alpina*

The low tide counts for Dunlin were variable, with an approximately even split between declines, increases and stability in the short- and long-term on the 62 sectors for which results could be produced. There were slightly more declines recorded in the medium-term (on 50% of low tide sectors). The increases and decreases were scattered across the lough with different trends often occurring in adjacent sectors, suggesting changes in distribution have generally occurred at a very local level rather than more broad scale changes to favoured foraging areas. However, increases were notable in the Butterlump area, where all seven sectors for which trends could be preoduced showed increases in at least two of the three time periods (E60/2, E60/4, E60/6, E60/8 & E70/1-E70/3) (BS102, BS104, BS106 & BS108-BS111). Two of these sectors (BS106 & BS108) were among the three low tide count sectors which recorded mean peak counts of 500 or more individuals in one or more of the last five winters (2012/2013 – 2016/2017). The other sector which recorded such high numbers over this period was at Castle Espie to Comber River (D90/2) (BS093) where numbers were stable over all three time periods.

4.3.27 Common Redshank *Tringa totanus*

As was the case with the core counts, the majority of low tide count sector trends for Redshank were negative, with decreases occurring at around 60% of the sectors for which trends could be produced in the short-term, but around 70% in the medium- and long-terms. Increases occurred in only around 10%, 7% and 15% of sectors over the short-, medium- and long-term periods respectively. The declines were widespread and affected almost all areas across Strangford Lough, but increases were observed over two or more time periods in several low tide count sectors in the north-east of the lough (E60/4, E60/6, E60/8, E70/3 & E80/3) (BS104, BS106, BS108, BS111 & BS115) and also at West Sloane to Castle Island (A90) (BS024) and at Nusquarter Point to Monaghan Bank (F70) (BS143). The most important sectors, based on mean peak counts over the last five winters (2012/2013 – 2016/2017) recorded mixed results. At Sewarage to Ards Sluice Gates, sector E40/2 (BS176) was stable over all three time periods, whereas sector E40/N (BS173) showed moderate decreases in the medium- and long-term but a steep increase in the short-term. Castle Espie to Comber River (D90/2) (BS093) showed steep declines in the medium- and long-term and stability in the short-term, whilst numbers at Mahee Point to Cross Island (D30) (BS074) were stable in the short- and long-term but increased moderately over the medium-term.

4.3.28 Common Greenshank *Tringa nebularia*

As was the case with the core counts, there were insufficient numbers of Greenshank recorded to produce trends for any of the low tide count sectors. This reflects the fact that the species winters in very low numbers across the lough, with only three sectors having recorded a mean peak count of more than two individuals over the last five winters (2012/2013 – 2016/2017). The maximum mean peak count of just four birds occurred both at South Ringdufferin to Pawle Island Black Rock (C10/5) (BS040) and at Monaghan Bank to Hare Island (F80 Whole) (BS146).

4.4 Broad patterns in relation to aquaculture in sectors

While there have been a number of studies that showed a negative association between mussel and cockle fisheries on shorebirds (e.g. Atkinson *et al*. 2003; Goss-Custard *et al*. 2004; Smit *et al*. 1998) (although for positive associations, see Caldow *et al.* 2003)), there has been little research to date on the impacts of intertidal oyster cultivation on waterbirds, and much of it suffers from limited spatial and temporal scope. It is hypothesised that intertidal oyster cultivation may reduce waterbird (particularly shorebird) abundance by interfering with access to foraging habitat and from disturbance caused by aquaculture husbandry (Ahmed and Solomon 2016). Kelly *et al*. (1996) found that the abundance of shorebirds was reduced in areas of intertidal oyster trestles, and likewise Hilgerloh *et al.* (2001) found that while the presence of intertidal oyster trestles did not impact the behaviour of six waterbird species, some species occurred at lower numbers within the trestle area. Wigeon and Brent Geese were also observed feeding on the algae attached to the trestles, but the effect of this was not tested (Hilgerloh *et al.* 2001). However, in both Kelly *et al.* (1996) and Hilgerloh *et al.* (2001), differences in bird abundance may have been the result of habitat differences between the trestle and non-trestle areas. In a more comprehensive study of intertidal oyster cultivation in the Republic of Ireland, Gittings and O'Donoghue (2012) found that assemblages of birds were different within and outside of trestle areas. In addition it was found that the flocking tendencies of species influenced their aversion to trestle areas; species that feed in small or widely dispersed flocks (e.g. Curlew, Oystercatcher, Redshank, and Turnstone) had a neutral or positive response to trestles, whereas species that forage in large, dense flocks (e.g. Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit and Ringed Plover) had an aversion to the trestle areas (Gittings and O'Donoghue 2012). This negative association was thought to be due to the trestle areas interfering with the flocking of these species. Interestingly, the researchers frequently observed Oystercatchers, Dunlin, Bar-tailed Godwit and Redshank feeding within 50-100m of husbandry activity, without appearing to be disturbed.

4.4.1 Carlingford Lough

All the intertidal oyster cultivation in Carlingford Lough occurred in Mill Bay (01407, Figure 2.1.ii), and increased from zero production in 2010 to a peak of 193 tonnes in 2017. Initial operations were low yield, producing six tonnes in 2011 and seven tonnes in 2012. Short-term trends (the last five winters, 2012/13 – 2016/17) in Mill Bay were compared with the short-term trends across the site as a whole and with long- and medium-term trends, prior to the initiation of oyster cultivation. Species that are particularly of interest in the sector include the features of the SPA (Light-bellied Brent Goose, Oystercatcher, Ringed Plover, Grey Plover, Dunlin, Redshank).

Looking at the short-term trends in wintering waterbird population sizes in Mill Bay alongside the short-term trends across Carlingford Lough as a whole (Table 9), it appears that there have been no negative trends since the initiation of intertidal oyster cultivation in the sector, while negative trends have occurred across Carlingford Lough as a whole. This suggests that aquaculture activity is not impacting on the short-term population trends of any species analysed for this report within Mill Bay. However, examining species annual mean and annual peak numbers and percent proportion of total site numbers in Mill Bay provides additional detail to this assessment.

Mill Bay is a stronghold for wintering Light-bellied Brent Goose in Carlingford Lough, and held the majority of the site's population of these prior to a sudden decline in the percentage contribution in the winter of 2009/2010 (Figure 4.4.1.i), potentially caused by a displacement to other sectors. However, numbers remained steady on the site and showed no sign of being deterred from the sector by the increasing intensity of aquaculture activity in the sector from 2010.

