

Ballycotton Bay
Special Protection Area

(Site Code 4022)



Conservation Objectives
Supporting Document

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SUMMARY

This document presents conservation objectives for the non-breeding Special Conservation Interests of Ballycotton Bay Special Protection Area, designated under Directive 2009/147/EC on the conservation of wild birds (Birds Directive).

Part One presents an introduction to the Special Protection Area (SPA) designation process and to the site designated as Ballycotton Bay Special Protection Area, as well as introducing the concept of conservation objectives and their formulation.

Part Two provides site designation information for Ballycotton Bay SPA and Part Three presents the conservation objectives for this site.

Part Four reviews the conservation condition of the site Special Conservation Interest (SCI) species based on an analysis of wintering (non-breeding) population trends. Importantly, this section states the current conservation condition of each of the SCI species and examines these site trends in light of all-Ireland and international status and trends.

Part Five provides supporting information that will assist the interpretation of the site-specific conservation objectives. This section includes a review of the ecological characteristics of the SCI species and examines waterbird distribution recorded during the 2010/11 Waterbird Survey Programme, drawing also on data from NPWS monitoring programmes (e.g. benthic surveys) and the Irish Wetland Bird Survey (I-WeBS). Part Five concludes with information on activities and events that occur in and around the site which may interact with waterbirds during the non-breeding season and includes an assessment of those activities that were recorded to cause disturbance to non-breeding waterbirds during the 2010/11 Waterbird Survey Programme.

PART ONE - INTRODUCTION

1.1 Introduction to the designation of Special Protection Areas

The over-arching framework for the conservation of wild birds within Ireland and across Europe is provided by Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended) (Birds Directive). Together with the EU Habitats Directive (Council Directive 92/43/EEC), these legislative measures provide for wild bird protection via a network of protected sites across Europe known as Natura 2000 sites, of which the overriding conservation objective is the maintenance (or restoration) of 'favourable conservation status' of habitats and species.

Under Article 4 of Directive 2009/147/EC, Ireland, along with other Member States, is required to classify the most suitable territories in number and size as Special Protection Areas (SPAs) for the conservation of certain wild bird species, which are:

- species listed in Annex I of the directive
- regularly occurring migratory species

Also under Article 4, Member States are required to pay particular attention to the protection of wetlands, especially those of international importance.

The National Parks & Wildlife Service (NPWS), part of the Department of the Arts, Heritage and the Gaeltacht, is responsible for the selection and designation of SPAs in Ireland. NPWS has developed a set of criteria, incorporating information relating to the selection of wetland sites developed under the Ramsar Convention, which are used to identify and designate SPAs. Sites that meet any of the following criteria may be selected as SPAs:

- A site regularly supporting 20,000 waterbirds or 10,000 pairs of seabirds;
- A site regularly supporting 1% or more of the all-Ireland population of an Annex I species;
- A site regularly supporting 1% or more of the biogeographical population of a migratory species;
- A site that is one of the 'n' most suitable sites in Ireland for an Annex I species or a migratory species (where 'n' is a variable which is related to the proportion of the total biogeographic population of a species held by Ireland).

The biogeographic population estimates and the recommended 1% thresholds for wildfowl and waders are taken from Wetlands International (Wetlands International, 2002); thresholds reflecting the baseline data period used. The all-Ireland populations for the majority of wintering waterbirds are taken from Crowe et al. (2008).

Site specific information relevant to the selection and designation of a SPA is collated from a range of sources including the Irish Wetland Bird Survey (I-WeBS), The Wetland Bird Survey (WeBS) in Northern Ireland, species specific reports and a wide range of scientific publications, reports and other surveys. If, following collation of all the available scientific data, a site meets the relevant criteria for designation and is selected as an SPA, a list of species for which the site is nationally and internationally important is compiled. These species are known as **Special Conservation Interests** and may be one of the following:

- An Annex I species that occurs at the site in numbers that exceed the all-Ireland 1% population threshold;
- A migratory species that occurs at the site in numbers that exceed the biogeographic 1% population threshold ('internationally important');
- A migratory species that occurs at the site in numbers that exceed the all-Ireland 1% threshold ('all-Ireland importance');

- A species for which the site is considered to be one of the '*n*' most suitable sites in Ireland for the conservation of that species (where *n* is a variable that is related to the proportion of the total biogeographic population held by Ireland).

The wetlands of northwest Europe are a vital resource for millions of northern and boreal nesting waterbird species that overwinter on these wetlands or visit them when migrating further south. To acknowledge the importance of Ireland's wetlands to wintering waterbirds the term Wetland & Waterbirds can be included as a Special Conservation Interest for a Special Protection Area that has been designated for wintering waterbirds, and is or contains a wetland site of significant importance to one or more of the species of Special Conservation Interest.

1.2 Introduction to Ballycotton Bay Special Protection Area

Ballycotton Bay is an east-facing coastal complex situated on the south coast of Co. Cork. The designated site stretches northwards from Ballycotton to Ballynamona, a distance of c.2 km.

The site comprises two sheltered inlets which receive the flows of several small rivers. The southern inlet had formerly been lagoonal (Ballynamona Lagoon) but breaching of the shingle barrier by erosion has led to the habitat becoming estuarine in nature since 1991 (Smiddy, 2005).

The principal habitat within the site is intertidal sand and mudflats. The bay has a range of littoral sediments, ranging from the exposed eastward facing shores of the outer Bay characterised by mobile sands and shingle, to the mid to low shore and inner bay that supports muddier sediments, with a richer species diversity (MERC/ERM, 2012). Saltmarsh and marsh habitat is best represented at Shanagarry and at Ballynamona, while rocky shore (reef) is exposed at low tide in various locations.

Near Ballynamona Lagoon, peat exposures derived from former lake sediments occur. These exposures have a well-developed gallery of burrows from a former piddock population but were not found to contain live piddocks (boring bivalves) when surveyed in 2011. Peat and clay exposures with either existing or historical evidence of piddock activity are unusual communities of limited extent, adding to the biodiversity interest where they occur (MERC/ERM, 2012). The relict burrows provide a potential micro-habitat for species such as small crabs and anemones and the bivalve *Ruditapes decussatus* is also frequent (NPWS, 2014).

While relatively small in area, Ballycotton Bay supports an excellent diversity of wintering waterfowl and has nationally important populations of eleven species, of which two, Golden Plover and Bar-tailed Godwit are listed on Annex I of the E.U. Birds Directive.

The Site Synopsis for Ballycotton Bay SPA and a map showing the SPA boundary are given in Appendix 1.

1.3 Introduction to Conservation Objectives

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve '*favourable conservation status*' and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 2012). In its broadest sense, favourable conservation status means that an ecological feature is being maintained in a satisfactory condition, and that this status is likely to continue into the future. Definitions as per the EU Habitats Directive are given in Box 1.

Box 1

Favourable Conservation Status as defined by Articles 1 (e) and 1(i) of the Habitats Directive

The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:

- *its natural range and areas it covers within that range are stable or increasing; and*
- *the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and*
- *the conservation status of its typical species is favourable'.*

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- *the population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats; and*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations*

Site-specific conservation objectives define the desired condition or range of conditions that a habitat or species should be in, in order for these selected features within the site to be judged as favourable. At site level, this state is termed 'favourable conservation condition.' Site conservation objectives also contribute to the achievement of the wider goal of biodiversity conservation at other geographic scales, and to the achievement of favourable conservation status at national level and across the Natura 2000 network¹.

Where relevant, conservation objectives are defined for attributes² relating to waterbird species populations, and for attributes related to the maintenance and protection of habitats that support them. These attributes are:

- Population trend;
- Population distribution;
- Habitat range and area (extent).

Further guidance is given in Section 3.1 (Conservation Objectives for the Special Conservation Interests of Ballycotton Bay Special Protection Area).

¹ Note that the terms 'conservation condition' and 'conservation status' are used to distinguish between site and the national level objectives respectively.

² Attribute can be defined as: 'a characteristic of a habitat, biotope, community or population of a species which most economically provides an indication of the condition of the interest feature to which it applies' (JNCC, 1998).

PART TWO – SITE DESIGNATION INFORMATION

2.1 Special Conservation Interests of Ballycotton Bay Special Protection Area

The **Special Conservation Interest species**³ for Ballycotton Bay SPA are listed below and summarised in Table 2.1. This table also shows the importance of Ballycotton Bay SPA for these SCI species, relative to the importance of other sites within Ireland, within the South West region⁴ and within County Cork.

The Special Conservation Interests listed for Ballycotton Bay SPA are as follows:-

1. During winter the site regularly supports 1% or more of the all-Ireland population of Teal (*Anas crecca*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 903 individuals.
2. During winter the site regularly supports 1% or more of the all-Ireland population of Ringed Plover (*Charadrius hiaticula*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 167 individuals.
3. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Golden Plover (*Pluvialis apricaria*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,383 individuals.
4. During winter the site regularly supports 1% or more of the all-Ireland population of Grey Plover (*Pluvialis squatarola*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 124 individuals.
5. During winter the site regularly supports 1% or more of the all-Ireland population of Lapwing (*Vanellus vanellus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,782 individuals.
6. During winter the site regularly supports 1% or more of the all-Ireland population of Black-tailed Godwit (*Limosa limosa*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 136 individuals.
7. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Bar-tailed Godwit (*Limosa lapponica*). The mean peak number within the SPA during the baseline period (1995/96 – 1999/00) was 175 individuals.
8. During winter the site regularly supports 1% or more of the all-Ireland population of Curlew (*Numenius arquata*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 853 individuals.
9. During winter the site regularly supports 1% or more of the all-Ireland population of Turnstone (*Arenaria interpres*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 179 individuals.
10. During winter the site regularly supports 1% or more of the all-Ireland population of Common Gull (*Larus canus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 584 individuals.

³ Special Conservation Interest species are listed in taxonomic order.

⁴ 'Region' refers to regions as defined by Irish Regions Office and in the case of the South West region takes into account cross-border sites Blackwater Estuary and Blackwater Callows.

11. During winter the site regularly supports 1% or more of the all-Ireland population of Lesser Black-backed Gull (*Larus fuscus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,293 individuals.
12. The wetland habitats contained within Ballycotton Bay SPA are identified of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore the wetland habitats are considered to be an additional Special Conservation Interest.

Table 2.1 Site Designation Summary: species listed for Ballycotton Bay Special Protection Area, plus site importance at national, regional and county scale

Special Conservation Interests	Annex I species	Baseline Population ^a	Population status at baseline	National Importance Rank ¹	Regional Importance Rank ²	County Importance Rank ³
Teal (<i>Anas crecca</i>)		903	All-Ireland Importance	9	2	2
Ringed Plover (<i>Charadrius hiaticula</i>)		167	All-Ireland Importance	12	3	1
Golden Plover (<i>Pluvialis apricaria</i>)	Yes	2,383	All-Ireland Importance	23	6	5
Grey Plover (<i>Pluvialis squatarola</i>)		124	All-Ireland Importance	16	3	2
Lapwing (<i>Vanellus vanellus</i>)		2,782	All-Ireland Importance	21	5	4
Black-tailed Godwit (<i>Limosa limosa</i>)		136	All-Ireland Importance	25	8	7
Bar-tailed Godwit (<i>Limosa lapponica</i>)	Yes	175	All-Ireland Importance	22	6	4
Curlew (<i>Numenius arquata</i>)		853	All-Ireland Importance	13	6	5
Turnstone (<i>Arenaria interpres</i>)		179	All-Ireland Importance	6	2	1
Common Gull (<i>Larus canus</i>)		584	All-Ireland Importance	9	5	4
Lesser Black-backed Gull (<i>Larus fuscus</i>)		1,293	All-Ireland Importance	3	3	3
Other conservation designations associated with the site ^b	SAC	RAMSAR SITE	IMPORTANT BIRD AREA (IBA)	WILDFOWL SANCTUARY	OTHER	OTHER
		Yes	Yes	Yes	pNHA	

^a Baseline data are the 5-year mean peak counts for the period 1995/96 – 1999/00 (I-WeBS).

^b Note that other designations associated with Ballycotton Bay may relate to different areas and/or some of these areas may extend outside the SPA boundary.

¹ National importance rank – the number given relates to the importance of the site for the non-breeding populations of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites in Ireland.

² Regional importance rank - the number given relates to the importance of the site for the non-breeding populations of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within the South West Region; includes the cross-region sites Blackwater Estuary and Blackwater Callows.

³ County importance rank - the number given relates to the importance of the site for the non-breeding populations of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within Co Cork; includes the cross-county sites Blackwater Estuary and Blackwater Callows.

PART THREE – CONSERVATION OBJECTIVES FOR BALLYCOTTON BAY SPA

3.1 Conservation Objectives for the non-breeding Special Conservation Interests of Ballycotton Bay SPA

The overarching Conservation Objective for Ballycotton Bay Special Protection Area is to ensure that waterbird populations and their wetland habitats are maintained at, or restored to, favourable conservation condition. This includes, as an integral part, the need to avoid deterioration of habitats and significant disturbance; thereby ensuring the persistence of site integrity.

The site should contribute to the maintenance and improvement where necessary, of the overall favourable status of the national resource of waterbird species, and continuation of their long-term survival across their natural range.

Conservation Objectives for Ballycotton Bay Special Protection Area, based on the principles of favourable conservation status, are described below and summarised in Table 3.1. Note that these objectives should be read and interpreted in the context of information and advice provided in additional sections of this report.

Objective 1: *To maintain the favourable conservation condition of the non-breeding waterbird Special Conservation Interest species listed for Ballycotton Bay SPA.*

This objective is defined by the following attributes and targets:-

- To be favourable, the long term **population trend** for each waterbird Special Conservation Interest species should be stable or increasing.⁵ Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.⁶
- To be favourable, there should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.⁷

Factors that can adversely affect the achievement of Objective 1 include:

- ❖ Habitat modification: activities that modify discrete areas or the overall habitat(s) within the SPA in terms of how one or more of the listed species use the site (e.g. as a feeding resource) could result in the displacement of these species from areas within the SPA and/or a reduction in their numbers (for further discussion on this topic please refer to Section 5.4).
- ❖ Disturbance: anthropogenic disturbance that occurs in or near the site and is either singular or cumulative in nature could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and/or a reduction in their numbers (for further discussion on this topic please refer to Section 5.4).

⁵ Note that 'population' refers to site population (numbers wintering at the site) rather than the species biogeographic population.

⁶ Population trend analysis is presented in Section 4.

⁷ Waterbird distribution from the 2010/2011 waterbird survey programme is examined in Section 5.

- ❖ Ex-situ factors: several of the listed waterbird species may at times use habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it. The reliance on these habitats will vary from species to species and from site to site. Significant habitat change or increased levels of disturbance within these areas could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and/or a reduction in their numbers (for further information on this topic please refer to Section 5.2).

Objective 2: *To maintain the favourable conservation condition of the wetland habitat at Ballycotton Bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.*

This objective is defined by the following attributes and targets:-

- To be favourable, the permanent **area** occupied by the wetland habitat should be stable and not significantly less than the area of **281 ha**, other than that occurring from natural patterns of variation.

The boundary of Ballycotton Bay SPA was defined to include the primary wetland habitats of this site. Objective 2 seeks to maintain the permanent extent of these wetland habitats, which constitute an important resource for regularly-occurring migratory waterbirds. The wetland habitats can be categorised into three broad types: subtidal; intertidal; and supratidal. Over time and through natural variation these subcomponents of the overall wetland complex may vary due to factors such as changing rates of sedimentation, erosion etc. Waterbird species may use more than one of the habitat types for different reasons (behaviours) throughout the tidal cycle.

Subtidal areas refer to those areas contained within the SPA that lie below the mean low water mark and are predominantly covered by marine water. Tidal rivers, creeks and channels are included in this category. For Ballycotton Bay SPA this broad category is estimated to be **71 ha**. Subtidal areas are continuously available for benthic and surface feeding waterfowl and piscivorous/other waterbirds, while various waterbirds roost in subtidal areas (e.g. gulls).

The intertidal area is defined, in this context, as the area contained between the mean high water mark and the mean low water mark. For Ballycotton Bay SPA this is estimated to be **150 ha**. When exposed or partially exposed by the tide, intertidal habitats provide important foraging areas for many species of waterbirds, especially wading birds, as well as providing roosting/loafing⁸ areas. When the intertidal area is inundated by the tide it becomes available for benthic and surface feeding ducks and piscivorous/other waterbirds. During this tidal state this area can be used by various waterbirds as a loafing/roosting resource.