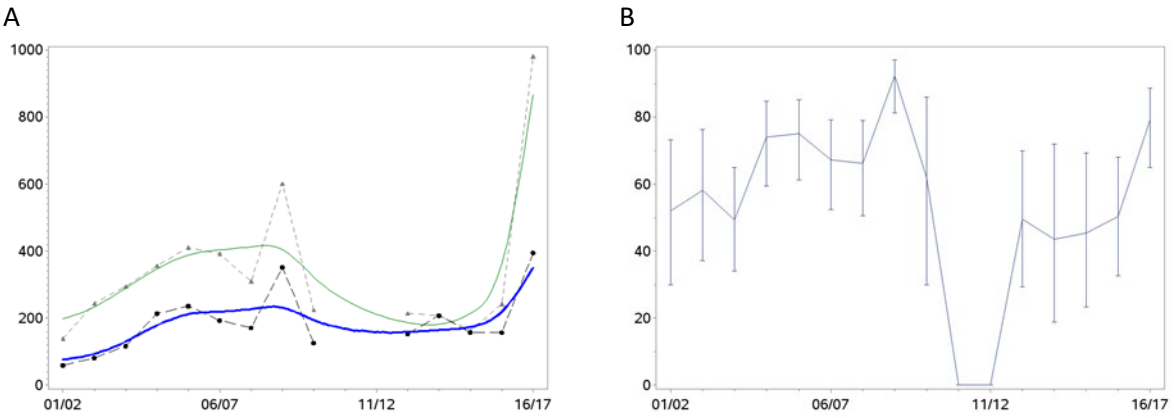


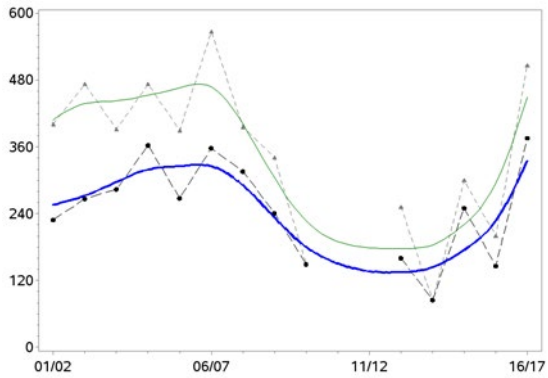
Figure 4.4.1.i: A: The trend in the number of Light-bellied Brent Geese on Mill Bay, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Light-bellied Brent Geese on Carlingford Lough that have been recorded on the Mill Bay count sector between the winters of 2001/2002 and 2016/2017.

Oystercatcher and Redshank, both SPA features of Carlingford Lough, were found by Gittings and O'Donoghue (2012) to have a positive associations with trestle areas. In Mill Bay both species have increased moderately in the last five years, compared with a neutral trend across the lough as a whole (Table 2). Numbers of Oystercatchers had fallen between 2006/2007 and 2009/2010 prior to the commencement of oyster cultivation in Mill Bay. Since then, numbers increased in the sector, although no data were available between 2010/2011 and 2011/2012. Conversely, Redshank increased moderately in Mill Bay over both the long- and short-terms (Table 2, Table 9, 4.4.1.ii), despite long-term decreases in Carlingford Lough overall. Therefore, there is no evidence to suggest that the increase in oyster cultivation since 2010 negatively influenced trends for Redshank or Oystercatcher in the sector, and may have contributed to increases. Turnstone and Curlew, both shown to have neutral or positive responses to trestles by Gittings and O'Donoghue (2012), did not significantly change in their population trends after the establishment or scaling-up of oyster cultivation in Mill Bay, remaining stable in the short-term despite small increases across the site as a whole.

Table 9 Short-term, Core Count population changes of wintering waterbirds in Mill Bay and Carlingford Lough. Trends are taken from Table 2. Red – a decline in numbers of at least 50%; orange – a decline in numbers of at least 25% but less than 50%; white – a decline in numbers of less than 25% or an increase of less than 33%; pale green – an increase in numbers of at least 33% but less than 100%; dark green – an increase in numbers of at least 100%; grey – insufficient data.

	Core Count	
Species	**Mill Bay**	**Carlingford Lough**
Mute Swan		
Light-bellied Brent Goose		
Greylag Goose		
Shelduck		
Wigeon		
Gadwall		
Teal		
Mallard		
Pintail		
Shoveler		
Eider		
Red-breasted Merganser		
Goldeneye		
Great Crested Grebe		
Coot		
Oystercatcher		
Ringed Plover		
Golden Plover		
Grey Plover		
Lapwing		
Dunlin		
Knot		
Black-tailed Godwit		
Bar-tailed Godwit		
Turnstone		
Curlew		
Greenshank		
Redshank		

A



B

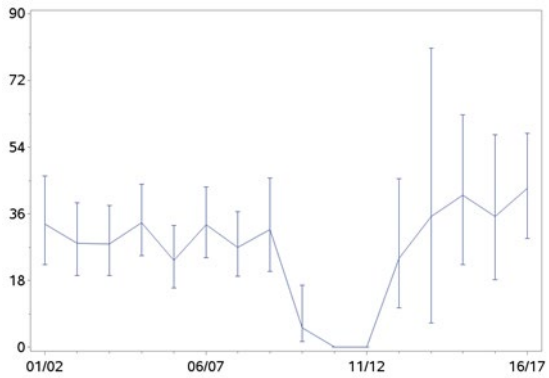
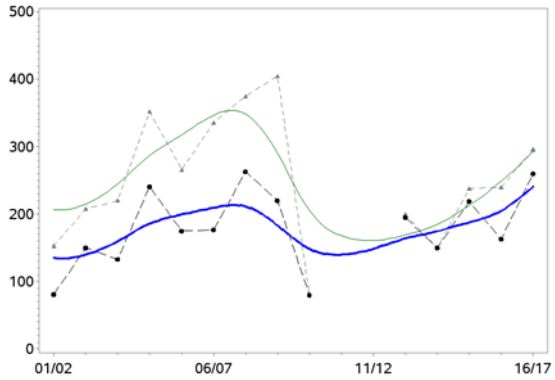


Figure 4.4.1.ii: A: The trend in the number of Redshank on Mill Bay, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Redshank on Carlingford Lough that have been recorded on the Mill Bay count sector between the winters of 2001/2002 and 2016/2017.

A



B

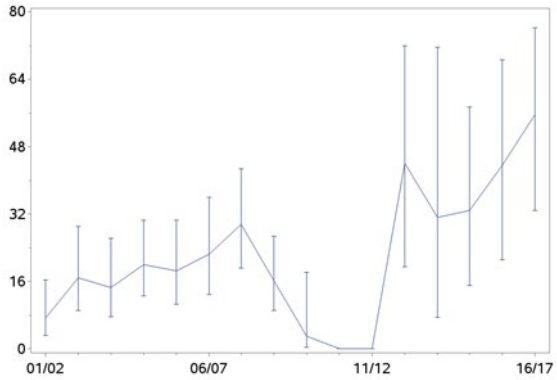
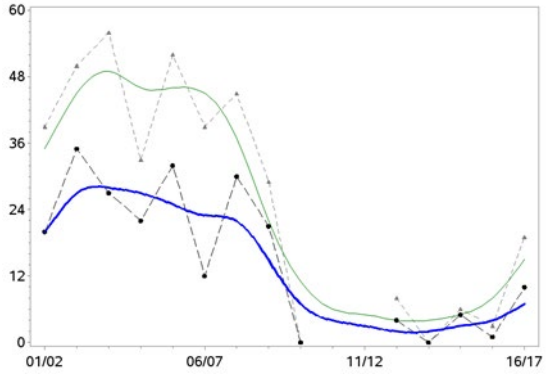


Figure 4.4.1.iii: A: The trend in the number of Oystercatcher on Mill Bay, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Oystercatcher on Carlingford Lough that have been recorded on the Mill Bay count sector between the winters of 2001/2002 and 2016/2017.

A



B

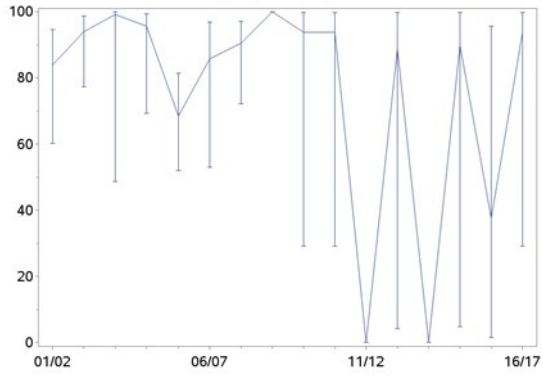


Figure 4.4.1.iv: A: The trend in the number of Grey Plover on Mill Bay, Carlingford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter mean counts. B: The percent proportion of Grey Plover on Carlingford Lough that have been recorded on the Mill Bay count sector between the winters of 2001/2002 and 2016/2017.

Grey Plover were found to have a strong negative association with oyster trestle areas by Gittings and O'Donoghue (2012), despite not foraging in large or dense flocks like other species found to avoid trestle areas. The population of Grey Plover is a feature of the Carlingford Lough SPA, although winter peak counts are relatively low in number (mean = 39, SD = 6). Until 2010/2011 Mill Bay held the only significant number of Grey Plover in the lough. However, in winter 2009/2010 numbers plummeted and have not recovered since (Figure 4.4.1.iv). Although over the short-term, there has been a positive trend in Carlingford Lough, numbers have remained stable but very low in Mill Bay (Table 9). It therefore appears that conditions have changed in Mill Bay and that this may be preventing a recovery in numbers of Grey Plover. Grey Plover are in decline in Northern Ireland, so the lack of recovery in Mill Bay is a concern.

Other SPA feature species for Carlingford Lough that were shown to have a negative association with oyster trestle areas by Gittings and Donoghue (2012) were Dunlin and Ringed Plover. Neither of these species appear to have been negatively affected by the initiation nor scaling up of oyster cultivation in Mill Bay. Although both species declined in the medium- and long-terms in Mill Bay (Dunlin from 2006/2007 and Ringed Plover from 2003/2004), in the short-term populations remained low but stable in the sector. Numbers of Ringed Plover have also remained stable at the site-level in the short-term, but Dunlin continued to decline steeply at the site level despite their stability in low numbers in Mill Bay. Because declines in Dunlin and Ringed Plover were already underway prior to the arrival of intertidal aquaculture, and have remained stable since its establishment, it is unlikely that aquaculture activity is having an adverse effect on these species in Mill Bay.

4.4.2 Strangford Lough

The only licenced intertidal oyster cultivation area in Strangford Lough spans two Core Count, high tide sectors: Paddy's Point to Sleepers (01A33) and Ringneill Point to Paddy's Point (01A32, Figure 2.1.v), and two low tide sectors Strangford Lough LTC D50 (BS078) and Strangford Lough LTC D60 (BS079, 2.1.vi). There was no information available on the tonnage over time produced by this area, so here it is assumed that oyster cultivation began in the same time-period as in Carlingford Lough. Short-term trends (the last five winters, 2012/13 – 2016/17) in the high tide sectors Paddy's Point to Sleepers and Ringneill Point to Paddy's Point were compared with the short-term trends across the site as a whole (Table 10) and with long- and medium-term trends to look for potential environmentally-influenced changes within each sector. Short-term trends in the low tide sectors Strangford Lough LTC D50 and Strangford Lough LTC D60 were compared with long- and medium-term trends, but low tide trends for the entire lough are not available, as low-tide counts are not synchronous and therefore do not represent whole site trends, and instead are used to compare sector usage by wintering birds. All species analysed are important to Strangford Lough as they are features of the SPA, but in particular Strangford Lough's populations of Light-bellied Brent Geese, Knot and Redshank are of international importance and therefore it is important to ensure that aquaculture is not impacting on these species.

4.4.2.1 Core Count (high tide) trends

For the majority of species analysed, numbers of birds were too few to generate short-term trends in the sectors (Table 10), where there was sufficient data to create trends, two species had a more

negative sector-level trend than the site-level trend (Knot and Curlew), two species had a more positive sector-level trend than the site-level trend (Light-bellied Brent Goose and Lapwing), and one species had contrasting trends between the two sectors (Oystercatcher).