The supratidal category refers to areas that are not frequently inundated by the tide (i.e. occurring above the mean high watermark) but contain shoreline and coastal habitats and can be regarded as an integral part of the shoreline. For Ballycotton Bay SPA this is estimated to be **60 ha**. Supratidal areas are used by a range of waterbird species as a roosting resource as well as providing feeding opportunities for some species.

The maintenance of the 'quality' of wetland habitat lies outside the scope of Objective 2. However, for the species of Special Conservation Interest, the scope of Objective 1 covers the need to maintain, or improve where appropriate, the different properties of the wetland habitats contained within the SPA.

⁸ Loafing can be described as any behaviour not connected with breeding or feeding, and includes preening and resting.

Table 3.1 Conservation Objectives for the waterbird Special Conservation Interests of Ballycotton Bay SPA.

Objective 1:				
<i>To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Ballycotton Bay SPA, which is defined by the following list of attributes and targets:</i>				
Parameter	Attribute	Measure	Target	Notes
Population	Population trend	Percentage change as per population trend assessment using waterbird count data collected through the Irish Wetland Bird Survey and other surveys.	The long term population trend should be stable or increasing	Waterbird population trends are presented in Part Four of this document.
Range	Distribution	Range, timing or intensity of use of areas used by waterbirds, as determined by regular low tide and other waterbird surveys.	There should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest other than that occurring from natural patterns of variation.	Waterbird distribution from the 2010/11 waterbird survey programme is reviewed in Part Five of this document.
Objective 2:				
<i>To maintain the favourable conservation condition of the wetland habitat at Ballycotton Bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:</i>				
Parameter	Attribute	Measure	Target	Notes
Area	Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 281 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 281 ha using OSI data and relevant orthophotographs.

PART FOUR – REVIEW OF THE CONSERVATION CONDITION OF WATERBIRD SPECIAL CONSERVATION INTERESTS

4.1 Population data for waterbird SCI species of Ballycotton Bay SPA

Non-breeding waterbirds are counted at Ballycotton Bay each winter as part of the Irish Wetland Bird Survey (I-WeBS). The dataset spans the period 1995/96 to 2010/11 and there have been six or seven counts in each season with the exception of 2005/06 when no data were collected.

I-WeBS counts are undertaken during what is termed the 'core survey period' which covers the main wintering period when many species occur in their largest concentrations, but also the autumn and spring passage periods when total waterbird numbers may be enhanced by staging/stopover birds⁹. During I-WeBS the site is counted as one large count subsite and the total count area is approximately 356 ha (note that the I-WeBS count area is larger than the SPA area). Information on I-WeBS and other waterbird surveys is given in Appendix 2.

Table 4.1 presents population¹⁰ data for the non-breeding waterbird SCI species of Ballycotton Bay. Annual maxima were identified and used to calculate the five-year mean peak for each species. The baseline period was 1995/96 – 1999/00 while the recent average relates to the five-year period 2006/07 – 2010/11. When examining waterbird data, it is standard practice to use the mean of peak counts generated for each species because it reflects more accurately the importance of a site for a particular species by helping to account for inconsistencies in data gathering (i.e. differing coverage) or extraordinary fluctuations in numbers. However it is important to note that waterbird counts represent a 'snapshot' of bird numbers during a count session, so in general and taking into account all potential sources of error, resulting data are regarded to be underestimates of population size (Underhill & Prŷs-Jones, 1994).

Table 4.1 indicates where the numbers shown surpass the threshold for all-Ireland importance. These thresholds are different for the baseline and recent time periods (refer to Crowe et al. 2008 and Crowe & Holt, 2013 respectively).

Gull species are not assigned 1% thresholds in Table 4.1. The wintering distributions of gull species are widespread and not monitored routinely during I-WeBS therefore standard methods of population estimation and threshold setting are difficult. SCI selection in relation to gull species therefore relates to the known most important sites for the gull species in question and a 'threshold of significance' is applied (Crowe, 2005).¹¹

⁹ The terms 'stopover' and 'staging' are often used interchangeably. A stopover site can be defined as any place where a bird takes a break during migration. Staging areas can be defined as stopover sites that attract large numbers of individuals and play an important part in re-fuelling the birds before their onward migration (e.g. Warnock, 2010).

¹⁰ Note that 'population' refers to site population (numbers wintering at the site) rather than a species' biogeographic population.

¹¹ Current threshold of significance is 500 for both Common Gull and Lesser Black-backed Gull (Crowe, 2005).

Table 4.1 Population data for non-breeding waterbird Special Conservation Interest Species of Ballycotton Bay SPA

Site Special Conservation Interests (SCIs)	Baseline Period ¹ (1995/96 – 1999/00)	Recent Site Data ² (2006/07 – 2010/11)
Teal (<i>Anas crecca</i>)	903 (n)	421 (n)
Ringed Plover (<i>Charadrius hiaticula</i>)	167 (n)	109 (n)
Golden Plover (<i>Pluvialis apricaria</i>)	2,383 (n)	2,228 (n)
Grey Plover (<i>Pluvialis squatarola</i>)	124 (n)	60 (n)
Lapwing (<i>Vanellus vanellus</i>)	2,782 (n)	1,089
Black-tailed Godwit (<i>Limosa limosa</i>)	136 (n)	146
Bar-tailed Godwit (<i>Limosa lapponica</i>)	175 (n)	66
Curlew (<i>Numenius arquata</i>)	853 (n)	314
Turnstone (<i>Arenaria interpres</i>)	179 (n)	99 (n)
Common Gull (<i>Larus canus</i>)	584 (n)	677 (n)
Lesser Black-backed Gull (<i>Larus fuscus</i>)	1,293 (n)	2,104 (n)

¹Baseline data is the 5-year mean peak for the period 1995/96 – 1999/00; ²recent site data is the 5-year mean peak for the period 2006/07 – 2010/11 (I-WeBS).

(n) denotes numbers of all-Ireland importance; note that thresholds differ for the baseline and recent time periods and are shown within Crowe et al. (2008) and Crowe & Holt (2013) respectively.

4.2 Waterbird population trends for Ballycotton Bay SPA

The calculation and assessment of waterbird population trends at Irish coastal SPA sites follows the UK Wetland Bird Survey 'Alerts System' which provides a standardised technique for monitoring changes in the numbers of non-breeding waterbirds over a range of spatial scales and time periods. The methods include the calculation of annual indices using a standard set of months which excludes passage periods unlike the mean peaks shown in Section 4.1 which include data across a longer time period; so it should be borne in mind that waterbird population data presented in Section 4.1 and 4.2 are not directly comparable. A detailed methodology for the trend analysis is provided in Appendix 3.

Annual population indices were calculated for waterbird SCI species for the data period 1994/95 to 2010/11. Trends are given for the 'long-term' 14-year period (1995/96–2009/10) and the recent ('short-term') five-year period (2004/05 – 2009/10) (Table 4.2). The values given represent the percentage change in index (population) values across the specified time period. Positive values equate to increases in population size while negative values reflect a decrease in population size.

Waterbirds are relatively long-lived birds and changes in population size can take several years to become evident. The short-term trend can be useful to assess whether species numbers at the site are remaining stable, showing increase or signs of recovery, or are continuing to decline. For example, although a species' long-term trend may be negative, the short-term trend could be positive if numbers have increased during the recent five year period being assessed. Importantly, the short-term trend may detect more rapidly where a species population is beginning to decline.

Population indices were not calculated for Common Gull and Lesser Black-backed Gull because gulls are not counted consistently during I-WeBS. Therefore a measure of population change was calculated using the generic threshold method which compares population size at two time intervals based on five-year means (see Appendix 3 for methods).

Table 4.2 Site Population trends for waterbird Special Conservation Interest species of Ballycotton Bay SPA

Site Special Conservation Interests (SCIs)	Site Population Trend ¹ 14 Yr	Site Population Trend ² 5 Yr	Site Population Trend ³
Teal (<i>Anas crecca</i>)	- 33	- 8	
Ringed Plover (<i>Charadrius hiaticula</i>)	- 15	- 6	
Golden Plover (<i>Pluvialis apricaria</i>)	- 74	- 33	
Grey Plover (<i>Pluvialis squatarola</i>)	- 37	- 17	
Lapwing (<i>Vanellus vanellus</i>)	- 75	- 44	
Black-tailed Godwit (<i>Limosa limosa</i>)	+ 72	- 13	
Bar-tailed Godwit (<i>Limosa lapponica</i>)	- 50	- 19	
Curlew (<i>Numenius arquata</i>)	- 43	- 15	
Turnstone (<i>Arenaria interpres</i>)	- 9	- 20	
Common Gull (<i>Larus canus</i>)			+ 16
Lesser Black-backed Gull (<i>Larus fuscus</i>)			+ 63

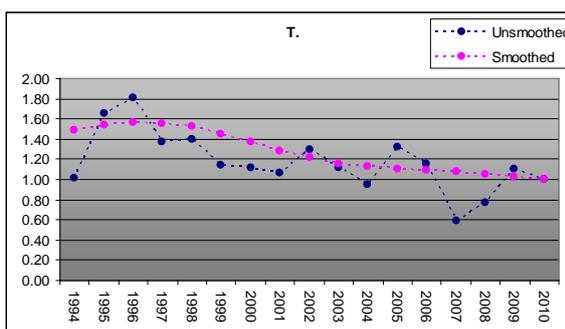
¹Site population trend analysis: 14-year period = 1995/96–2009/10

²Site population trend analysis: 5 yr = 2004/05 – 2009/10.

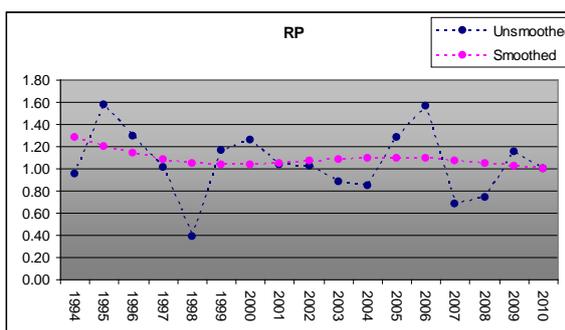
³Site population change based on two five-year – means (1995/96 – 1999/00 and 2006/07 – 2010/11).

For selected species, explanatory notes are given below to aid the interpretation of trends. Smoothed and unsmoothed indices are shown graphically. Site trends are compared with national trends (Boland & Crowe, 2012¹²); all-Ireland trends (Crowe & Holt, 2013), and British trends (Holt et al. 2012). Graph headings use waterbird species codes and a list of these is provided in Appendix 4.

Teal – numbers of Teal at the site have exhibited a steady decline over the long term. This contrasts to the national trend; numbers having increased throughout I-WeBS, while the all-Ireland trend is stable.

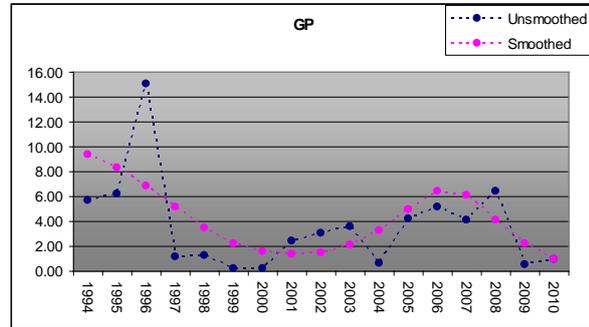


Ringed Plover – numbers at the site have been broadly stable across much of the data period with a relatively small decline over the long-term. This contrasts to the national trend however, numbers having increased over the long-term. In Britain and Northern Ireland a steady decline has been evident for over twenty years.

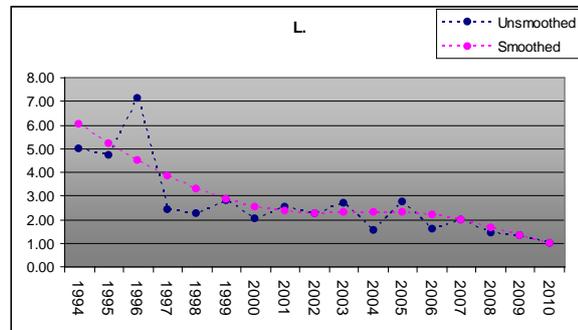


¹² National trends presented in Boland & Crowe (2012) update those previously shown in Crowe (2005).

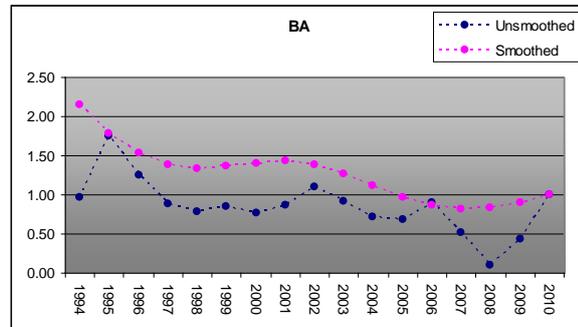
Golden Plover – site numbers can be highly variable between seasons but a decline in numbers occurred from the mid 1990's to 2000/01 after which numbers steadily increased to 2008/09. Both long- and short-term trends are influenced by the relatively low numbers in the penultimate season (2009/10); this low number likely attributed to the cold weather event experienced that winter. At a national level, numbers have been broadly stable since the mid 1990's, while the all-Ireland trend is for decline.



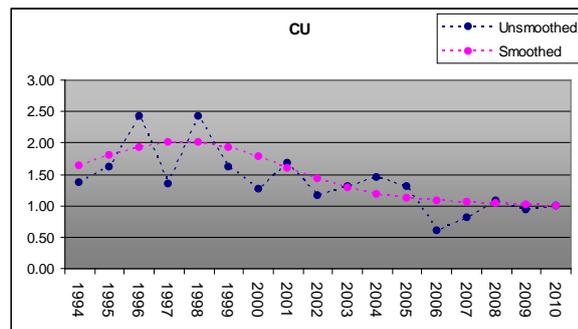
Lapwing – numbers have declined progressively since the mid 1990's, mirrored by the national and all-Ireland long-term trends for decline.



Bar-tailed Godwit – this species has declined over the long-term at Ballycotton Bay while exhibiting a broadly stable trend at national level. In Britain, numbers declined from the early 2000's but have increased in recent seasons.



Curlew – numbers at the site have declined progressively since the late 1990's. This is consistent with the national trend where numbers have declined throughout I-WeBS by an average c.3% per year. In Britain, numbers of Curlew increased from the 1970's until the start of the 2000's but have since steadily declined.



4.3 Ballycotton Bay SPA – site conservation condition of waterbird SCI species

Conservation condition of waterbird species is determined using the long-term site population trend and is assigned using the following criteria:

Favourable population = population is stable/increasing.

Intermediate (unfavourable) = Population decline in the range 1.0 – 24.9%.

Unfavourable population = populations that have declined between 25.0 – 49.9% from the baseline reference value.

Highly Unfavourable population = populations that have declined > 50.0% from the baseline reference value.

The threshold levels of >25.0% and >50.0% follows standard convention used for waterbirds (e.g. Lynas et al. 2007; Leech et al. 2002). The 'Intermediate' range (1.0% - 24.9% decline) allows for natural fluctuations and represents a range within which relatively small population declines have the potential to be reversible and less likely to influence conservation status in the long-term (Leech et al. 2002). Declines of more than 25.0% are deemed of greater ecological significance for the long-term.

With regards the 11 waterbird species of Special Conservation Interest listed for Ballycotton Bay SPA, and based on the population trend for the site, it has been determined that (Table 4.3):-

1. 3 species are currently considered as **Highly Unfavourable** (Golden Plover, Lapwing and Bar-tailed Godwit);
2. 3 species are currently considered as **Unfavourable** (Teal, Grey Plover and Curlew);
3. 2 species are currently considered as **(Intermediate) Unfavourable** (Ringed Plover and Turnstone);
4. 3 species are currently considered as **Favourable** (Black-tailed Godwit, Common Gull and Lesser Black-backed Gull).

Site conservation condition and population trends were also reviewed in light of species' all-Ireland and international trends (Table 4.3). All-Ireland trends follow Crowe & Holt (2013) while International trends follow Wetlands International (2012).