Strangford Lough's internationally important population of Light-bellied Brent Geese remained stable across all time periods analysed. Ringneill Point to Paddy's Point and Paddy's Point to Sleepers did not support a significant proportion of this population (~1%), but Ringneill Point to Paddy's Point had slight short-term increases, while Paddy's Point to Sleepers remained stable in the short-term. Therefore, there was no strong signature for an impact of intertidal oyster cultivation on Light-bellied Brent Geese in the sectors.

Table 10 High and low tide short-term population changes of wintering waterbirds for sectors overlapping licenced intertidal oyster cultivation in Strangford Lough (High tide trends from Table 5 and low tide trends are Table 8). Red – a decline in numbers of at least 50%; orange – a decline in numbers of at least 25% but less than 50%; white – a decline in numbers of less than 25% or an increase of less than 33%; pale green – an increase in numbers of at least 33% but less than 100%; dark green – an increase in numbers of at least 100%; grey – insufficient data.

	High Tide			Low Tide	
	Ringneill Point to Paddy's Point	**Paddy's Point to Sleepers**	**Strangford Lough**	**Strangford Lough LTC D50**	**Strangford Lough LTC D60**
Mute Swan					
Light-bellied Brent Goose					
Greylag Goose					
Shelduck					
Wigeon					
Gadwall					
Teal					
Mallard					
Pintail					
Shoveler					
Eider					
Red-breasted Merganser					
Goldeneye					
Great Crested Grebe					
Coot					
Oystercatcher					
Ringed Plover					
Golden Plover					
Grey Plover					
Lapwing					
Dunlin					
Knot					
Black-tailed Godwit					
Bar-tailed Godwit					
Turnstone					
Curlew					
Greenshank					
Redshank					

Lapwing also showed a positive short-term population trend in the sectors (Table 10), contrasting with the trends for Strangford Lough overall, which declined moderately in the short-term and steeply over the long-term. Ringneill Point to Paddy's Point suffered from moderate declines in the long- and medium-terms, and the positive short-term trend reflected an increase from very low numbers. The long-term trend in Paddy's Point to Sleepers was stable but this sector increased strongly in the medium- and short-terms. Previous research suggested that intertidal oyster cultivation would be expected to have a negative impact on Lapwing numbers in the sectors (Gittings and O'Donoghue 2012). However, short-term increases in the sectors, in contrast with decreases across the rest of the site, suggest that this has not been the case. It is also unlikely that oyster cultivation is a factor in the increase of Lapwing in the sectors, given the time-scale of the trends observed.

Other species that might be expected to show a positive or neutral response to oyster trestle areas from research by Gittings and O'Donoghue (2012) are Curlew, Oystercatcher and Redshank. However, no positive responses were observed in analysis of WeBS data for Strangford Lough for these species. Redshank remained stable (although very few in number) in the two sectors and across the lough as a whole in the short-term, following declines in the medium- and long-term at both the site- and sector-level. Trends for Oystercatcher contrasted between the sectors (Table 10, Figure 4.4.2.1). In Ringneill Point to Paddy's Point the trend was positive across all time scales, while there was a steep decline in the sector over the short-term, contrasting with a moderate increase in the long-term and stability in the medium-term in Paddy's Point to Sleepers. More widely, Strangford Lough experienced moderate declines over all time-scales. Therefore, it is unlikely that intertidal oyster cultivation is responsible for influencing trends in Oystercatcher either positively or negatively, because the trends contrasted between the sectors, and because changes occurred over a longer time scale than the assumed commencement of aquaculture activity in the sectors.

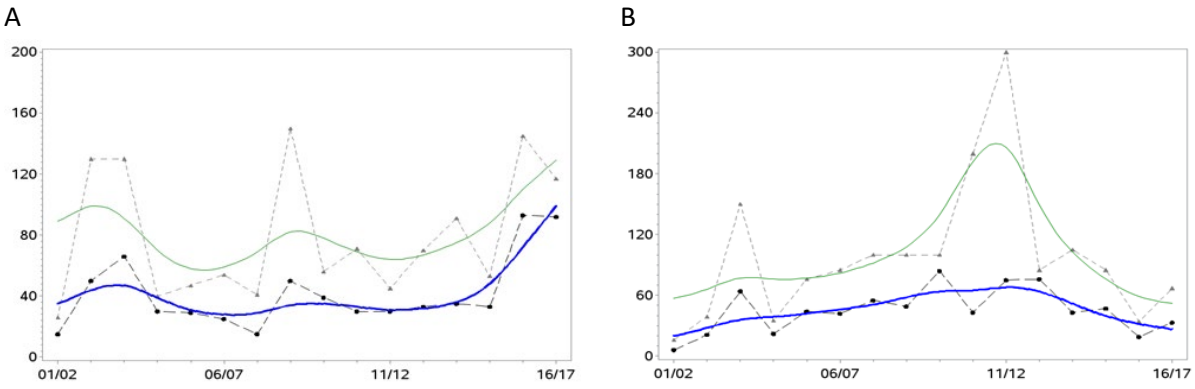


Figure 4.4.2.1: A: The trend in the number of Oystercatcher on Ringneill Point to Paddy's Point, Strangford Lough. B: The trend in the number of Oystercatcher on Paddy's Point to Sleepers, Strangford Lough. The upper (green) trend line is fitted through the winter peak counts whilst the lower (blue) line is fitted through the winter

While Gittings and O'Donoghue (2012) found that Curlew had a neutral association with trestle areas, in Paddy's Point to Sleepers although there were few Curlew on the site (<20 winter mean per year) the number declined moderately over the long- and short-term and steeply over the medium-term. Insufficient Curlew were counted for trends to be generated for Ringneill Point to Paddy's Point. The decline of the Paddy's Point to Sleepers population contrasts with the trend of the lough, which remained stable over all time scales. This suggests that there may have been factors in the Paddy's Point to Sleepers sector that caused a decline in Curlew. However, given the time scale of the decline this is unlikely to be solely due to oyster culture activity and since numbers of Curlew are low, the confidence in the trend must also be treated with caution.

Knot also experienced a more negative population trend in the vicinity of the licenced oyster trestle area than was observed at the level of the lough. While there were insufficient Knot recorded in Ringneill Point to Paddy's Point to generate a trend, in Paddy's Point to Sleepers the trends for the sector were steeply declining at all time scales. Declines were also observed at the site-level, but these were moderate in the short-term, contrasting with the steep decline in Paddy's Point to Sleepers. Therefore, as with Curlew, there may have been factors creating a greater decline in Paddy's Point to Sleepers, but since this decline has occurred not only in the short-term but across the long-term, it is unlikely to be a response to increasing aquaculture activity in the sector.

4.4.2.2 Low tide trends

Although Core Counts provide important information on the number of birds within the loughs and sectors of the loughs, there are additional advantages to analysing low tide trends for the assessment of impacts of human activities on waterbirds, because the ebb and flow of the tide has a large influence on the foraging habitat available within sectors. For example, the birds counted at high tide in one sector may be roosting in that sector but foraging elsewhere in a different sector. Therefore the impacts of disturbance on foraging habitat exposed by the tide may not be evident from high tide counts.

There were insufficient data for 20 species in the low tide sectors surrounding the licenced intertidal oyster cultivation area in Strangford Lough (Table 10). In particular Ringed Plover and Grey Plover, two species shown to have a negative association with oyster trestles (Gittings and O'Donoghue 2012) were not frequently counted on the sectors and therefore no trends were generated.

Strangford Lough LTC D50 included three species with positive short-term trends: Light-bellied Brent Goose, Golden Plover, Bar-tailed Godwit and Redshank, while no species in Strangford Lough LTC D60 had a positive short-term trend. Of the eight species with trend information, Dunlin declined only in the short-term, which is assumed to be the time period where oyster cultivation was initiated or at least scaled-up, without declining in the medium- or long-terms. For all other species, short-term declines were associated with medium- and long-term declines, and therefore unlikely to be linked to the commencement of oyster cultivation unless this has been active in the sectors for over 10 years.

Trends for Light-bellied Brent Goose in the short-term matched the trends for the high tide sectors they overlapped with, namely a moderate increase in Strangford Lough LTC D50 and stability in Strangford Lough LTC D60. However, Light-bellied Brent Goose have declined in the sectors over the medium- and long-terms, therefore any environmental factors that are negatively effecting the

trend in the low-tide population of Light-bellied Brent Goose in the sectors are likely to be persistent over the long-term.

Oystercatcher, a species that may be neutrally or positively impacted by oyster trestles (Gittings and O'Donoghue 2012), declined across both low-tide sectors over all time scales. There is not a clear link between the low-tide and high-tide trends in the area however. In the high-tide sector, Ringneill Point to Paddy's Point saw a large increase in numbers over the short-term, while Strangford Lough LTC D50 had a moderate decline in numbers. In contrast, Paddy's Point to Sleepers experienced a steep decline in Oystercatcher, while overlapping low tide sector Strangford Lough LTC D50 only experienced a moderate decline. Contrasts were also evident between high tide and low tide trends in Lapwing, Knot and Redshank. Like Oystercatcher, Redshank may have positive associations with oyster trestle areas (Gittings and O'Donoghue 2012), and there was a positive short-term trend for Redshank in Strangford Lough LTC D50, while the population was stable in the short-term in Strangford Lough LTC D60. Both sectors suffered declines over the long-term, therefore the more positive trend in the short-term may be a result of recent improvements in the sectors, although impossible to link to oyster cultivation at this stage. Lapwing underwent steep short-term declines in Strangford Lough LTC D60, but increased in Paddy's Point to Sleepers. The decline in Lapwing on the low-tide sector was also present in the long-and medium-terms. Knot were stable on Strangford Lough LTC D60, contrasting with the overlapping sector, where steep declines over short-term were observed and in Strangford Lough LTC D50 there were steep short-term declines. In both low tide sectors declines were long-term, so although Knot and Lapwing are species that are potentially negatively associated with oyster trestle areas (Gittings and O'Donaghue 2012), here the long-term declines suggest that other factors are causing the population to decrease. Dunlin are also potentially negatively impacted by oyster trestle areas (Gittings and O'Donaghue 2012). Although there were insufficient data in the high tide sectors to generate trends, at low tide declines were experienced over the short term on both sectors. While numbers of Dunlin on Strangford Lough LTC D60 declined over the long-term, declines of Dunlin on Strangford Lough LTC D50 may be related to recent environmental factors within the sector such as oyster cultivation activity, as medium- and long-term trends were positive.

4.4.3 Conclusions

The increase in tonnage between 2010 and 2017 did not appear to result in a decline in the majority of species analysed for Mill Bay, Carlingford Lough, and conversely increases occurred in both Oystercatcher and Redshank, in agreement with the positive association with oyster trestle areas observed by Gittings and O'Donoghue (2012). The only species to have suffered a negative population trend around the time of the establishment of intertidal oyster cultivation in Mill Bay was the Grey Plover. This species only occurs in small numbers in Carlingford Lough, concentrated in Mill Bay. While the population declined around the time of the establishment of licencing for oyster cultivation, the decline did not persist in line with the scaling-up of aquaculture activity (as measured by tonnage) in the sector, although this could not be assessed formally within the scope of this report. The lack of negative association between the scaling-up of tonnage in the sector and waterbird populations may suggest that an increase in activity has not impacted on populations, but may also indicate that tonnage is weakly linked to the degree of activity, or that increasing activity does not necessarily increase disturbance. In Strangford Lough, no tonnage data were available, nor data on the commencement of oyster cultivation in the licenced area, which would have made

declines in species observed in high tide and low tide sectors difficult to relate to aquaculture activity. However, little evidence was found at both high and low tide for the impact of the licenced oyster cultivation area on waterbird populations. The only declines observed in the high tide sectors that overlapped the licenced area were long-term declines, and therefore not likely to reflect an avoidance response to the commencement of oyster cultivation in the sectors. During the low tide, Dunlin had a negative short-term trend on one of the two sectors, contrasting with longer term increases, suggesting that there was a recent change in the environment of the sector influencing the population. The short-term positive trends in Oystercatcher and Redshank populations observed in Mill Bay were not reflected in Strangford Lough high tide trends, although Redshank had more positive short-term trends at low tide. High tide trends in the sectors containing the single licenced intertidal oyster cultivation area contrasted (Oystercatcher) or were stable (Redshank).Therefore, although there was some evidence that declines in Redshank improved in the short term during low tides in the area of oyster cultivation, and of negative population change for Dunlin on one sector at low tide in Strangford Lough and of Grey Plover in Carlingford Lough, the evidence for oyster cultivation impacting population trends of waterbirds using WeBS data is weak and mixed.