Table 4.3 SCI species of Ballycotton Bay SPA – Current Site Conservation Condition

Special Conservation Interests	BoCCI Category ^a	Site Population Trend ^b	Site Conservation Condition	Current all-Ireland Trend ^c	Current International Trend ^d
Teal	Amber	- 33	Unfavourable	Stable	Increasing
Ringed Plover	Green	- 15	Intermediate Unfavourable	Stable	Fluctuating
Golden Plover	Red	- 74	Highly Unfavourable	Declining	Declining
Grey Plover	Amber	- 37	Unfavourable	Declining	Declining?
Lapwing	Red	- 75	Highly Unfavourable	Declining	Stable
Black-tailed Godwit	Amber	+ 72	Favourable	Increasing	Increasing
Bar-tailed Godwit	Amber	- 50	Highly Unfavourable	Stable	Increasing
Curlew	Red	- 43	Unfavourable	Declining	Declining
Turnstone	Green	- 9	Intermediate Unfavourable	Increasing	Increasing ?
Common Gull	Amber	+ 16	Favourable	n/c	n/c
Lesser Black-backed Gull	Amber	+ 63	Favourable	n/c	n/c

^aAfter Colhoun & Cummins, 2013; ^b Site population trend analysis; see Table 4.2; ^call-Ireland trend - where a species is deemed to be increasing or declining if the annual rate of change is equal to or greater than 1.2% (after Crowe & Holt, 2013); ^d current international trend after Wetlands International, 2012.

Table 4.3 also shows the relationship between a species' long-term site trend and the current all-Ireland trend for the period 1999/00 to 2010/11. The colour coding used represents the following cases:-

- Grey – unassessed.
- Green – species whose populations are stable or increasing at both site level and all-Ireland level.
- Beige – species whose populations are declining at both site level and all-Ireland level. Therefore there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level.
- Orange - species whose populations are exhibiting a 1 – 24.9% decline at site level but are stable or increasing at all-Ireland level.
- Pink - species whose populations are exhibiting a 25.0 – 49.9% decline at site level but are stable or increasing at all-Ireland level.
- Red - species whose populations are exhibiting a decline of >50.0% at site level but are stable or increasing at all-Ireland level.

The pink and red categories listed above highlight where populations are stable at all-Ireland level, but where significant declines are seen at site level. In these cases it would be reasonable to suggest that site-based management issues may be responsible for the observed declining site population trends (Leech et al. 2002).

PART FIVE – SUPPORTING INFORMATION

5.1 Introduction

Part Five of this report is based around the need to review, collate and disseminate site-specific information relating to the Special Conservation Interests of Ballycotton Bay SPA.

Section 5.2 provides selected ecological summary information for non-breeding waterbirds of Ballycotton Bay. Section 5.3 presents results from the 2010/11 Waterbird Survey Programme. Finally, Section 5.4 provides summary information on activities and events that occur in and around Ballycotton Bay that may either act upon the habitats within the site, or may interact with waterbirds using the site.

The information provided is intended to:-

- assist the interpretation and understanding of the site-specific conservation objectives;
- facilitate the identification of conservation priorities and direct site management measures;
- inform the scope and nature of Appropriate Assessments in applying the provisions of Article 6 of the Habitats Directive.

Note however, that the information does not aim to provide a comprehensive assessment on which to assess plans and projects as required under the Habitats Directive, but rather should inform the scope of these assessments and help direct where further detailed examinations are required. The information presented in this report was compiled in November 2013.

5.2 Waterbird species – Ecological characteristics, requirements and specialities – summary information

Waterbirds, defined as “birds that are ecologically dependent on wetlands” (Ramsar Convention, 1971), are a diverse group that includes divers, grebes, swans, geese and ducks, gulls, terns and wading birds. During the data period 1995/96 – 2010/11, the I-WeBS database shows a total of 75 waterbird species that have been recorded at Ballycotton Bay. These species represent eleven waterbird families: *Gaviidae* (divers), *Podicipedidae* (grebes), *Anatidae* (swans, geese and ducks), *Rallidae* (Water Rail, Moorhen and Coot), *Haematopodidae* (oystercatchers), *Charadriidae* (plovers and lapwings), *Scolopacidae* (sandpipers and allies) and *Laridae* (gulls and terns) plus *Phalacrocoracidae* (Cormorants), *Ardeidae* (Hérons) and *Alcedinidae* (Kingfisher).

As described in Section 1.1, the wetland habitats contained within this SPA are considered to be a Special Conservation Interest in their own right. The wetland habitat is an important resource for listed SCI species and for other waterbird species included in the total waterbird assemblage. These species may include those that utilise the site during passage, those that are present in months of the year outside of the non-breeding season¹³ or species that use the site at certain times only (e.g. as a cold weather refuge).

During the I-WeBS period 1995/96 – 2010/11, 19 waterbird species occurred on a regular basis¹⁴ at Ballycotton Bay in addition to the listed SCI species. These additional species are listed in Table 5.1.

¹³ Non-breeding season is defined as September – March inclusive.

¹⁴ Regular is defined as a species that has occurred in 13 out of the 16-year data period (no data for the season 2005/06).

Table 5.1 Regularly-occurring non SCI waterbird species of Ballycotton Bay during the non-breeding season

Species	Baseline Data Period ¹ (1995/96 – 1999/00)	Recent Site Average ² (2006/07 – 2010/11)
Light-bellied Brent Goose (<i>Branta bernicla hrota</i>)	38	75
Shelduck (<i>Tadorna tadorna</i>)	99	34
Wigeon (<i>Anas penelope</i>)	522	433
Mallard (<i>Anas platyrhynchos</i>)	232	114
Cormorant (<i>Phalacrocorax carbo</i>)	11	18
Grey Heron (<i>Ardea cinerea</i>)	12	11
Little Egret (<i>Egretta garzetta</i>)	1	16
Moorhen (<i>Gallinula chloropus</i>)	6	2
Oystercatcher (<i>Haematopus ostralegus</i>)	255	255
Sanderling (<i>Calidris alba</i>)	56	66 (n)
Dunlin (<i>Calidris alpina</i>)	575	204
Ruff (<i>Philomachus pugnax</i>)	4	6
Snipe (<i>Gallinago gallinago</i>)	134	57
Greenshank (<i>Tringa nebularia</i>)	12	14
Redshank (<i>Tringa totanus</i>)	117	95
Black-headed Gull (<i>Chroicocephalus ridibundus</i>)	-	993
Herring Gull (<i>Larus argentatus</i>)	-	408
Great Black-backed Gull (<i>Larus marinus</i>)	-	289
Sandwich Tern (<i>Sterna sandvicensis</i>)	83	9

Grey shading denotes an Annex I species; ¹ Baseline data is the 5-year mean peak for the period 1995/96 – 1999/00 (I-WeBS); ² recent data is the 5-year mean peak for the period 2006/07 – 2010/11 (I-WeBS).

(n) denotes numbers of all-Ireland importance; note that thresholds differ for the baseline and recent time periods and are shown within Crowe et al. (2008) and Crowe & Holt (2013) respectively.

Although waterbirds may be linked by their dependence on water, different species vary considerably in aspects of their ecology due to many evolutionary adaptations and specialisations to their wetland habitats. Different species or groups of species may therefore utilise wetland habitats in very different ways which relates to how species are distributed across a site as a whole.

Table 5.2 provides selected ecological information for waterbird SCI species of Ballycotton Bay SPA. Information is provided for the following categories¹⁵:-

- waterbird family (group);
- winter distribution – species distribution range during winter (based on the period 2001/02 – 2008/09 (after Boland & Crowe, 2012);
- trophic (foraging) guild (after Weller, 1999; see Appendix 5);
- food/prey requirements;
- principal supporting habitat within the site;
- ability to utilise other/alternative habitat in/around the site;
- site fidelity (species ‘faithfulness’ to wintering sites).

It should be borne in mind that a single wetland site is unlikely to meet all of the ecological requirements of a diverse assemblage of waterbirds (Ma et al. 2010). Although some waterbird species will be faithful to specific habitats within the SPA, many will at times also use habitats situated within the immediate hinterland of the site or in areas ecologically connected to the SPA. These areas may be used as alternative high tide roosts, as a foraging resource or, be simply flown over, either on migration or on a more frequent basis throughout the non-breeding season as waterbirds move between different areas used (e.g. commuting corridors between feeding and roosting areas).

¹⁵ Notes to aid the understanding of categories and codes used in Table 5.2 are provided in the table sub text.

Reliance on alternative habitats will vary between species and from site to site. Use of alternative habitats is also likely to vary through time, from seasonally through to daily, and different habitats may be used by day and night (Shepherd et al. 2003). Different waterbirds may utilise wetland habitats in different ways. For example, while the majority of wading birds forage across exposed tidal flats, species such as Lapwing and Golden Plover are considered to be 'terrestrial waders,' typically foraging across grassland and using tidal flats primarily for roosting. When tidal flats are covered at high water, intertidally-foraging waterbirds are excluded and many will move to nearby fields to feed. Terrestrial foraging is also important when environmental factors (e.g. low temperature) reduce the profitability of intertidal foraging (e.g. Zwarts & Wanink, 1993). Some waterbird species are simply generalists, and make use of a range of habitats, for example the Black-tailed Godwit that forages across intertidal mudflats and grassland habitats. Other waterbird species such as Greenland White-fronted Goose or Bewick's Swan are herbivores and are therefore reliant on terrestrial areas, often outside of the SPA boundary, and use the wetland site primarily for roosting. Some species switch their habitat preference as food supplies become depleted; an example being Light-bellied Brent Geese that exploit grasslands increasingly when intertidal seagrass and algae become depleted.

The topic of alternative habitat use is also applicable to benthic-foraging seaducks and divers whose foraging distribution is highly influenced by water depth and tidal conditions. Many of these species however (e.g. Great Northern Diver, Common Scoter) exhibit a widespread coastal distribution during winter utilising shallow nearshore waters to a greater degree at certain times (e.g. storms, driving onshore winds).

Thus the area designated as a SPA can represent a variable portion of the overall range of the listed waterbird species. To this end, data on waterbird use of areas adjacent to or ecologically connected to the SPA are often collected. Indeed for some species a mix of site-related and wider countryside measures are needed to ensure their effective conservation management (Kushlan, 2006). Furthermore, it is recommended that assessments that are examining factors that have the potential to affect the achievement of the site's conservation objectives should also consider the use of these 'ex-situ' habitats, and their significance to the listed bird species.

Table 5.2 Waterbirds – Ecological characteristics, requirements & specialities

Special Conservation Interests	Family (group)	Winter distribution ^A	Trophic Guild ^B	Food/Prey Requirements ^C	Principal supporting habitat within site ^D	Ability to utilise other/alternative habitats ^E	Site Fidelity ^F
Teal <i>Anas crecca</i>	Anatidae (dabbling ducks)	Very widespread	1	Wide	Intertidal flats & shallow subtidal	3	Weak
Ringed Plover <i>Charadrius hiaticula</i>	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Golden Plover <i>Pluvialis apricaria</i>	Charadriidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Grey Plover <i>Pluvialis squatarola</i>	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Lapwing <i>Vanellus vanellus</i>	Charadriidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	Moderate
Black-tailed Godwit <i>Limosa limosa</i>	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	High
Bar-tailed Godwit <i>Limosa lapponica</i>	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	Moderate
Curlew <i>Numenius arquata</i>	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	High
Turnstone <i>Arenaria interpres</i>	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	High
Common Gull <i>Larus canus</i>	Lariidae (gulls)	n/c	1, 2, 4, 6, 7	Wide	Intertidal mud and sand flats & sheltered & shallow subtidal	2	Moderate
Lesser Black-backed Gull <i>Larus fuscus</i>	Lariidae (gulls)	n/c	1, 2, 4, 6, 7	Wide	Intertidal flats & sheltered & shallow subtidal	1	Unknown

^A Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on Boland & Crowe, 2012).

^B Waterbird foraging guilds. 1 = Surface swimmer, 2 = water column diver (shallow), 3 = water column diver (deeper), 4/5 = intertidal walker (out of water), 6 = intertidal walker (in water), 7 = terrestrial walker. Further details are given within Appendix 5.

^C Food/prey requirements - species with a wide prey/food range; species with a narrower prey range (e.g. species that forage upon a few species/taxa only), and species with highly specialised foraging requirements (e.g. piscivores).

^D Principal supporting habitat present within Ballycotton Bay. Note that this is the main habitat used when foraging with the exception of Golden Plover and Lapwing (roosting).

^E Ability to utilise alternative habitats refers to the species ability to utilise other habitats adjacent to the site. 1 = wide-ranging species with requirement to utilise the site as and when required; 2 = reliant on site but highly likely to utilise alternative habitats at certain times (e.g. high tide); 3 = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements.

^F Site fidelity on non-breeding grounds: Unknown; Weak; Moderate; or High (based on published literature).

5.3 The 2010/11 waterbird survey programme

5.3.1 Introduction

The 2010/11 waterbird survey programme was designed to investigate how waterbirds are distributed across coastal wetland sites during the low tide period. The surveys ran alongside and are complementary to the Irish Wetland Bird Survey (I-WeBS) which is a nationwide survey undertaken primarily on a rising tide or at high tide.

At Ballycotton Bay, a standard survey programme of four low tide counts (October, November and December 2010 and February 2011) and one high tide counts (January 2011) were undertaken.¹⁶ Waterbirds were counted within a series of eight count subsites (refer to Appendix 6). Count boundaries and SPA boundaries are not coincident and three count subsites, namely 0L577, 0L578 and 0L599, are outside the SPA boundary.

The behaviour of waterbirds during counts was attributed to one of two categories (foraging or roosting/other) while the position of birds was recorded in relation to one of four broad habitat types (Table 5.3). Note that these broad habitats were defined specifically for the survey programme and do not follow strict habitat-based definitions for these areas, nor follow definitions used in relation to conservation objectives outlined in Section 3.1. For a detailed survey methodology, please refer to NPWS (2011).

Table 5.3 Definition of broad habitat types used

Broad Habitat Type	Broad Habitat Description
Intertidal (area between mean high water and mean low water)	Refers to the area uncovered by the tide and most likely dominated by mudflats and sandflats. It may also include areas of rocky shoreline, areas of mixed sediment and grave/pebbles or shingle and gravel shores.
Subtidal (area that lies below mean low water)	Refers to areas that are covered by seawater during counts. During low-tide counts it will include offshore water, tidal channels and creeks as well as tidal rivers.
Supratidal	This category pertains to the shore area and habitats immediately marginal to and above the mean high-water mark. The supratidal section is an integral part of the shoreline. This broad habitat also includes areas of saltmarsh where the saltmarsh is contiguous with coastal habitats lying above. Note that patches of lower saltmarsh (e.g. <i>Spartina</i> sp.) surrounded by intertidal flats, were included in the intertidal category.
Terrestrial	Used where birds were recorded within habitats close to the shoreline but were above the intertidal and supratidal levels.

In addition to the main survey programme described above, a high tide roost survey was undertaken on 02/11/10. During this survey waterbird roost sites were located, species and numbers of waterbirds counted and the position of roosts marked onto field maps.

5.3.2 Waterbird data, analyses and presentation

The aim of data analyses was to understand how waterbirds are distributed across the site of Ballycotton Bay during the autumn and winter months. By assessing patterns of waterbird distribution at low and high tide, together with examination of data on sediment and invertebrate distribution and abundance, we aimed to identify areas (subsites) within the site that are the most important for foraging and roosting on a species by species basis.

Data analyses were undertaken to determine the proportional use of subsites by each Special Conservation Interest (SCI) species, relative to the whole area surveyed on each survey occasion. Analyses were undertaken on datasets as follows:

¹⁶ Low tide counts on 11/10/10, 06/11/10, 08/12/10 & 01/02/11 plus a high tide count on 16/01/11.

- Total numbers (low tide surveys);
- Total numbers (high tide survey);
- Total numbers of foraging birds (low tide surveys);
- Total numbers of roosting birds (low tide and high tide surveys).

For each of the analyses listed above and for each survey date completed, subsites were ranked in succession from the highest to the lowest in terms of their relative contribution to each species' distribution across all subsites surveyed. Rank positions were then converted to categories (see below) with the exception of those relating to the high tide survey that are presented simply as rank numbers. The highest rank position/category for each subsite across any of the low tide count dates is presented in a subsite by species matrix.

Subsite Rank Position - Categories

Very High (V)	Any section ranked as 1.
High (H)	Top third of ranking placings (where n = total number of count sections species was observed in)
Moderate (M)	Mid third of ranking placings (where n = total number of count sections species was observed in)
Low (L)	Lower third of ranking placings (where n = total number of count sections species was observed in).

For selected species, intertidal foraging density was calculated for each low tide survey occasion, by dividing the number of the species within a subsite by the area of intertidal habitat within the same subsite. Subsites were ranked based on the peak foraging density recorded. Whole site intertidal foraging density was calculated by summing the mean subsite counts for each species and dividing by the total area of intertidal habitat.