4.5 Broad patterns

4.5.1 Carlingford Lough

4.5.1.1 Shelduck and waders

As in Austin *et al.* (2008) and Ross-Smith *et al*. (2013), Shelduck and waders are discussed together because all these species feed on mudflat invertebrates, and are therefore likely to respond in similar ways to changes in the environment. Of the 13 species considered, nine declined at the Carlingford Lough scale over at least one time period in the 15 winters covered by this report. Dunlin and Shelduck declined in numbers over all time scales and were the only species where a decline was apparent over the short-term. Oystercatcher, Ringed Plover, Grey Plover, Bar-tailed Godwit and Reshank declined in the medium- and long-terms. Increases in numbers were apparent for eight species over at least one timeframe, including four species for which increases have been sustained over all three timeframes (Golden Plover, Lapwing, Knot and Black-tailed Godwit). Numbers of Bar-tailed Godwit, Turnstone and Curlew all exhibited moderate increases in the short-term following earlier declines. The sectors within Rostrevor to Newry appeared to particularly struggle to support the population of Shelduck and waders in Carlingford Lough, with the exception of Lapwing and Black-tailed Godwit. In contrast Omeath to Ballagan Point, on the south shore of the lough had more positive trends in population number, in particular seeing an increase in Turnstone and Redshank that contrasted with Rostrevor to Newry. More mudflat species were in decline in Mill Bay than increasing, with steep long-term declines observed in Shelduck, Ringed Plover, Grey Plover, Dunlin, Bar-tailed Godwit and Redshank.

4.5.1.2 Dabbling ducks

While there was insufficient data available to create trends for Gadwall, Pintail and Shoveler, of the three species with sufficient data, Wigeon and Mallard saw population increases in Carlingford Lough, while Teal remained stable in the long-term, with declines over the medium- and short-terms. Within the lough, Teal increased in Omeath to Ballagan Point (and sectors within) and Mill Bay, despite declines from Rostrevor to Newry. Omeath to Greenore and Mill Bay were particularly

important sectors in the lough, experiencing increases across all time scales for Wigeon, Mallard and Teal.

4.5.1.3 Other wildfowl

Other species for which trends could be calculated for Carlingford Lough were Light-bellied Brent Goose, Red-breasted Merganser, Goldeneye and Great Crested Grebe. Although sector level trends could not be calculated for Red-breasted Merganser, across the lough as a whole this species remained stable at the long-term, and increased slightly over the short term. Goldeneye and Great Crested Grebe declined steeply in Carlingford Lough over all time scales, whereas Light-bellied Brent Goose increased over the long- and short-terms. The differences in the trends for these species was consistent at the sector level, with all sectors with available data experiencing steep declines in Goldeneye and Great Crested Grebe at all time scales. Long term increases in Light-bellied Brent Goose were observed in Rostrevor to Newry, Omeath to Ballagan Point (and sub-sectors within) and Mill Bay.

4.5.2 Strangford Lough

4.5.2.1 Shelduck and waders

Of the 13 species considered, 12 declined at the Strangford Lough scale over at least one time period in the 15 winters covered by this report. Oystercatcher, Golden Plover, Grey Plover, Lapwing, Knot and Bar-tailed Godwit all declined in numbers over all time scales and were the only species where a decline was apparent over the short-term. Dunlin and Redshank declined over the medium- and long-terms, Shelduck and Ringed Plover declined in the medium-term, while Curlew remained stable over all time periods. Only Black-tailed Godwit experienced a population increase in Strangford Lough over the count period.

Only two high tide sectors saw population increases for some mud-flat species without declines in other species. These were Islands Mid Lough, which had increases in Oystercatcher, Golden Plover, Dunlin and Curlew, and Bankmore to Carrstown where Oystercatcher, Golden Plover, Lapwing and Curlew increased in number. Some collections of high tide sectors appeared to be particularly suffering with declines in multiple species, for example Ards Sluice Gates to Butterlump to Gasworks to Anne's Point, Anne's Point to South Island / Skillens to Skillens to Mill Point, and Monaghan Bank to Hare Island to Castle Hill to Ringburr. The sectors between Hannah's Hedge to Walshestown Quay and Castle Island to Hare Island all experienced long-term, steep declines in Redshank.

The overall impression from low tide counts was of decreasing trends across all species and time scales, all around the lough. Collections of low tide sectors with negative trends across a spread of species included Strangford Lough LTC D60 (BS079) to Strangford Lough LTC E30 (BS097) in the north-west of the lough and Strangford Lough LTC G10/2 (BS148) to Strangford Lough LTC G20 whole (BS159) between Hare Island and Ringburr. However, a range of mudflat species had increasing low tide trends between Strangford Lough LTC E60/3 (BS103) and Strangford Lough LTC E70/3 (BS111) in the Ards Sluice Gates to Cunningburn area, in contrast with the high tide trends in the area. The exception in this area was Knot, which saw declines on three of the included low tide sectors.

For the majority of species and sectors, high tide and low tide trends were similar. Comparisons for Oystercatcher were difficult to make, due to it being widespread throughout the lough and with variable trends across locations, time scales and tides. Although low tide trends for Golden Plover mostly agreed with high tide trends, but trends differed at Sewarage to Ards Sluice Gate (Strangford Lough LTC E40/N (BS173) and Strangford Lough LTC E40/C (BS174)), with long term declines seen in the high tide populations, and long term increases in the low tide population. This may be because Golden Plover roosts on mud at low tide, so perhaps that this area has become a preferred roosting site at low tide and birds dispersing inland/elsewhere at high tide. Although general trends were in agreement for low and high tide for Lapwing, this species also saw some spatial mismatch between trends, but like Golden Plover birds at low tide could be roosting rather than feeding. Comparing trends between the tides for Dunlin is difficult, as the trends were very varied across spatial and temporal scales. However, the more positive high tide trends were located close to low tide sectors with more positive trends, which may also reflect birds roosting close to areas which have been increasingly favoured for foraging. The stability observed in the high tide counts of Curlew was not evident in the low tide counts across all time scales, with only the short-term low tide counts suggesting stability. Curlew were widely distributed around the lough at both high and low tides and there was a mismatch between sites with trends at the low tide with those at high tide, possibly because Curlew do not necessarily forage close to their roosting sites.

4.5.2.2 Dabbling ducks

Across Strangford Lough as a whole, Wigeon, Mallard and Shoveler experienced moderate population declines in the long-term, while only Pintail increased over the long-term. Core counts of Gadwall were stable over the long- and short-terms, but increased over the medium-term, and Teal increased over the short-and medium- terms, but remained stable over the long-term. High tide numbers of Wigeon, Teal and Mallard all declined over all time scales in Hare Island to Salt Water Bridge, while sectors Islands Mid Lough, Horse to Castle Espie consol and Comber River to Rough Island consol all suffered from steep long-term declines in Wigeon. Few high tide sectors saw increases in multiple species of dabbling duck, but the population of Mallard and Teal in Audley's to Hannah's Hedge, and the population of Wigeon and Mallard in Ardmillan West increased over the long-term. Pintail only increased in Sewarage to Ards Sluice Gates and Ards Sluice Gates to Butterlump.

In the low tide sectors, Wigeon declined over the long term between sectors Strangford Lough LTC D80/1 L (BS083) and Strangford Lough LTC E20/2 (BS095), between Strangford Lough LTC E90/1 (BS117) and Strangford Lough LTC E90/3 (BS119), and between Strangford Lough LTC G10/2 (BS148) and Strangford Lough LTC G10/5 and 6 combined (BS155). However these declines did not match up with similar trends for other dabbling duck species.

High tide and low tide trends were comparable for dabbling ducks in Strangford Lough. In particular, trends for Pintail between the tides in the area of the Ards Sluice Gates matched between tides, the declines at two low tide sectors within the area are explainable by a change in distribution of Pintail in the local area. Declines in low tide numbers of Mallard and Teal did not appear to match up with the locations of declines at high tide, but local changes in distribution between the tides may explain the small differences seen between high tide and low tide trends in Wigeon and Shoveler.

4.5.2.3 Other wildfowl

Of the eight species in this category, three species underwent steep declines in high tide counts over all time scales: Greylag Goose, Goldeneye and Great Crested Grebe; two species declined steeply over the medium- and long-terms: Red-breasted Merganser and Coot; two species remained stable: Mute Swan and Light-bellied Brent Goose; only Eider increased over the long-term.

Quoile Pondage experienced declines across multiple species at high tide, with Mute Swan, Greylag Goose, Goldeneye and Coot all reducing in number across varying time scales. The species on Anne's Point to South Island / Skillens varied in their trends: Eider increased in the long term, but Light-bellied Brent Goose remained stable and Greylag Goose declined.

At low tide, Light-bellied Brent Goose was the only species to be widespread throughout the lough. The overwhelming majority of low tide trends for this species were negative across all time scales, unlike at high tide, when trends were much more variable. In contrast, trends for Eider were positive, in line with high tide trends. Most of the counts for which trends could be produced for Eider were on the western side of the lough, as was the case with the high tide counts. Goldeneye, which underwent declines in the high tide count, did not have sufficient numbers to calculate low tide trends. There were insufficient observations for further trend comparisons at low tide.

4.6 Recommendations

The analysis of WeBS data highlighted some sectors and species in Carlingford and Strangford Loughs that appeared to be suffering population declines and that merit further investigation, since both loughs are important sites for waterbirds in Northern Ireland and designated for the species included in the analyses.

For example, many species between Rostrevor and Newry have suffered steep declines across at least one time scale, including Oystercatcher, Ringed Plover, Dunlin and Redshank, which are features of the Carlingford Lough SPA. It is important to consider these declines in the wider context of the site and the region. Oystercatcher have remained stable at the site-level, suggesting a redistribution away from Rostrevor to Newry sectors, whereas the proportion of the Northern Irish population of Dunlin supported by Carlingford Lough has decreased overall, suggesting problems not only between Rostrevor to Newry, but across multiple sectors.

In Strangford Lough, no high tide sectors saw increases in all species with sufficient data for analysis, and the overall picture was of widespread declines. Some particular problem areas were highlighted by the trend matrix (Table 5 Overview of population trends in Strangford Lough based on high-tide counts.) however. For example, there were steep declines in a range of duck and wader species, in addition to the internationally important population of Light-bellied Brent Goose in the Hare Island to Salt Water Bridge sector, and notable declines in Lapwing, Dunlin and Knot, as well as Shelduck, between Ards Sluice Gates to Butterlump and Skillens to Mill Point. Areas of the lough that were faring poorly for particular species were also evident: Redshank especially declined over all time scales between Hannah's Hedge to Walshestown Quay and Castle Island to Hare Island. Trends for low tide sectors generally followed high tide trends, although there was a mismatch in area for some

species, for example Curlew, as foraging areas and roosting areas may not necessarily be in the same area. As with high tide some areas of the lough, for example the north-west and between Hare Island and Ringburr, saw more negative trends across a range of species, while other sectors and areas did not fare as badly.

There are many reasons why particular sectors may be experiencing declines in the loughs. Recreational human use of the loughs, for example for wildfowling, walking and boating may cause disturbance to birds while they are feeding or roosting, which has the potential to be very energetically costly to wintering species. Other human impacts may modify the habitat or ecosystem, making it less suitable for foraging or roosting for waterbird populations, for example pollution, harvesting of shellfish or seaweed or gravel extraction.

The analyses conducted here can only highlight sectors where there are potentially factors impacting waterbird populations and describe whether species trends in sectors with aquaculture are diverging from the trends in the site as a whole. Therefore while they provide an understanding of the fluctuations in bird numbers within each lough and assess the potential impact of aquaculture activities and additional developments on site populations, they cannot directly link population changes to environmental factors, human disturbance or aquaculture activity. Furthermore, a lack of divergence in trends between sector and site does not necessarily mean that waterbirds are not affected by human activity on a sector.

It is important to ensure that the biodiversity of Northern Ireland's sea-loughs is protected while their sustainable use is promoted. Therefore, to build on the findings of this report we recommend developing a more targeted field-based study to assess the potential impact of disturbance associated with aquaculture activity on waterbirds, which could also be expanded to include other potential form of disturbance. Data collection describing how the numbers and behaviour (e.g. feeding, diving, resting) of waterbirds vary through the tidal cycle would be of particular importance, as the tide has a strong influence on both the behaviour of waterbirds in estuaries, and also influences the husbandry activity in intertidal oyster trestle areas. A field-based study would provide an assessment of differences in the behaviour and numbers of waterbirds between sites with and without intertidal aquaculture, thereby informing on the potential impacts of disturbance associated with aquaculture on species' activity budgets and providing an assessment of the activities causing disturbance and birds' responses.