Waterbird count data for low tide surveys are also presented as species distribution maps ('dot density maps'). Dot-density maps show waterbird species distribution within intertidal, subtidal and terrestrial habitat¹⁷ divided into 'foraging' birds and 'roosting/other' birds. These maps show the number of birds represented by dots; each dot representing one, or a pre-determined number of birds. As the dots are placed in the appropriate subsites and broad habitat types for the birds counted, the resulting map is equivalent to presenting numbers and densities and provides a relatively quick way of assessing species distribution.

In contrast to dot-density maps, roost maps produced from roost survey data show the mapped locations of waterbird roosts, but note the limitations in relation to field mapping discussed below.

Notes on data interpretation and methodological limitations

Weather conditions during the winter of 2010/11 proved extremely challenging for fieldworkers, December 2010 being the coldest on record (Met Éireann, 2010). It should be borne in mind that the cold weather is likely to have affected the numbers and distribution of waterbirds at the site, as well as nationally, as was the case in the previous cold winter of 2009/10 (Crowe et al. 2011).

Subsite rankings and dot-density maps relate to the distribution of waterbirds at subsite level as recorded within the survey area during the 2010/11 waterbird survey programme. Care must be taken in the interpretation of these data, and subsite rankings in isolation should not be used to infer a higher level of conservation importance to one area over another without a

¹⁷ Note that birds within supratidal habitat are not included within these maps.

detailed examination of data and understanding of each species' ecology. For instance, while some species are known to be highly site-faithful, both at site level and within-site level (e.g. Dunlin), other species may range more widely across a site(s). While some species by their nature may aggregate in high numbers, other species such as Greenshank or Grey Heron may not. It is also important to consider that distribution maps and data refer to a single season of low tide surveys. Although important patterns of distribution will emerge, these distributions should not be considered absolute; waterbirds by their nature are highly mobile and various factors including tide (e.g. spring/neap), temperature, direction of prevailing winds, changing prey densities/availabilities and degree of human activity across the site, could lead to patterns that may change in different months and years.

Dot-density maps are not intended to show the actual position of each bird; the dots are placed randomly within subsites so no conclusions can be made at a scale finer than subsite. Dots are placed in the appropriate subsites and broad habitat types for the birds counted but given that the broad habitats are based on OS mapping, there are various cases where the mapping does not accurately portray where a bird was e.g. in the case of birds associated with freshwater flows, or small creeks that are not shown on OS maps. These associations are discussed as necessary in the individual species text tables.

The mapping of flock positions or roost locations over large distances in intertidal habitats (i.e. mapping by eye) is inherently difficult and prone to error. Flock or roost positions should therefore be viewed as indicative only.

5.3.3 Summary Results

A total of 41 waterbird species were recorded during the 2010/11 survey programme at Ballycotton Bay. Cummins and Crowe (2011) provide a summary of waterbird data collected. Note that the total count area and SPA area are not coincident; maps showing count subsites are provided in Appendix 6.

All SCI species were recorded within all counts of the main survey programme with the exception of Golden Plover that was not recorded in the January low tide survey or the February high tide survey 2011. Table 5.4 shows peak numbers (whole site) for SCI species recorded during the low tide (LT) and high tide (HT) surveys.

Average subsite occupancy, the average proportion of subsites in which a species occurred during low tide counts, ranged from 13% for Golden Plover that occurred in one subsite only; to 75% for Curlew, the most widely-ranging species. Only two SCI species (Curlew and Common Gull) were recorded in more than half of the count subsites.

Average percentage area occupancy is defined as the average proportion of the whole site area that a species occurred in during low tide counts. Although this is a broad calculation across all habitat zones it presents some indication of the range of a species across the site as a whole. Average percentage area occupancy was highest for Curlew and Common Gull and lowest for Golden Plover. Six SCI species ranged, on average, across more than half of the survey area (Table 5.4).

Table 5.4 Ballycotton Bay 2010/2011 waterbird surveys – summary data

Site Special Conservation Interests (SCIs)	Peak number - LT surveys ⁱ	Peak number - HT survey ⁱⁱ	Average subsite % occupancy ⁱⁱⁱ	Average % area occupancy ⁱⁱⁱ
Teal (<i>Anas crecca</i>)	642 (n)	549 (n)	31 (13)	34 (15)
Ringed Plover (<i>Charadrius hiaticula</i>)	124 (n)	118 (n)	47 (19)	62 (26)
Golden Plover (<i>Pluvialis apricaria</i>)	17	0	13 (0)	15 (0)
Grey Plover (<i>Pluvialis squatarola</i>)	37 (n)	73 (n)	31 (24)	44 (30)
Lapwing (<i>Vanellus vanellus</i>)	170	802	31 (24)	32 (27)
Black-tailed Godwit (<i>Limosa limosa</i>)	499 (n)	2	38 (14)	50 (12)
Bar-tailed Godwit (<i>Limosa lapponica</i>)	58	39	31 (22)	46 (25)
Curlew (<i>Numenius arquata</i>)	266	254	75 (10)	87 (9)
Turnstone (<i>Arenaria interpres</i>)	100 (n)	237(n)	44 (13)	57 (20)
Common Gull (<i>Larus canus</i>)	293	151	66 (12)	82 (11)
Lesser Black-backed Gull (<i>Larus fuscus</i>)	619	112	44 (13)	58 (17)

(n) denotes numbers of all-Ireland importance (after Crowe & Holt, 2013); ⁱ 4 low-tide counts undertaken on 11/10/10, 06/11/10, 08/12/10 & 01/02/11; ⁱⁱ High-tide count undertaken on 16/01/11; ⁱⁱⁱ Mean (\pm s.d.) averaged across the four low tide surveys with the exception of Golden Plover that was average across three (absent on 01/02/11).

Whole site species richness (total number of species) ranged between 31 species and 34 species during low tide surveys and 28 species were recorded during the high tide survey on 16/01/11.

During low tide surveys, all except two terrestrial subsites (0L578 and 0L599) supported, on average, ten or more species. Average subsite species richness peaked at 21 species (0L575). Six out of the total eight subsites recorded a greater number of species during low tide surveys, as opposed to the high tide survey (Table 5.5).

Table 5.5 Subsite species richness

Subsite Code	Subsite name	Mean (\pm S.D) LT Survey	HT Survey	Peak Overall (H/L)
0L575	Ballynamona Lagoon	21 (2)	23	H
0L576	Ballycotton lower	20 (3)	18	L
0L577	Knockadoon/Ballymakeagh	16 (3)	12	L
0L578	Ardnahinch	1 (1)	1	L
0L579	Shangarry	16 (4)	1	L
0L580	Ballynamona Marsh	11 (3)	11	L
0L581	Ballycotton mid	15 (5)	9	L
0L599	Ballylangane Fields	3 (3)	7	L/H

5.3.4 Waterbird distribution

Data analyses determined the proportional use of subsites by each Special Conservation Interest (SCI) species, relative to the site as a whole during both low tide and high tide surveys. Selected results from these 'subsite assessments' are shown in Tables 5.6 (a–f). The relative importance of each subsite is based on the final rank positions (see 5.3.2 for methodology). Where a box is left blank, it simply means that a species was not recorded in that subsite.

Ranked assessments relate to the broad habitat that birds were observed in. In some cases, data for different broad habitats have been combined, for example, in the case of wading

birds and intertidal/subtidal habitat which were combined in order to include those individuals that had their feet in water and were recorded as subtidal.

The fact that different subsites may be ranked as 'Very High' for the same species highlights the fact that several subsites may be equally important for the species being analysed. This approach, rather than averaging across all surveys, allows for equal weightings to be given for temporal differences – e.g. concentrations of foraging birds in different subsites at different times reflecting the natural pattern of distribution across time as species move in response to changing prey densities or availabilities.

Tables 5.6 (a–f) are followed by species discussion notes which provide additional information on the distribution of each SCI species, drawing upon the full extent of the data collected and analysed for Ballycotton Bay. Waterbird distribution dot-density maps are provided in Appendix 7; summary roost data are presented in Appendix 8.

Table 5.6 (a) Ballycotton Bay Subsite assessment – total numbers during LT surveys (across all behaviours and habitats) (L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods).

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T.	V		L			H	M	
RP	M	V	V		H		V	
GP	V							
GV	V	V	L	M		H		H
L.	V	M	L	M		H		H
BW	V	V			L	M	L	H
BA	M	V	M		H		V	
CU	V	H	V		M	M	M	H
TT	M	V	V		H		H	
CM	V	V	M		H	M	H	L
LB	V	H	H		H		H	

Table 5.6 (b) Ballycotton Bay Subsite assessment – total numbers: highest rank obtained during the high tide survey

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T.	1					2		
RP	3	1	2					
GP	<i>not recorded</i>							
GV	2	1					3	
L.	1					3		2
BW	1							
BA		1						
CU	1		2			4		3
TT	3	1	2				4	
CM	1	2	3					4
LB	1	2						

Table 5.6 (c) Ballycotton Bay Subsite assessment – total numbers foraging intertidally^I and subtidally^{II} (L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods)

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T. ^I	V					H		
T. ^{II}	V					H	V	
RP ^I	M	V	V		H		V	
GP	<i>not recorded</i>							
GV ^I	V	V	H		M		H	
L. ^I	V	H	M			M		
BW ^I	V	V			M	L	M	
BA ^I		V	L		H		V	
CU ^I	H	V	M		M	L	H	
TT ^I		V	V		M		V	
CM ^I		V	L		H		H	
LB ^I		V					H	

Table 5.6 (d) Ballycotton Bay Subsite assessment – ranked peak low tide intertidal foraging densities - LT surveys

Subsites	0L575	0L576	0L577	0L579	0L580	0L581
Species						
RP	5	3	1	4		2
GV	4	2	1	3		5
BW	1	3		4	2	5
BA		2	4	1		5
CU	3	1	6	5	2	4
TT		2	1	3		4

Table 5.6 (e) Ballycotton Bay Subsite assessment – total numbers (roosting/other behaviour) during LT surveys, intertidal^I and subtidal^{II} (L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods).

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T. ^I	V					V		
T. ^{II}			H			V		
RP ^I			V		V		H	
GP ^I	V							
GV ^I			V					
L. ^I	V					H		
BW ^I	V	V				H		
BA ^I	V	V						
CU ^I	V	H	V		H	M		
TT ^I	V				V		H	
CM ^I	V	V	M		M		M	
CM ^{II}		M	V		H		V	
LB ^I	V	H	M		H		M	
LB ^{II}		M	V		H			

Table 5.6 (f) Ballycotton Bay Subsite assessment – highest rank obtained (roosting/other behaviour) during the HT survey (Intertidal^I, Subtidal^{II})

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T. ^I	1					2		
T. ^{II}	2					1		
RP ^I		1	2					
GP ^I	<i>not recorded</i>							
GV ^I		1					2	
L. ^I	1					2		
BW ^I	<i>not recorded</i>							
BA ^I		1						
CU ^I						1		
TT ^I	1		2					
CM ^I	1		2					
CM ^{II}		1						
LB ^I	1							
LB ^{II}		1						

Ballycotton Bay - Waterbird Survey Programme 2010/11

Waterbird distribution - discussion notes

Where mentioned, information on benthic communities or sediment is from the intertidal and subtidal sampling programme commissioned by the National Parks & Wildlife Service (NPWS) and Marine Institute and reported in MERC/ERM (2012) and NPWS (2014).

'I-WeBS' refers to count data recorded at Ballycotton Bay as part of the Irish Wetland Bird Survey.

Teal *Anas crecca* - Family (group): Anatidae (ducks)

Anas crecca has five breeding subspecies that occur across north and northwest Europe, Siberia and into Asia (Wetlands International, 2006). Teal are largely migratory, moving south of their breeding range during winter. Being highly responsive to cold spells they can show rapid and extensive movement during these periods. Teal breeding in Britain and Ireland are supplemented during winter by birds from a range extending from Iceland, through Scandinavia to northwest Siberia (Wernham et al. 2002).

Numbers

Across the whole site, low tide numbers of Teal ranged from 250 (01/02/11) to 642 (06/11/10). Numbers during the November and December low tide surveys plus the high tide survey (549) exceeded the threshold of all-Ireland importance. The peak number recorded during I-WeBS in the 2010/11 season was 250 Teal, recorded in the month of September.

Teal was recorded in four subsites overall: 0L575, 0L577, 0L580 and 0L581, but very low numbers were recorded in 0L577 and 0L581 and on a single occasion only. Therefore the two subsites of importance were 0L575 (Ballynamona Lagoon) and 0L580 (Ballynamona Marsh) which recorded highest and second highest numbers respectively in all surveys undertaken.

0L575 (Ballynamona Lagoon) held numbers of all-Ireland importance on 06/11/10 (382) and during the high tide survey (372) on 16/01/11.

Foraging Distribution

Non-breeding Teal are widely distributed throughout Ireland, favouring areas of shallow water on estuarine coastal lagoons, coastal and inland marshes, and flooded pastures and ponds. Teal are omnivores and have a variety of foraging methods (e.g. dabbling and up-ending) within differing habitats and water depths.

0L575 (Ballynamona Lagoon) held peak numbers of intertidally foraging Teal in the two low tide surveys (December 2010 and February 2011); a greater number of Teal generally recorded in roosting/other behaviour. These birds foraged within benthic habitat classified as 'sandy mud to sand with *Hediste diversicolor* and *Peringia (Hydrobia) ulvae*.'

21 Teal foraged in shallow creeks classified as subtidal in 0L575 (Ballynamona Lagoon) on 11/10/10. One and two individuals respectively foraged subtidally in 0L580 (Ballynamona Marsh) and 0L581 (Ballycotton mid). Note that the subtidal creeks in 0L575 and 0L580 are not shown on OS or dot density maps.

155 Teal foraged subtidally in 0L575 (Ballynamona Lagoon) during the high tide survey on 16/01/11.

Roosting Distribution

A greater number of Teal were recorded in roosting/other behaviour in all low tide surveys and the peak number overall was 382 individuals on 06/11/10.

During low tide surveys, 0L575 (Ballynamona Lagoon) held peak numbers roosting intertidally with the exception of 08/12/10 when 0L580 (Ballynamona Marsh) recorded the peak number (197).

Almost without exception, subtidal roosting/other was recorded in 0L580 (Ballynamona Marsh) during low tide surveys and this subsite also held the peak number (147) during the high tide survey. A further 47 Teal roosted subtidally in 0L575 (Ballynamona Lagoon) during the high tide survey.

Supratidal roosting/other behaviour was recorded once in 0L580 (Ballynamona Marsh) (41 Teal on 01/02/11). Terrestrial roosting/other behaviour was recorded once in this same subsite.

The roost survey (02/11/10) recorded roosting Teal in two subsites (0L575 and 0L580). 0L580 (Ballynamona Marsh) held two roosting flocks totalling 335 individuals that roosted both intertidally and subtidally. The biggest flock comprised 212 individuals. In 0L575 (Ballynamona Lagoon) a single flock of 240 Teal roosted intertidally as part of a larger mixed-species concentration with Wigeon, Mallard, Curlew and Shelduck also present.

Ringed Plover *Charadrius hiaticula* - Family (group): Charadriidae (wading birds)

The Ringed Plover breeds across Arctic and temperate zones from the east coast of Baffin Island, Greenland, across northern Europe and the Russian tundra to the coasts of the Bering Sea. Three subspecies are generally recognised of which the nominate subspecies, *C. h. hiaticula*, breeds in Britain and Ireland, southern Scandinavia and northern and eastern Europe and winters in Europe and north-west and west Africa (Thorisson et al. 2012). The Irish breeding population is thought to be largely sedentary; wintering numbers enhanced by birds that breed further north, but Ireland also provides important passage sites for birds breeding in east Canada, Greenland and Iceland *en route* to wintering areas in Africa (Delany et al. 2009; Thorisson et al. 2012).

Numbers

Total site numbers of Ringed Plovers peaked in October 2010 when 124 individuals were recorded. This count and that recorded during the high tide survey (118) exceeded the threshold of all-Ireland importance. The peak number recorded during I-WeBS in the 2010/11 season was 128 individuals recorded in the month of September.

Ringed Plovers were recorded in a total of five subsites throughout the survey programme (0L575, 0L576, 0L577, 0L579 and 0L581).

0L577 (Knockadoon/Ballymakeagh) held peak numbers on 11/10/10 and 06/11/10; note that this subsite is outside the SPA boundary. 0L576 (Ballycotton lower) held peak numbers during the final two low tide surveys; 0L581 (Ballycotton mid) sharing peak numbers on 01/02/11.

The low tide peak subsite count was 66 individuals recorded for 0L577 (Knockadoon/Ballymakeagh) on 11/10/10; only surpassed by the peak count of 78 individuals recorded by 0L576 (Ballycotton lower) during the high tide survey.

Foraging Distribution

Ringed Plovers are 'visual foragers' searching the sediment surface for the visible signs of prey such as worms, crustaceans and insects. They forage in a variety of habitats including sand and mudflats, shingle shores and sandbanks, as well as saltmarshes, short grassland, flooded fields and artificial habitats.

Ringed Plovers foraged intertidally across five subsites (see above). 0L581 (Ballycotton mid) recorded peak numbers on 11/10/10 (40), 0L577 (Knockadoon/Ballymakeagh) held peak numbers on 06/11/10 (37); and 0L576 (Ballycotton lower) held peak numbers during the final two low tide surveys (35 and 16 respectively); 0L581 (Ballycotton mid) sharing peak numbers (16) on 01/02/11. All other subsites however held good numbers relative to subsite peaks during at least one survey indicating the importance of all five subsites for this species. The benthic community of these subsites has been classified as 'fine to coarse sand with polychaetes and bivalves' (NPWS, 2014). The sediments are mobile and influenced by the presence of reefs in the lower and mid intertidal, leading to spatial heterogeneity in grain size distribution although the most common sediment type is fine sand (generally representing between 40% and 90% of the sediment fractions). The distinguishing species of this community complex are the oligochaetes of the family Enchytraeidae, the polychaetes *Nephtys cirrosa*, *Scolecopsis (Scolecopsis) squamata*, and *Capitella* sp., the bivalves *Mytilus edulis* and *Tellina tenuis*, and the amphipod *Talitrus saltator*. Ringed Plovers also foraged within areas classified as reef habitat; for example 17 individuals that foraged on the lower shore of 0L576 on 08/12/10 alongside species such as Turnstone, Redshank and Oystercatcher; however the habitat is likely to be highly heterogeneous with sediment and rock (hard substratum) intermixing.

The peak intertidal foraging density was 1 Ringed Plover ha⁻¹ recorded for 0L577 (Knockadoon/Ballymakeagh) (outside SPA boundary). 0L581 (Ballycotton mid) recorded the second highest foraging density (0.9 Ringed Plover ha⁻¹). The whole site average intertidal foraging density was 0.3 Ringed Plover ha⁻¹.

Roosting Distribution

Ringed Plovers often roost on rocky shores and are known to be highly faithful to roost sites (e.g. Rehfish et al. 2003).

During low tide surveys, relatively low numbers of Ringed Plover were recorded in roosting/other behaviour with the exception of 59 individuals that roosted intertidally in 0L577 (Knockadoon/Ballymakeagh) on 11/10/10 (outside SPA boundary).

During the high tide survey (16/01/11), a total of 99 Ringed Plovers roosted intertidally. 70 were within 0L576 (Ballycotton lower) and these birds were part of a larger aggregation that foraged and roosted in the far west of the subsite with species also including Sanderling, Bar-tailed Godwit and Dunlin. A further 29 Ringed Plovers roosted on intertidal reef in 0L577 (Knockadoon/Ballymakeagh) (outside SPA boundary).

The roost survey (02/11/10) recorded two flocks of intertidally roosting Ringed Plover with 71 individuals in 0L576 and three individuals in 0L581. In 0L576 a single flock of 71 Ringed Plover roosted together with two Turnstones.

Golden Plover *Pluvialis apricaria* - Family (group): Charadriidae (wading birds)

The Eurasian Golden Plover is a Palearctic species, occurring mainly at higher latitudes of Western Europe to north-central Siberia and wintering south in Europe, north Africa and parts of Asia. Two subspecies are currently described. *P. a. altifrons* is the 'northern' form and breeds at high latitudes in Western Eurasia from Iceland and the Faeroes across northern Scandinavia to 125°E in the north Siberia lowlands south of Taymyr (Delaney et al. 2009). The nominate *P. a. apricaria* breeds at more southerly latitudes including Ireland and Britain and migrates south for winter. Golden Plovers that winter in Ireland are thought to be mostly Icelandic-breeding birds *P. a. altifrons* (Wernham et al. 2002).

Numbers

Whole site numbers of Golden Plover were exceptionally low during the 2010/11 Waterbird Survey Programme with a peak site count of 17 individuals recorded on 06/11/10. The absence of the species later in the season could be attributed to the cold weather spell, with December 2010 reported as the coldest since 1963 (Met Éireann, 2010), however numbers were also very low at the start of the season with only one individual recorded on 11/10/10. Crowe et al (2012) reported particularly low numbers of Golden Plover in the 2010/11 I-WeBS season.

The peak number recorded during I-WeBS in the 2010/11 season was one individual.

Foraging Distribution

During winter, Golden Plovers feed primarily within agricultural grassland and arable land. Tidal flats are used more as a roosting/resting habitat and the birds tend to favour large, open tidal flats. As a consequence, Golden Plovers tend to be in large aggregations when observed upon tidal flats. Intertidal feeding is observed to a greater degree during cold weather periods when grassland feeding areas are frozen over. Although Golden Plovers eat a wide range of invertebrate species, relatively little is known about their intertidal feeding patterns (Gillings et al. 2006).

No observations of foraging Golden Plover were made during the 2010/11 Waterbird Survey Programme.

Roosting Distribution

Roosting Golden Plover were recorded exclusively within 0L575 (Ballynamona Lagoon); one individual on 11/10/10 and 17 individuals on 06/11/10.

The roost survey (02/11/10) did not record Golden Plover.

Grey Plover *Pluvialis squatarola* - Family (group): Charadriidae (wading birds)

The Grey Plover is generally considered a monotypic species and has a holarctic breeding distribution across the tundra of Eurasia and North America (Delaney et al. 2009). The species migrates from breeding areas to a very wide wintering range extending to the coastlines of Africa, south and east Asia, Australasia and South America (BWPI, 2004). In Ireland, Grey Plovers occur as both passage and wintering birds and are thought to originate from Russian breeding populations (Wernham et al. 2002).

Numbers

Whole-site counts of Grey Plover rose from relatively low numbers during the first two low tide survey (four individuals) to a low tide peak of 37 individuals on 08/12/10 which exceeds the threshold of all-Ireland importance. Almost double the low tide peak number was recorded during the high tide survey (73 individuals) (16/01/11). The peak number recorded during I-WeBS in the 2010/11 season was just three individuals.

Grey Plovers were recorded in five subsites overall: 0L575, 0L576, 0L577, 0L579 and 0L581. 0L576 (Ballycotton lower) recorded peak numbers in all but one of the surveys and recorded the subsite peak count of 62 individuals during the high tide survey.

Foraging Distribution

During winter Grey Plovers mainly forage intertidally and have a characteristic mode of foraging whereby they stand motionless watching the mudflat surface before snatching a prey item (often a worm) from the sediment surface. Grey Plovers take a wide range of prey species including Lugworms (*Arenicola marina*), Ragworms (*Hediste diversicolor*), amphipod crustaceans and small bivalves (e.g. *Macoma balthica* and *Scrobicularia plana*) (Dit Durrell & Kelly, 1990).

Grey Plovers foraged in five subsites overall (as above). 0L576 (Ballycotton lower) recorded peak numbers in all but one of the surveys; 0L575 (Ballynamona Lagoon) recording all individuals (four) during both the October low tide survey and during the high tide survey (nine individuals). 0L577, 0L579 and 0L581 however held good numbers relative to subsite peaks during at least one survey indicating the importance of all five subsites for this species.

The benthic community of all but one (0L575) of the forementioned subsites has been classified as 'fine to coarse sand with polychaetes and bivalves' (NPWS, 2014). The sediments are mobile and influenced by the presence of reefs in the lower and mid intertidal, leading to spatial heterogeneity in grain size distribution although the most common sediment type is fine sand (generally representing between 40% and 90% of the sediment fractions). The distinguishing species of this community complex are the oligochaetes of the family Enchytraeidae, the polychaetes *Nephtys cirrosa*, *Scolecopsis (Scolecopsis) squamata*, and *Capitella* sp., the bivalves *Mytilus edulis* and *Tellina tenuis*, and the amphipod *Talitrus saltator*. In contrast, the sediments of 0L575 are muddier, and classified as 'sandy mud to sand with *Hediste diversicolor* and *Peringia (Hydrobia) ulvae*.'

The peak intertidal foraging density was 0.5 Grey Plover ha⁻¹ recorded for 0L577 (Knockadoon/Ballymakeagh) (outside SPA boundary). 0L576 (Ballycotton lower) recorded the second highest density (0.3 Grey Plover ha⁻¹). The whole site average intertidal foraging density was 0.1 Grey Plover ha⁻¹.

Roosting Distribution

During low tide surveys, only one record was made of Grey Plovers in roosting/other behaviour – four individuals in 0L577 (Knockadoon/Ballymakeagh) on 01/02/11 (outside SPA boundary).

62 Grey Plovers roosted intertidally within 0L576 (Ballycotton lower) during the high tide survey and were part of a larger aggregation that foraged and roosted in the far west of the subsite; species also including Sanderling, Turnstone, Ringed Plover, Bar-tailed Godwit and Dunlin. Two individuals were also recorded in 0L581 (Ballycotton mid).

The roost survey (02/11/10) recorded just three roosting individuals in 0L579 (Shangarry). These birds roosted intertidally on the upper shore along with 16 Oystercatchers and three Cormorants.

Lapwing *Vanellus vanellus* - Family (group): Charadriidae (wading birds)

The Lapwing is a monotypic species and has a wide Palearctic breeding distribution from Britain and Ireland in the west to Eastern and southern Siberia in the east with a southern limit extending into Spain (Delaney et al. 2009). Birds breeding in Britain and Ireland are partial migrants with some residing over winter and some migrating south. The wintering population is enhanced by Lapwings moving in from continental Europe and northern and western Britain (Wernham et al. 2002). Cold weather movements can result in a greater flux of birds to Ireland's estuaries.

Numbers

Whole site numbers of Lapwing were relatively low during the first three low tide surveys (115, 131 and 170 respectively) and dropped back to just 16 individuals during February 2011, likely related to the cold weather spell, with December 2010 reported as the coldest since 1963 (Met Éireann, 2010), and when numbers of many species in the country reduced due to birds moving to warmer climes (Crowe et al. 2012). Whole site numbers rose to 802 during the high tide survey (16/01/11) but overall no whole site count surpassed the threshold of all-Ireland importance.

The peak number recorded during I-WeBS in the 2010/11 season was 305 individuals.

Across the survey programme, Lapwings were recorded within six subsites: 0L575, 0L576, 0L577, 0L578, 0L580 and 0L599.

Numbers were highest in all surveys in one subsite: 0L575 (Ballynamona Lagoon) which held peak numbers of 785 individuals during the high tide survey. The only other subsite to hold relatively good numbers (peak: 58) was the terrestrial subsite 0L599 (Ballylangane Fields) (outside the SPA boundary).

Foraging Distribution

Lapwings are traditionally 'inland' waders. During winter they can be observed across a wide variety of habitats, principally using lowland farmland and freshwater wetlands (e.g. turloughs and callows) but also coastal wetlands where they feed on a variety of soil and surface-living invertebrates. They are opportunistic and mobile birds and will readily exploit temporary food sources such as newly-ploughed fields. Estuaries are typically used as roosting areas where large flocks may be observed roosting upon the tidal flats but coastal areas will also be used to a greater degree during cold weather events when farmland and freshwater habitats freeze over. There is evidence in the UK that utilisation of coastal habitats has increased, coupled with an increase in intertidal feeding (Gillings et al. 2006).

Relatively low numbers of Lapwings were recorded foraging intertidally with the exception of 08/12/10 when 15 were recorded across four subsites (0L575, 0L576, 0L577, 0L580), although the majority of these (11) were within 0L575 (Ballynamona Lagoon).

45 Lapwing foraged terrestrially within 0L599 (Ballylangane Fields) on 06/11/10 (outside the SPA boundary).

Roosting Distribution

With the exception of two observations of single birds in 0L580 (Ballynamona Marsh), all intertidally roosting Lapwing were recorded in 0L575 (Ballynamona Lagoon).

Terrestrial roosting was recorded in 0L599 (Ballylangane Fields) on 06/11/10 (13 Lapwing) and during the high tide survey (16 Lapwing) (outside the SPA boundary).

The roost survey (02/11/10) recorded four flocks of roosting Lapwing across three subsites (0L575, 0L580 and 0L599). The largest single flock was 44 Lapwing that roosted supratidally in 0L580 (Ballynamona Marsh) along with Teal, Redshank and Black-headed Gulls. A further flock of 36 Lapwing roosted supratidally in 0L580. Five Lapwing roosted as part of a larger mixed-species concentration in 0L575 (Ballynamona Lagoon). In addition, seven Lapwing roosted terrestrially in 0L599 (Ballylangane Fields).

Black-tailed Godwit *Limosa limosa* - Family (group): Scolopacidae (wading birds)

Black-tailed Godwits *Limosa limosa* have a widespread Palearctic breeding distribution. Four populations are recognised – three populations of the nominate *L. l. limosa* and one *L. l. islandica*, the latter of which breeds almost exclusively in Iceland and winters in Britain, Ireland, Spain, Portugal and Morocco (Delaney et al. 1999). Recoveries and sightings confirm that Black-tailed Godwits wintering in Ireland are of the *islandica* race, whereas further south (e.g. Spain and Portugal) some mixing of *limosa* and *islandica* occurs in the non-breeding season (Wernham et al. 2002).

Numbers

Numbers of Black-tailed Godwits peaked in October 2010 when a site total of 499 was recorded, representing numbers of all-Ireland importance. Numbers dropped down to 114 in December 2010, likely as a result of the cold weather spell, December 2010 reported as the coldest since 1963 (Met Éireann, 2010), which saw many birds move south in Europe to warmer climes. Just two individuals were recorded during the high tide survey (16/01/11) and 58 were counted during the final low tide survey on 01/02/11. No count exceeded the threshold for international importance.

The peak number recorded during I-WeBS in the 2010/11 season was 76 individuals.

Black-tailed Godwits were recorded in six subsites overall: 0L575, 0L576, 0L579, 0L580, 0L581 and 0L599.

0L575 (Ballynamona Lagoon) held peak numbers in three low tide surveys. 0L576 (Ballycotton lower) held peak numbers during one low tide survey with numbers ranked second highest in all others. 0L579, 0L580, 0L581 and 0L599 held reasonable numbers on one occasion each only.

Foraging Distribution

Black-tailed Godwits are relatively large long-billed wading birds that forage within intertidal flats for their preferred prey of bivalves such as *Macoma balthica*, *Scrobicularia plana* and *Mya arenaria*. At some sites, polychaete worms form a larger proportion of the diet and the species is relatively adaptable, utilising other habitats for foraging where available, such as terrestrial grassland, coastal marshes and freshwater callows.

Black-tailed Godwits were recorded foraging intertidally in five subsites overall: 0L575, 0L576, 0L579, 0L580 and 0L581.

0L575 (Ballynamona Lagoon) held peak numbers on 11/10/10 when 115 individuals represented 91% of all those counted during the survey. Thereafter this subsite recorded numbers ranked as second highest in all low tide surveys.

0L576 (Ballycotton lower) held numbers ranked as second highest on 11/10/10 (9% of the total counted) but thereafter held peak numbers during all low tide surveys, the peak number recorded being 36 individuals on 06/11/10.

0L579, 0L580 and 0L581 held very low numbers on single occasions only, with peak numbers of six, two and one individuals respectively.

Note that the low overall numbers recorded at the site during the survey programme results in some limitations to the distributional dataset.

The intertidal habitat of 0L575 (Ballynamona Lagoon) is classified as 'sandy mud to sand with *Hediste diversicolor* and *Peringia (Hydrobia) ulvae*.' The distinguishing fauna of this community includes the polychaetes *Hediste diversicolor*, *Eteone longa*, *Malacoceros fuliginosus* and *Capitella* sp., the gastropod *Peringia (Hydrobia) ulvae*, the bivalves *Cerastoderma edule* and *Ruditapes decussatus* and the amphipod *Corophium volutator*. The outer sections of 0L575 and 0L576 (Ballycotton lower) have more mobile sediments that vary greatly in their grain size but the sediment is predominantly that of fine sand (generally representing between 40% and 90% of the sediment fractions). The distinguishing species of this community complex are the oligochaetes of the family Enchytraeidae, the polychaetes *Nephtys cirrosa*, *Scolecopsis (Scolecopsis) squamata*, and *Capitella* sp., the bivalves *Mytilus edulis* and *Tellina tenuis*, and the amphipod *Talitrus saltator*. The biotope 'polychaete/bivalve dominated muddy and shore' was assigned by MERC/ERM (2012).