References

Ahmed, O. O., & Solomon, O. O. (2016). Ecological Consequences of Oysters Culture. *Journal of Fisheries and Livestock Production*, *4*. https://doi.org/10.4172/2332-2608.1000198

Atkinson, P. W., Austin, G. E., Baillie, S. R., Rehfisch, M. M., Baker, H., Cranswick, P., … Maclean, I. M. D. (2006). Raising 'alerts' for changes in waterbird numbers: the effects of missing data, population variability and count period on the interpretation of long-term survey data in the UK. *Biological Conservation*, *130*(4), 549–559.

Atkinson, P. W., Austin, G. E., Burton, N. H. K., Musgrove, A. J., Pollitt, M., & Rehfisch, M. M. (2000). *WeBS Alerts 1988/99: changes in numbers of waterbirds in the United Kingdom at national, country and Special Protection Area (SPA) scales*. *BTO Research Report No. 239*. Thetford. Retrieved from http://scholar.google.co.uk/scholar?start=10&q=allintitle:+waterbirds+author:austin&hl=en&as_sdt=0,5#1

Atkinson, P. W., Clark, N. A., Bell, M. C., Dare, P. J., Clark, J. A., & Ireland, P. L. (2003). Changes in commercially fished shellfish stocks and shorebird populations in the Wash, England. *Biological Conservation*, *114*(1), 127–141. https://doi.org/10.1016/S0006-3207(03)00017-X

Austin, G. E., Calbrade, N., Rehfisch, M., & Wright, L. (2008). *Humber Estuary Spa Waterbird Populations : Trend Analyses*. *BTO Research Report No. 497*. Thetford.

Austin, G. E., & Ross-Smith, V. H. (2014). *Guidance to Interpretation of Wetland Bird Survey Within-Site Trends Authors*. *BTO Research Report No. 661*. Thetford. Retrieved from https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2014/rr661.pdf

Banks, A. N., & Austin, G. E. (2004). *Statistical comparisons of waterbird site trends with regional and national trends for incorporation within the WeBS Alerts System*. *BTO Research Report No. 359*. Thetford.

Caldow, R. W. G., Beadman, H. A., McGrorty, S., Kaiser, M. J., Goss-Custard, J. D., Mould, K., & Wilson, A. (2003). Effects of intertidal mussel cultivation on bird assemblages. *Marine Ecology Progress Series*, *259*, 173–183. Retrieved from www.jncc.gov.uk/ukspa/

DAERA. (2020). Poots announces £360k support for aquaculture sector. Retrieved July 28, 2022, from https://www.daera-ni.gov.uk/news/poots-announces-ps360k-support-aquaculture-sector

Frost, T. M., Calbrade, N. A., Birtles, G. A., Mellan, H. J., Hall, C., Robinson, A. E., … Austin, G. E. (2020). *Waterbirds in the UK 2018/19: The Wetland Bird Survey*. *BTO, RSPB and JNCC, in association with WWT.* Thetford.

Gittings, T., & O'Donoghue, P. (2012). *The effects of intertidal oyster culture on the spatial distribution of waterbirds.* Cork. Retrieved from https://oar.marine.ie/bitstream/handle/10793/983/Oyster Trestles Shorebirds Atkins.pdf?sequence=1

Goss-Custard, J. D., Stillman R.A., West, A. D., Caldow R.W.G., Triplet, P., le V. dit Durell, S. E. A., & McGrorty, S. (2004). When enough is not enough: shorebirds and shellfishing. *Proceedings of the Royal Society B*, *271*, 233–237. https://doi.org/10.1098/rspb.2003.2602

Hilgerloh, G., Halloran, J. ., Kelly, T. C., & Burnell, G. M. (2001). A preliminary study on the effects of

oyster culturing structures on birds in a sheltered Irish estuary. *Hydrobiologia*, *465*, 175–180. https://doi.org/10.1023/A:1014501210227

Kelly, J. P., Evens, J., Stallcup, R. W., & Wimpfheimer, D. (1996). Effects of aquaculture on habitat use by wintering shorebirds in Tomales Bay, California. *California Fish and Game*, *82*(4), 160–174. Retrieved from http://coalitiontoprotectpugetsoundhabitat.org/wp-content/uploads/2013/03/Sierra_Club_Marin_Doc-0096-Kelly_et_al_1996_aquaculture.pdf

Ross-Smith, V. H., Calbrade, N. A., & Austin, G. E. (2013). *Updated analysis of Wetland Bird Survey (WeBS) data for the Humber Estuary SSSI, SAC, SPA and RAMSAR site*. *BTO Research Report No. 636*. Thetford.

Ross-Smith, V. H., Calbrade, N. A., & Austin, G. E. (2015). *Waterbird population trend analysis of the Mersey Estuary SPA, Mersey Narrows & North Wirral Foreshore pSPA and Ribble & Alt Estuaries SPA*. *BTO Research Report No. 640*. Thetford.

Smit, C. J., Dankers, N., Ens, B. J., & Meijboom, A. (1998). Birds, mussels, cockles and shellfish fishery in the Dutch Wadden Sea: how to deal with low food stocks for eiders and oystercatchers? *Senckenbergiana Maritima*, *29*(1–6), 141–153.

Woodward, I. D., Frost, T. M., Hammond, M. J., & Austin, G. E. (2019). Wetland Bird Survey Alerts 2016/2017: Changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Areas of Special Scientific interest (AS. *BTO Research Report*, *721*.

Image: Liz Cutting. Front cover image: Liz Cutting

Analysis of waterbird population trends for Northern Ireland's sea loughs: assessing the potential impacts of aquaculture and disturbance.

Part 1 – Strangford Lough and Carlingford Lough

This study aims to produce the first sector-level analysis of Wetland Bird Survey (WeBS) data in Northern Ireland, on two of the sea-lough sites that host aquaculture activities. This will improve understanding of the fluctuations in numbers of waterbirds within the sites and inform the consenting of operations and assessment of development plans on these SPAs.

Booth Jones, K., Calbrade, N., Woodward, I. & Austin, G. (2019). Analysis of waterbird population trends for Northern Ireland's sea loughs: assessing the potential impacts of aquaculture and disturbance. Part 1 – Strangford Lough and Carlingford Lough. BTO Research Report 719, British Trust for Ornithology, Thetford.

ISBN : 978-1-912642-40-3

9 781912 642403 >