Terrestrial foraging was recorded on single occasions in 0L580 (Ballynamona Marsh) (15 birds) and 0L599 (Ballylangane Fields); the latter outside the SPA boundary.

The peak intertidal foraging density was 5 Black-tailed Godwits ha⁻¹ recorded for 0L575 (Ballynamona Lagoon). The second highest density, recorded for 0L580 (Ballynamona Marsh) relates to just two individuals that foraged in the very small amount of intertidal habitat that occurs in creeks in this subsite. The whole site average intertidal foraging density was 0.4 Black-tailed Godwits ha⁻¹.

Roosting Distribution

Black-tailed Godwits were recorded roosting intertidally during low tide surveys in 0L575, 0L576, and 0L580. 0L575 (Ballynamona Lagoon) and 0L576 (Ballycotton lower) held individuals on three occasions while 0L580 (Ballynamona Marsh) held two individuals on a single occasion.

The peak number of Black-tailed Godwits recorded roosting at low tide was 389 individuals within 0L576 (Ballycotton lower) on 06/11/10.

During the high tide survey, only two Black-tailed Godwits were counted and these were foraging intertidally in 0L575 (Ballynamona Lagoon).

Just 17 Black-tailed Godwits were recorded roosting during the November roost survey. A flock of 15 individuals roosted as part of a larger mixed-species concentration in 0L575 (Ballynamona Lagoon) and a single bird roosted intertidally in 0L576 (Ballycotton lower) as part of a larger mixed-species flock.

Bar-tailed Godwit *Limosa lapponica* - Family (group): Scolopacidae (wading birds)

The Bar-tailed Godwit has a widespread breeding distribution across the sub-arctic and low Arctic zones of the Palearctic and extending into western Alaska (Delaney et al. 2009). The taxonomy of the species is complex but five subspecies are generally recognised. The nominate subspecies *L. l. lapponica* breeds in northern Fennoscandia and Northern European Russia, east to the Kanin Peninsula, and winters mainly in Western Europe, including Ireland. The Wadden Sea is used by *L. l. lapponica* and other populations as a staging and moulting area in autumn and spring.

Numbers

Whole site numbers of Bar-tailed Godwits were relatively low throughout the survey programme and peaked at 58 on 08/12/10. 39 individuals were recorded during the high tide survey on 16/01/11. No count exceeded the threshold of all-Ireland importance.

The peak number recorded during I-WeBS in the 2010/11 season was 29 individuals.

Bar-tailed Godwits were recorded in five subsites overall: 0L575, 0L576, 0L577, 0L579 and 0L581. With the exception of 11/10/10, 0L576 (Ballycotton lower) held peak numbers in all surveys and recorded the subsite peak count of 38 individuals on 08/12/10. 0L576 was also the only subsite to record this wader in all four low tide surveys.

Foraging Distribution

Bar-tailed Godwits are a wader species considered characteristic of coastal wetland sites dominated by sand. The birds forage by probing within intertidal sediment for invertebrate species, predominantly large polychaete worms such as *Arenicola marina* and *Nephtys* sp. (Scheiffarth, 2001). The species is characteristic of sites with sandy substrates (e.g. Hill et al. 1993).

Bar-tailed Godwits were recorded foraging within four subsites overall (0L576, 0L577, 0L579 and 0L581). 0L581 (Ballycotton mid) held peak numbers on 11/10/10 (19) but foraging individuals were not recorded there again until 01/02/11 when 12 Bar-tailed Godwits were counted. The clearly favoured subsite was 0L576 (Ballycotton lower) that held peak numbers in three low tide surveys and during the high tide survey; but note the low overall numbers recorded at the site during the survey programme which results in some limitations to the dataset.

The benthic community of 0L576 (Ballycotton lower) is classified as 'fine to coarse sand with bivalves and polychaetes.' The area has mobile sediments that vary greatly in their grain size but the sediment is predominantly that of fine sand (generally representing between 40% and 90% of the sediment fractions). The distinguishing species of this community complex are the oligochaetes of the family Enchytraeidae, the polychaetes *Nephtys cirrosa*, *Scolecopsis (Scolecopsis) squamata*, and *Capitella* sp., the bivalves *Mytilus edulis* and *Tellina tenuis*, and the amphipod *Talitrus saltator*. The biotope 'polychaete/bivalve dominated muddy and shore' was assigned by MERC/ERM (2012).

The highest intertidal foraging density recorded for a single subsite was 0.9 Bar-tailed Godwits ha⁻¹ (0L579 Shangarry). 0L576 (Ballycotton lower) and 0L581 (Ballycotton mid) recorded densities of 0.5 and 0.4 Bar-tailed Godwits ha⁻¹ respectively. The whole site mean feeding density (intertidal habitat) was 0.2 Bar-tailed Godwits ha⁻¹.

Roosting Distribution

Relatively few Bar-tailed Godwits were recorded roosting intertidally during low tide surveys. 0L576 (Ballycotton lower) recorded low numbers (maximum nine) on two occasions while 0L575 (Ballynamona Lagoon) recorded two individuals on one occasion.

36 Bar-tailed Godwits roosted intertidally in 0L576 (Ballycotton lower) during the high tide survey. No other roosting individuals were recorded on this day.

Just seven Bar-tailed Godwits were recorded roosting during the November roost survey. These birds were positioned on the upper shore of 0L576 (Ballycotton lower) amongst a larger group also comprising Herring Gull (53), Black-headed Gull (79), Lesser Black-backed Gull (2) and a single Black-tailed Godwit.

Curlew *Numenius arquata* - Family (group): Scolopacidae (wading birds)

The Curlew has a widespread breeding range across temperate latitudes of the Palearctic region, occurring across Europe and Asia from Ireland in the west to northern China in the east (Delaney et al. 2009). The nominate subspecies breeds across Europe and winters in Europe. Ireland supports a small and declining population of breeding Curlew. Irish breeding Curlew are thought to make only short migrations and be mainly resident during winter. Wintering numbers are enhanced by birds moving in from breeding grounds in Fennoscandia, the Baltic and northwest Russia (Delaney et al. 2009) and Britain (Wernham et al. 2002).

Numbers

Whole-site numbers of Curlew were variable throughout the survey programme and dropped back considerably in December 2010 likely as a result of birds moving in response to the cold weather; December 2010 being reported as the coldest since 1963 (Met Éireann, 2010). A similar pattern of significantly lower numbers in the month of December was also reported at national level (Crowe et al. 2012). Numbers picked up again however and were highest at the end of the survey season. 266 Curlew were counted during the low tide count on 01/02/11 and 254 were recorded during the high tide survey (16/01/11). No whole site count exceeded the threshold of all-Ireland importance.

The peak number recorded during I-WeBS in the 2010/11 season was 153 individuals.

Curlews were widespread and occurred in all seven subsites overall: 0L575, 0L576, 0L577, 0L579, 0L580, 0L581 and 0L599. 0L575 (Ballynamona Lagoon) held peak numbers during the first three low tide surveys. 0L577 (Knockadoon/Ballymakeagh) held peak numbers (134) and 50% of the total number counted on 01/02/11 when overall site numbers were at their highest (note that this count subsite is outside the SPA boundary). 0L576 (Ballycotton lower) was notable for supporting numbers ranked as second highest on three survey occasions.

Foraging Distribution

Curlews are the largest intertidal wader to spend the non-breeding season within Ireland. Within intertidal areas they seek out larger prey items such as crabs, large worms and bivalves. Their de-curved bill is ideally suited to extracting deep-living worms such as Lugworms (*Arenicola marina*). Curlews rely on large prey that takes more time to handle (long handling time) in contrast to many other wader species that swallow prey relatively quickly upon finding it (short handling time). As a consequence, Curlews are territorial foragers and tend to occur widely spaced from each other to avoid competitive conflicts.

Intertidally foraging Curlews were recorded in six subsites as follows: 0L575, 0L576, 0L577, 0L579, 0L580 and 0L581. 0L576 (Ballycotton lower) held peak numbers in all low tide surveys. The benthic community of 0L576 (Ballycotton lower) is classified as 'fine to coarse sand with bivalves and polychaetes.' The area has mobile sediments that vary greatly in their grain size but the sediment is predominantly that of fine sand (generally representing between 40% and 90% of the sediment fractions). The distinguishing species of this community complex are the oligochaetes of the family Enchytraeidae, the polychaetes *Nephtys cirrosa*, *Scolecopsis (Scolecopsis) squamata*, and *Capitella* sp., the bivalves *Mytilus edulis* and *Tellina tenuis*, and the amphipod *Talitrus saltator*. The biotope 'polychaete/bivalve dominated muddy and shore' was assigned by MERC/ERM (2012).

0L575, 0L577, 0L579 and 0L581 all held good numbers relative to subsite peaks during at least one survey indicating the importance of all subsites for this species.

Good numbers of Curlew also foraged terrestrially. 88 Curlew foraged terrestrially in 0L575 (Ballynamona Lagoon) during the high tide survey. The terrestrial subsite Ballylangane Fields (0L599) recorded a maximum number of 91 Curlew during low tide surveys and 36 Curlew during the high tide survey (outside the SPA boundary). 14 Curlew foraged terrestrially adjacent to 0L577 (Knockadoon/Ballymakeagh) on one low tide survey occasion while 72 Curlew foraged there during the high tide survey (outside the SPA boundary).

The highest intertidal foraging density recorded within a subsite was 0.8 Curlew ha⁻¹ (0L576 Ballycotton lower). The second highest density, recorded for 0L580 (Ballynamona Marsh) relates to just one individual that foraged in the very small amount of intertidal habitat that occurs in creeks within this subsite. Other subsites held densities ranging from 0.2 to 0.5 8 Curlew ha⁻¹. The whole site mean feeding density (intertidal habitat) was 0.3 Curlew ha⁻¹.

Roosting Distribution

Intertidal roosting/other behaviour was recorded in 0L575, 0L576, 0L577, 0L579 and 0L580.

0L575 (Ballynamona Lagoon) held good numbers during all low tide surveys, and the peak number in three of these. 119 Curlew roosted intertidally in 0L577 (Knockadoon/Ballymakeagh) on 01/02/11 accounting for 82% of all roosting individuals recorded on this date (outside the SPA boundary). 0L576 (Ballycotton lower) held lower numbers (maximum 12 Curlew) on three occasions while 0L579 and 0L580 recorded very low numbers (one or two birds) on rare occasions.

During the high tide survey, 56 Curlew roosted supratidally in 0L575 (Ballynamona Lagoon) while single birds were recorded in 0L580 and 0L599.

The roost survey (02/11/10) recorded a total of 146 Curlew roosting across four subsites (0L575, 0L577, 0L580 and 0L599). The largest flock of 72 Curlew roosted terrestrially in 0L599 (Ballylangane Fields). The second largest roost of 68 individuals was in 0L575 (Ballynamona Lagoon) and part of a larger mixed-species flock. 0L580 and 0L577 held five and one individuals respectively.

Turnstone - Family (group): Scolopacidae (wading birds)

Turnstones breed widely in both the high and low arctic zones. Two subspecies are recognised. The nominate subspecies is divided into three recognised populations that occur in Western Eurasia and Africa, one of which breeds in north-eastern Canada and northern and eastern Greenland and winters mainly in Western Europe and West Africa (Delaney et al. 2009). Iceland is used as a staging post. Wintering birds in Ireland have a widespread distribution and are a familiar species of open, non-estuarine, rocky shorelines although they also occur within estuaries.

Numbers

Whole site numbers of Turnstone were variable and ranged from 36 (11/10/10) to a low tide peak count of 100 the following month (06/11/10). This peak count (100) and the count of 237 Turnstones recorded during the high tide survey both surpassed the threshold of all-Ireland importance.

The peak number recorded during I-WeBS in the 2010/11 season was 53 individuals.

Turnstones were recorded in five count subsites overall (0L575, 0L576, 0L577, 0L579 and 0L581). 0L577 (Knockadoon/Ballymakeagh) recorded peak counts in three low tide surveys and the second highest in another (outside SPA boundary). The other four subsites held good numbers relative to subsite peaks during at least one survey indicating the importance of all five subsites for this species.

Foraging Distribution

Turnstones are generally associated with shorelines with rocky substratum, particularly those with algal wrack zones within which the birds forage for prey species such as amphipod crustaceans, insects and small molluscs.

Intertidal foraging occurred in five subsites overall (0L575, 0L576, 0L577, 0L579 and 0L581). 0L577 (Knockadoon/Ballymakeagh) held peak numbers on 11/10/10 and 06/11/10, and 0L576 (Ballycotton lower) held peak numbers on 08/12/10 and 01/02/11. Note that 0L577 (Knockadoon/Ballymakeagh) is outside the SPA boundary.

0L581 (Ballycotton mid) held joint peak numbers on 01/02/11. 0L579 (Shangarry) recorded numbers of foraging individuals ranked third or fourth (maximum number 12 Turnstone). 0L575 (Ballynamona Lagoon) only held foraging individuals during the high tide survey.

Good numbers foraged during the high tide survey and the total 166 individuals was a higher count than recorded during any low tide count. The largest number of birds (49% - 85 individuals) were in 0L576 (Ballycotton lower). 0L575 (Ballynamona Lagoon) supported a further 62 individuals and smaller numbers were in 0L577 and 0L581.

Two intertidal benthic community types namely, 'fine to coarse sand with bivalves and polychaetes community complex' and 'sandy mud to sand with *Hediste diversicolor* and *Peringia ulvae* community', are recorded at this site. However the site is also characterised by many areas with a rocky substratum where high habitat heterogeneity will occur with sediments interspersed with rock, and areas with attached macroalgae. Strandlines at the site are also moderately developed and occur as a shifting line of decomposing seaweed and debris which is typically left behind on sediment (and some rocky shores) at the upper extreme of the intertidal at each high tide. The strandlines present at Ballycotton Bay SPA had a good relative abundance of gammarid species (MERC/ERM, 2012).

The highest intertidal foraging density recorded within a subsite was 1 Turnstone ha⁻¹ (0L577 Knockadoon/Ballymakeagh) (outside SPA boundary). 0L576 (Ballycotton lower) held 0.7 Turnstone ha⁻¹. The whole site mean feeding density (intertidal habitat) was 0.3 Turnstones ha⁻¹.

Roosting Distribution

Intertidal roosting was recorded within 0L577, 0L579 and 0L581 on two low tide occasions each. 0L577 (Knockadoon/Ballymakeagh) held the majority of roosting individuals during the high tide survey (97% - 69 individuals), a further two individuals positioned within 0L581 (Ballycotton mid). Note that 0L577 (Knockadoon/Ballymakeagh) is outside the SPA boundary.

The roost survey (02/11/10) recorded just two intertidally roosting Turnstone in 0L576 (Ballycotton lower).

Common Gull *Larus canus* - Family (group): Laridae (gulls)

The Common Gull breeds widely across the Palearctic and in North America (Mitchell et al. 2004). In Ireland, the species is most widely seen during winter when wintering birds arrive from Scotland and continental Europe (Wernham et al. 2004).

Numbers

Numbers of Common Gull peaked on 06/11/10 when a total site count of 293 was recorded. 151 Common Gulls were recorded during the high tide survey. The peak number recorded during I-WeBS in the 2010/11 season was 153 individuals.

Common Gulls were widespread across the site and recorded in seven subsites overall (all except 0L578). Peak numbers were recorded by 0L575 (Ballynamona Lagoon) and 0L576 (Ballycotton lower). The subsite peak of 110 individuals was recorded for 0L575 (Ballynamona Lagoon) on 06/11/10.

Foraging Distribution

Common Gulls foraged intertidally across four subsites: 0L576, 0L577, 0L579 and 0L581. Peak numbers during all four low tide surveys were recorded in 0L576 (Ballycotton lower). 0L579 (Shangarry) and 0L581 (Ballycotton mid) both held numbers ranked second highest at least once during the survey programme.

Subtidal foraging was recorded in 0L576 (Ballycotton lower) and 0L581 (Ballycotton mid) on two survey occasions and they both shared peak numbers on 01/02/11.

Roosting Distribution

Good numbers of Common Gulls were recorded roosting intertidally in most surveys and five subsites were used overall: 0L575, 0L576, 0L577, 0L579 and 0L581.

0L575 (Ballynamona Lagoon) held peak numbers roosting intertidally during three low tide surveys and the second highest numbers in another. With proportions ranging from 25% to 62% of the total numbers recorded, plus a count of 125 individuals during the high tide survey representing 93% of all those roosting intertidally; this was the clearly favoured subsite. 0L576 (Ballycotton lower) held peak numbers once, and numbers ranked as second highest in all other surveys. 0L579 (Shangarry) held good numbers that were always ranked in the top three.

Subtidal roosting/other behaviour was recorded less often and in four subsites during low tide surveys: 0L576, 0L577, 0L579 and 0L581. 0L577 and 0L581 recorded peak numbers on at least one occasion. The peak number recorded was 45 individuals in 0L577 on 06/11/10.

During the high tide survey a total of 134 Common Gulls were recorded roosting intertidally; 93% of these in 0L575 (Ballynamona Lagoon) (125 gulls). A further nine individuals roosted within 0L577 (Knockadoon/Ballymakeagh) (outside SPA boundary). 12 Common Gulls roosted subtidally during the high tide survey, all located within 0L576 (Ballycotton lower).

Terrestrial roosting was recorded on single occasions for 0L580 (Ballynamona Marsh) and 0L599 (Ballylangane Fields).

The roost survey (02/11/10) recorded four flocks of roosting Common Gull across three subsites (0L575, 0L576 and 0L581). 0L575 (Ballynamona Lagoon) held the largest flock of 62 gulls that roosted intertidally. 0L576 (Ballycotton lower) held two flocks of seven and 21 gulls that roosted/other subtidally. 0L581 (Ballycotton mid) recorded five individuals that roosted subtidally.

Lesser Black-backed Gull *Larus fuscus* - Family (group): Laridae (gulls)

Lesser Black-backed Gulls that occur as breeding and wintering birds in Britain and Ireland belong to the race *graellsii*, which also breeds across western Europe, Iceland, the Faeroes and Greenland. Smaller numbers of the race *intermedius* also occur at times and numbers during winter are increased by gulls from the Netherlands and Germany, thought to be an intergrade between *graellsii* and *intermedius* (Wernham et al. 2002).

Numbers

Total numbers of Lesser Black-backed Gulls peaked in October 2010 when 619 were recorded across the site. Thereafter numbers were lower during low tide surveys and at their lowest on 01/02/11. 112 Lesser Black-backed Gulls were counted during the high tide survey (16/01/11).

The peak number recorded during I-WeBS in the 2010/11 season was 223 individuals.

Lesser Black-backed Gulls were recorded in five subsites overall: 0L575, 0L576, 0L577, 0L579 and 0L581. 0L575 (Ballynamona Lagoon) held peak numbers throughout the survey programme. All other subsites recorded good numbers, ranked highly, on at least one occasion highlighting the importance of all of the five subsites.

Foraging Distribution

The majority of Black-backed Gulls were recorded in roosting/other behaviour. Low numbers were recorded foraging intertidally in 0L576 (Ballycotton lower) and 0L581 (Ballycotton mid) and this latter subsite also recorded three individuals foraging subtidally on one occasion.

Roosting Distribution

Lesser Black-backed Gulls were recorded in roosting/other behaviour (intertidal habitat) in five subsites: 0L575, 0L576, 0L577, 0L579 and 0L581.

0L575 (Ballynamona Lagoon) held peak numbers in all low tide surveys and the high tide survey and with numbers representing 64% to 100% of all those counted in this behaviour, was the clearly favoured subsite.

Numbers ranked as second highest were recorded by 0L576 (Ballycotton lower) and 0L579 (Shangarry).

Subtidal roosting/other behaviour was recorded irregularly. 0L577 (Knockadoon/Ballymakeagh) held 102 individuals on one occasion (outside SPA boundary) while 0L579 (Shangarry) held two individuals on one survey occasion.

During the high tide survey (16/01/11) 107 Lesser Black-backed Gulls were recorded in roosting/other behaviour (intertidal habitat) in 0L575 (Ballynamona Lagoon). A further five individuals roosted subtidally in 0L576 (Ballycotton lower).

The roost survey (02/11/10) recorded a flock of 248 Lesser Black-backed Gulls roosting intertidally in 0L575 (Ballynamona Lagoon). Flocks of 46 and 130 individuals were recorded in terrestrial grassland and stubble adjacent 0L577 (Knockadoon/Ballymakeagh) and comprised both roosting/other and foraging individuals. Two individuals roosted intertidally in 0L576 (Ballycotton lower).

5.4 Ballycotton Bay - Activities and Events

5.4.1 Introduction

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve '*favourable conservation status*' and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 2012). In its broadest sense, favourable conservation status means that an ecological feature is in a satisfactory condition, and that this status is likely to continue into the future.

At site level, the concept of 'favourable status' is referred to as 'conservation condition.' This can relate not only to species numbers, but importantly, to factors that influence a species abundance and distribution at a site. The identification of activities and events that occur at a designated site is therefore important, as is an assessment of how these might impact upon the waterbird species and their habitats, and thus influence the achievement of favourable condition. Site-based management and the control of factors that impact upon species or habitats of conservation importance are fundamental to the achievement of site conservation objectives.

Section 5.4 provides information on activities and events that occur in and around Ballycotton Bay that may either act upon the habitats within the site, or may interact with the Special Conservation Interest species and other waterbirds using the site.

5.4.2 Assessment Methods

Information on 'activities' and 'events' across the site was collected during a desk-top review which included NPWS site reporting files, County Development and other plans (e.g. Cork County Council, 2013), South Western River Basin District documents (e.g. SWRBD, 2010a) and other available documents relevant to the ecology of the site.

In addition, information was collected during the 2010/11 waterbird survey programme (NPWS, 2011) as field workers recorded activities or events that occurred at the site during their survey work. This information, together with results from a 'site activity questionnaire' provides valuable information gained from 50+ hours of surveyor effort across the site. All data collected were entered into a database but as the dataset will be subject to change over time, the assessment should be viewed as a working and evolving process.

The 'activities' and 'events' were categorised using the standard EU list of pressures and threats as used in Article 12 reporting under the EU Bird's Directive. Only factors likely to directly or indirectly affect waterbirds were included but the resulting list is broad and includes built elements (e.g. man-made structures such as roads and bridges that are adjacent to the site), factors associated with pollution (e.g. discharges from waste water treatment plants), various recreational and non-recreational activities as well as biological factors such as the growth of the invasive plant species *Spartina anglica*.

Data are presented in three ways:-

1. Activities and events identified as occurring in and around Ballycotton Bay (through either the desk-top review or field survey programme) are listed in relation to the subsite within which they were observed or are known to occur. The activities/events are classified as follows:

- O** observed or known to occur within Ballycotton Bay;
- U** known to occur but unknown spatial area hence all potential subsites are included (e.g. fisheries activities);
- H** historic, known to have occurred in the past.
- P** potential to occur in the future.

2. Of the activities and events identified to occur in and around Ballycotton Bay, those that have the potential to cause disturbance to waterbird species are highlighted.
3. Data from the 2010/11 waterbird survey programme were used to inform an assessment which examined the level of disturbance caused by activities recorded during field surveys. The methodology was adapted from that used for monitoring Important Bird Areas (IBAs) (Birdlife International, 2006) and involved assigning scores which ranged between 0 and 3, to three selected attributes of each disturbance event (1) frequency/duration; (2) intensity and (3) likely response of waterbirds (after Hill et al. 1997) (Table 5.7). The rationale for scoring is provided in Appendix 10.

Table 5.7 Scoring system for disturbance assessment

Frequency/Duration	(A) Timing Score	Intensity	(B) Scope Score	Response	(C) Severity Score	TOTAL SCORE A + B + C
Continuous	3	Active, high-level	3	Most birds disturbed all of the time	3	9
Frequent	2	Medium level	2	Most birds displaced for short periods	2	6
Infrequent	1	Low-level	1	Most species tolerate disturbance	1	3
Rare	0	Very low-level	0	Most birds successfully habituate to the disturbance	0	0

The scores assigned to the three attributes were then added together to give an overall 'disturbance score' which is used to define the extent of the impact as follows:-

Scores 0 – 3 = **Low**
 Scores 4 – 6 = **Moderate**
 Scores 7 – 9 = **High**

The attributes (1) frequency/duration and (3) response were scored based on field survey observations. Attribute (2) intensity was scored based on a combination of field survey observations and best expert opinion.

5.4.3 Overview of activities at Ballycotton Bay

Activities and events identified to occur in and around Ballycotton Bay are shown in Appendix 9, listed in terms of the subsites surveyed during the 2010/11 Waterbird Survey Programme. Activities highlighted in grey are those that have the potential to cause disturbance to waterbirds (see Section 5.4.4).

The following pages outline the range of activities and events that occur across the site using the following headings: (1) habitat loss, modification and adjacent landuse; (2) water quality; (3) fisheries and aquaculture; (4) recreational activities; and (5) others.

Habitat loss, modification and adjacent landuse

Ballycotton Bay is an east-facing coastal complex situated on the south coast of Co. Cork, stretching northwards from Ballycotton to Ballynamona, a distance of c.2 km. The surrounding landscape is low-lying agricultural land with scattered individual dwellings.

Farming in the area includes a mixture of intensive grassland and tillage farming.

The main centre of habitation close to the site is Ballycotton village, a fishing village that has expanded as a seaside resort over the years. This village lies outside and south-east of the southern extent of the SPA boundary. Further north the village of Shanagarry lies to the east of the site.

The wetland habitats within the site are known to have changed considerably since the publication of first edition OS six inch maps, including the development of a coastal lagoon in the 1930's by the creation of a shingle barrier (Ballynamona Lagoon) and its subsequent loss in the 1990's and reversion to estuarine habitat as a result of a breach (Smiddy, 2005; Smiddy & O'Halloran, 2006a). This breaching was in part caused by natural erosion, and in part by physical removal in order to control water levels and prevent flooding (Oliver, 2005). The loss of lagoon habitat has led to significant changes in the diversity and abundance of breeding waterfowl at the site (e.g. Smiddy, 2005) with further documented declines in diversity and abundance of non-breeding waterbirds during winter (Smiddy & O'Halloran, 2006b).

Shanagarry Marsh has predominantly saltmarsh habitat, but was once more saline in character with open areas of water. Drainage works in the 1980's reduced the level of saline pools and now reed and large sedge swamp dominates much of the marsh.

Coastal erosion has long been a phenomenon at Ballycotton Bay, especially given its location at the eastern end of the Cloyne syncline, a band of low-lying carboniferous limestone and the soft coastline of cliffs of glacial till. Such coastlines are predisposed to erosion by the sea and this has been occurring for tens of thousands of years (Smiddy & O'Halloran, 2006a), evidenced today by collapsing cliffs. Protective walls of boulders can be seen at Ardnahinch and Garryvoe to protect caravan parks and habitats behind.

Coastal habitats at Shanagarry have been identified as at risk to potential coastal flooding (RPS, 2011).

Common Cord-grass *Spartina* sp. was first recorded at Shanagarry Marsh in 1971 (Anon, 1972) but has not spread considerably, likely due to the lack of open mud (Smiddy & O'Halloran, 2006a).

At Garryvoe and Ballynamona, coastal carparks were developed on former sand dune habitat.

A natural gas field occurs offshore from Ballycotton, discovered in 1989. Gas is piped to an onshore terminal near Midleton, Co Cork.

Water Quality

The South Western River Basin District (SWRBD) River Basin Management Plan 2011 – 2015 covers the implementation of the Water Framework Directive (WFD) (2000/60/EEC) for the south-west coast of Ireland and covers Ballycotton Bay and its inflowing rivers (SWRBD, 2010a).

The current water quality status of Ballycotton Bay is 'moderate' according to the South Western River Basin Transitional and Coastal Waters Action Programme (SWRBD, 2010b) and therefore fails to meet the required standards as set by the Water Framework Directive.

Some insight to causative factors is given in the Womagh Water Management Unit Action Plan (SWRBD, 2010c) which lists eight rivers in the catchment, five of which have a 'poor' status. The principal suspected causes of less than satisfactory water in the catchment and across the wider river basin district are discharges, principally of nutrients, from agricultural

activities (diffuse pressures) and from waste water treatment plants (WWTP) (point source pressures).

The Ballylongane Stream, which rises to the east of Cloyne Village, flows in an easterly direction, and discharges to the sea south of Garryvoe beach via a culvert under the car park and an outfall on the foreshore. This stream drains an intensive agricultural area. This stream is classified as being of Poor Status in the SWRBD Management Plan; however this status is extrapolated (SWRBD, 2010c).

Monitoring and assessment carried out for Garryvoe Bathing Water by Cork County Council suggest that agriculture may be having a significant impact on water quality in the Ballylongane Stream, particularly following heavy rainfall events. Furthermore the Garryvoe effluent treatment system that services the hotel, caravan parks and houses in the local area, is based on a septic tank system that offers preliminary treatment only before being discharged onto the foreshore (Cork County Council, 2009). In Ballycotton, wastewater is directed either to a septic tank or is discharged directly (untreated) into Ballycotton Bay.

Ballycotton Village is part of the proposed Shannagarry/Garryvoe/Ballycotton Sewerage Scheme, which has been awaiting completion of the planning process and development for several years. The proposed scheme includes a waste water treatment plant, pumping stations and a new marine outfall in the form of a 350 mm diameter pipeline, approximately 1.7 km. in length, running from the treatment plant site, through the village, to discharge into Ballycotton Bay, 300m offshore from Cow's Slip.

Fisheries & aquaculture

Ballycotton village is a fishing harbour and deep sea angling boats are based there. Various commercial inshore fishing activities are likely to occur in and adjacent to the site (detail and spatial scale unknown). Line fishing and other static methods (e.g. pots) are likely to be widespread within the bay.

Recreational activities

Ballycotton Bay is located in a scenic area of east Cork. The bay is renowned for its long stretch of sandy beach that runs 25km from Ballycotton to Knockadoon Head. General beach recreational activities occur year round; dog walking is particularly common. Horse-riding is also common at the site. Although the site is not favoured for surfing it does occur from time to time.

Garryvoe Beach has received Blue Flag status previously (not in 2013) and is backed by sand dunes with a car park, caravan parks and hotel all close by. A little further south, Ardnahinch beach was awarded a 'green coast award' for 2013; an award that signifies good water quality and a natural, unspoilt environment.

Ballycotton village (outside of the SPA) is a famous fishing village with the longest sea angling history in Ireland (Dunlop, 2008). A marina is located at the eastern end of the village. Charter boats operate annually from May to the end of September and specialise in reef and shark fishing. Shore angling is common throughout the site both from rocky outcrops/reefs and from sandy shores.

The site is popular for bird watching and especially in autumn when many rare passage migrants have been recorded.

Other

Ballycotton has a lifeboat station that opened in 1858 and was updated in 2002.

Wildfowling occurred traditionally at the site but in the 1970's a no shooting order was placed on Ballynamona - Shanagarry in the form of a Wildfowl Sanctuary.

Wildfowling was not recorded at the site during the 2010/11 Waterbird Survey Programme. In response to the freezing conditions experienced in the winter of 2010, the Department of the Environment, Heritage and Local Government extended a temporary closure of the hunting season for wild birds (8th – 30th December 2010 inclusive).

5.4.4 Disturbance Assessment

During 2010/11 survey work, seven activities were recorded that had the potential to cause disturbance to waterbirds. These were aircraft, powered watercraft, wind-surfing (kite-surfing), walking (including with dogs), horse riding, bait-digging and the collection of molluscs (winkle picking) (Table 5.8).

Walking (including with dogs) was the most widespread activity occurring in five of the total eight subsites, and accounting for the peak disturbance score in all. This activity was most common in the outer sandy subsites (beaches) of 0L579, 0L581 and 0L576). A total of 11 records were made of dogs being present during counts and just over two-thirds of these observations resulted in birds being actively displaced.

A summary of the disturbance assessment is shown in Table 5.8 and full results are shown in Appendix 10. As a final review, Table 5.9 shows the peak disturbance scores overlaid on the subsite assessment table (total waterbird numbers, LT surveys).

Table 5.8 Disturbance Assessment Summary Table

Number of activities recorded during field surveys (2010/11 waterbird survey programme) observed to cause disturbance to waterbirds. The calculated peak disturbance score is shown (see text for explanation).

Scores 0 – 3 = **Low** Scores 4 – 6 = **Moderate** Scores 7 – 9 = **High**. Grey shading = no activity recorded.

Subsite Code	Subsite Name	Number Activities	Peak Disturbance Score	Activity Responsible
0L575	Ballynamona Lagoon	0	-	
0L576	Ballycotton lower	4	7	- Walking (incl. with dogs)
0L577	Knockadoon/Ballymakeagh	1	6	- Walking (incl. with dogs)
0L578	Ardnahinch	0	-	
0L579	Shangarry	3	7	- Walking (incl. with dogs)
0L580	Ballynamona Marsh	2	7	- Walking (incl. with dogs)
0L581	Ballycotton mid	5	7	- Walking (incl. with dogs)
0L599	Ballylangane Fields	0	-	

Table 5.9 Ballycotton Bay - subsite rankings based on total numbers of waterbirds (LT surveys) by peak disturbance score

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T.	V		L			H	M	
RP	M	V	V		H		V	
GP	V							
GV	V	V	L	M		H		H
L.	V	M	L	M		H		H
BW	V	V			L	M	L	H
BA	M	V	M		H		V	
CU	V	H	V		M	M	M	H
TT	M	V	V		H		H	
CM	V	V	M		H	M	H	L
LB	V	H	H		H		H	

5.4.5 Discussion

The review of Ballycotton Bay has revealed many habitat changes over the years that are likely to have affected waterbird diversity and numbers in a variety of ways (e.g. Smiddy, 2005, Smiddy and O'Halloran, 2006 a, b). While physical loss or modifications are often more historic in nature, on-going modifications to intertidal and coastal habitats are also occurring due to natural processes (e.g. sedimentation or erosion rates).

Human recreational activities at coastal sites occur less frequently during winter months and the range of activities is much reduced. Nevertheless, recreational activity in the form of walkers (with/without dogs) occurred in a majority of the count subsites and was a regular activity in several.

Interestingly, in December 2010 during the spell of extreme cold weather, waders in subsite 0L576 were observed not to leave the subsite despite being chased by dogs. This is not an unusual reaction because at such times birds sometimes simply do not have the energy to fly away too far. Indeed, some birds can become 'tame' and reluctant to fly when approached in order to avoid using their remaining energy reserves; this was also witnessed at other SPA sites covered during the 2010/11 Waterbird Survey Programme.

The significance of the impact that results from even a short-term displacement should not be underestimated. In terms of foraging habitat, displacement from feeding opportunities not only reduces a bird's energy intake but also leads to an increase in energy expenditure as a result of the energetic costs of flying to an alternative foraging area. Displacement also has knock-on ecological effects such as increased competition (within and/or between different species) for a common food source. In areas subject to heavy or on-going disturbance, waterbirds may be disturbed so frequently that their displacement is equivalent to habitat loss. When disturbance effects reduce species fitness¹⁸ (reduced survival or reproductive success) consequences at population level may result.

Whilst the nature and the frequency of disturbance-causing activities are key factors when assessing likely impacts, many aspects of waterbird behaviour and ecology will influence a species response. Waterbird responses are likely to vary with each individual event and to be

¹⁸ defined as a measure of the relative contribution of an individual to the gene pool of the next generation.

species-specific. The significance of a disturbance event upon waterbirds will vary according to a range of factors including:-

- Frequency/duration of disturbance event;
- Intensity of activity;
- Response of waterbirds.

and be influenced by:-

- Temporal availability – whether waterbirds have the opportunity to exploit the food resources in a disturbed area at times when the disturbance does not occur;
- Availability of compensatory habitat - whether there is suitable alternative habitat to move to during disturbance events;
- Behavioural changes as a result of a disturbance - e.g. degree of habituation;
- Time available for acclimatisation - whether there is time available for habituation to the disturbance. (there may be a lack of time for waterbirds during the staging period);
- Age - for example when feeding, immature (1st winter birds) may be marginalised by older more dominant flocks so that their access to the optimal prey resources is limited. These individuals may already therefore be under pressure to gain their required daily energy intake before the effects of any disturbance event are taken into account;
- Timing/seasonality - birds may be more vulnerable at certain times e.g. pre- and post-migration, at the end of the winter when food resources are lower;
- Weather - birds are more vulnerable during periods of severe cold weather or strong winds;
- Site fidelity – some species are highly site faithful at site or within-site level and will therefore be affected to a greater degree than species that range more widely;
- Predation and competition – a knock-on effect of disturbance is that waterbirds may move into areas where they are subject to increased competition for prey resources, or increased predation – i.e. the disturbance results in an indirect impact which is an increased predation risk.

Knowledge of site activities and events is important when examining waterbird distribution and understanding the many factors that might influence a species' distribution across a site. The above points also highlight the complex nature of waterbird behaviour and species specificity, as well as the need for careful consideration of the impacts of disturbance upon waterbird species when undertaking Appropriate Assessments or other environmental assessments. This review could therefore form the starting point for any future study aiming to quantify the effects of activities/disturbance events across the site, as well as to help identify the extent to which existing use and management of the site are consistent with the achievement of the conservation objectives described in Part Three of this document.

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APPENDIX 1

SITE NAME: BALLYCOTTON BAY SPA

SITE CODE: 004022

Situated on the south coast of Co. Cork, Ballycotton Bay is an east-facing coastal complex, which stretches northwards from Ballycotton to Ballynamona, a distance of c. 2 km. The site comprises two sheltered inlets which receive the flows of several small rivers. The southern inlet had formerly been lagoonal (Ballycotton Lake) but breaching of the shingle barrier in recent times has resulted in the area reverting to an estuarine system.

The principal habitat within the site is inter-tidal sand and mudflats. These are mostly well-exposed and the sediments are predominantly firm sands. In the more sheltered conditions of the inlets, sediments contain a higher silt fraction. The inter-tidal flats provide the main feeding habitat for the wintering birds. Sandy beaches are well represented. The shingle beach is mobile and is influenced by storms, which create open conditions that favour a particular suite of species. Species found here include Grass-leaved Orache (*Atriplex littoralis*), Black Mustard (*Brassica nigra*), Sand Couch (*Elymus farctus*) and Lyme-grass (*Leymus arenarius*). Also growing on the shingle beach is Sea-kale (*Crambe maritima*), a rare species that is listed in the Red Data Book. Salt marshes fringe the flats in the sheltered inlets and these provide high tides roosts. A small area of shallow marine water is also included.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Teal, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Turnstone, Common Gull and Lesser Black-backed Gull. The E.U. Birds Directive pays particular attention to wetlands, and as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Ballycotton Bay supports an excellent diversity of wintering waterbird species. The following species are of national importance (all figures are mean peak counts for the five years 1995/96 to 1999/2000): Teal (903), Ringed Plover (167), Golden Plover (2,383), Grey Plover (124), Lapwing (2,782), Black-tailed Godwit (136), Bar-tailed Godwit (175), Curlew (853) and Turnstone (179). Significant numbers of Common Gull (584) and Lesser Black-backed Gull (1,293) have also been recorded from the site. Other species, which occur in important numbers, are Shelduck (99), Wigeon (522), Mallard (232), Oystercatcher (255), Dunlin (575), Sanderling (56), Redshank (117), Greenshank (12) and Great Black-backed Gull (324). Ballycotton Bay was formerly of importance for Bewick's Swan but the birds have abandoned the site since the reversion of the lagoonal habitat to estuarine conditions.

The site is a well-known location for passage waders, especially in autumn. Species such as Ruff, Little Stint, Curlew Sandpiper, Green Sandpiper and Spotted Redshank occur annually though in variable numbers. Small numbers of Ruff may also be seen in late winter and spring. Rarer waders, such as Wood Sandpiper and Pectoral Sandpiper, have also been recorded.

While relatively small in area, Ballycotton Bay supports an excellent diversity of wintering waterfowl and has nationally important populations of nine species, of which two, Golden Plover and Bar-tailed Godwit are listed on Annex I of the E.U. Birds Directive. In addition, two species of gull winter at the site in nationally important numbers.

APPENDIX 2

Waterbird data sources

Irish Wetland Bird Survey (I-WeBS)

I-WeBS began in the Republic of Ireland in 1994/95 and aims to monitor wintering (non-breeding) waterbird populations at the wetland sites upon which they rely. Counts are carried out by volunteers and professional staff of the partner organisations across the months September to March of each year. I-WeBS counts take place on a rising tide or close to high tide. For further information please refer to Crowe (2005) and Boland & Crowe (2012).

The I-WeBS Programme monitors the larger coastal wetland sites together with inland lakes, turloughs, rivers and callows. However the resulting dataset is incomplete for some waterbird species that utilise other habitats such as non-wetland habitat (e.g. grassland used by many species and particularly foraging geese, and swans), non-estuarine coastline, small and ephemeral wetlands and the open sea; the latter of which is obviously difficult to monitor from land-based surveys (Crowe, 2005).

A number of additional and special surveys are therefore conducted on an annual or regular basis and data collected are, where appropriate, integrated into the I-WeBS database. These surveys include those undertaken for swan and geese species that forage typically during daylight hours across terrestrial habitats (e.g. grassland, arable fields) using coastal wetlands sites at night when they congregate to roost. Some of the additional surveys are carried out at certain times, aimed at providing a better estimate of numbers (e.g. Greylag Geese) and for some species an assessment of breeding success during the previous summer (e.g. Light-bellied Brent Geese). These surveys are introduced briefly below and more information is provided in Crowe (2005).

- Swan Surveys

Coordinated international censuses are carried out of the wintering populations of Whooper Swan (*Cygnus cygnus*) and Bewick's Swan (*Cygnus columbianus bewickii*) at four or five-yearly intervals. The surveys are organised by I-WeBS, the Irish Whooper Swan Study group (IWSSG) and WWT.

- Greenland White-fronted Goose

Greenland White-fronted Geese are concentrated at relatively few sites during winter, many of which are non-wetland habitats. The species is therefore not covered adequately by the I-WeBS programme. The Greenland White-fronted Goose census was initiated in the late 1970's and is carried out by NPWS in Ireland and by JNCC and Scottish Natural Heritage (SNH) in Scotland.

- Greylag Geese

Data for the Icelandic breeding population of Greylag Goose that winters in Ireland are taken from special surveys organised through I-WeBS and undertaken during November each year. The surveys aim to assess the distribution and status of the migratory flocks wintering in Ireland and focus on known feeding areas (grassland & agricultural land). When calculating population estimates of the Icelandic birds, data collected are adjusted to account for feral flocks that also occur within Ireland.

- Barnacle Goose (*Branta leucopsis*)

A wintering population from the northeast Greenland breeding population winters mainly on offshore islands along the west coast of Ireland. An aerial survey is conducted of the principal wintering areas every four to five years.

- Light-bellied Brent Geese

Special autumn surveys of this species have been conducted since 1996, organised in Ireland by the Irish Brent Goose Research Group (IBGRG). The survey is currently conducted on a bi-annual basis during the month of October which coincides with the autumn arrival of the species. Data collected are integrated into the I-WeBS database.

APPENDIX 3

Analysing population trends: a synopsis

Monitoring of non-breeding waterbirds has been undertaken by the Irish Wetland Bird Survey (I-WeBS) and its partner, WeBS in Northern Ireland, since the mid 1990's. For such long-term count data, there is clearly a need to assess long-term trends in a consistent and objective manner (Atkinson et al. 2006).

The first stage in the analytical process involves the use of the Underhill Program (Underhill & Prŷs-Jones, 1994) which models the raw monthly counts using a Generalised Linear Model (GLM). As part of this process, it accounts for changes in numbers at the site and the timing of the count (month, year) while also taking into account completed counts and trends at other sites. When counts at a site are flagged as poor quality (e.g. due to poor visibility) or where there are missing values in a given month, then the modelled values are used. This imputation process is used widely to replace missing data points (e.g. Houlahan et al. 2000; Atkinson et al. 2006; Leech et al. 2002; Gregory et al. 2005; Crowe et al. 2008). The resulting dataset is therefore complete for all months and seasons and comprises a combination of actual count data and imputed count data.

This complete dataset is then modelled using a Generalised Additive Models (GAM) which fits a smoothed curve to the counts. GAMs are non-parametric and flexible extensions of the generalised linear model where the linear predictor of the GLM is replaced by a general additive predictor which allows mean abundance to vary as a smooth function of time. Count data are assumed to follow independent Poisson distribution with 0.3T degrees of freedom (e.g. after Atkinson et al. 2006). The application of GAMs to analyse population trends was applied to UK farmland birds by Fewster et al. (2000) and has since been adopted for modelling waterbird trends elsewhere, for example, the UK WeBS Alert system (Leech et al. 2002).

Smoothed count data for a site are then indexed to assess population trends over time. An index number can be defined as a measure of population size in one year expressed in relation to the size of the population in another selected year (Leech et al. 2002). Changes in the index numbers can therefore explain the pattern of population change over time (Underhill & Prŷs-Jones, 1994).

Annual indices are calculated separately for each species at a site. For each year included in an analysis, a total is obtained by summing the number of birds present in a predetermined number of months. The final year in the series of totals is then scaled to equal 100 (please see example in table). Index values in any given year therefore represent the number of individuals relative to those present in the final year. As this process is the same across all species and all sites analysed it allows for some useful comparisons.

Count Data	Index
264.41	128.11
262.21	127.04
234.0	113.37
126.0	61.05
197.23	95.56
206.4	100.00

Un-smoothed indices are also calculated and provide a means of examining ('eye-balling') the variation across time and can also be used to provide a measure of the mean annual change over the entire period. However, the GAM extension to the methodology and resultant smoothed indices allows for the calculation of proportional change in population size between one season and another. This latter calculation is used in Section 4.2 whereby trends are calculated for the 'long-term' 14-year period (1995/96–2009/10) and the recent five-year period (2004/05–2009/10). The values given represent the percentage change in index (population) values across the specified time period, calculated by subtracting the smoothed index value at the start of the time-frame (1995) from the smoothed index value in the reference year (2009):-

$$\text{Change} = ((I_y - I_x) / I_x) \times 100$$

where I_y is the index from the current year and I_x is the index value at the start of the selected time period (see example below)

The reference year is the penultimate year in the time series because, when smoothing, the GAM takes into account values from both the preceding and following year. The last value in the smoothed dataset (2010) is therefore likely to be the least robust because it has no following year.

The final result is therefore % change in population size across a specified time period. Larger values indicate larger proportional changes in population size; positive values indicating relative increases while negative values indicate relative decreases over the specified time period.

Worked example

Year	Unsmoothed	Smoothed
1994	0.36	0.46
1995	0.81	0.53
1996	0.57	0.60
1997	0.67	0.67
1998	0.64	0.74
1999	0.91	0.79
2000	0.93	0.83
2001	0.87	0.86
2002	1.05	0.87
2003	1.00	0.87
2004	0.67	0.87
2005	0.92	0.88
2006	0.87	0.89
2007	1.24	0.91
2008	0.84	0.93
2009	1.10	0.96
2010	1.00	1.00

Term	Change
5YR	10.51
10YR	21.56
ALL YR	83.57

Further information on population indexing and trend analysis can be found in various references; for particular reference to waterbirds see Leech et al (2002) and Atkinson et al. (2006). For information on the UK WeBS Alerts system, please see Thaxter et al. (2010) and Cook et al. (2013).

Limitations

The months chosen for the calculation of population indices aim to reflect the months when the populations at a site are the most stable, excluding months when there may be fluctuations due to passage populations. Despite this, some datasets still present a high degree of variability or fluctuation both within and between years. Because of this, we assess each species separately and take into account where a species shows a history of wide fluctuations between years (within national dataset), or where a species naturally exhibits within-season fluctuations (e.g. species considered to have weak site faithfulness). Where necessary the results of the trend analysis are assigned necessary caution.

A high proportion of imputed counts can limit the effectiveness of the analysis to aid in the interpretation of the dataset. Species for which 50% or more of the monthly count values are imputed are excluded from analysis. But sometimes the calculation of population change may involve a comparison between winters where, at least one has a value based on a high proportion of imputed data. Where data for adjacent winters are relatively complete this is not a serious concern because of the smoothing technique used. However, where data for a number of consecutive winters rely heavily on imputed data then the resulting result is considered less reliable (Thaxter et al. 2010). Where necessary the results of the trend analysis are assigned necessary caution.

Despite the smoothing effects of the GAM analysis, interpretation of population trends may sometimes still be difficult. Therefore we calculate proportional change in the population across differing time periods (e.g. 12-year, 10-year and 5-year periods) to assess more effectively how the population has fared over time.

APPENDIX 4

Waterbird species codes

AE	Arctic Tern	<i>Sterna paradisaea</i>
BY	Barnacle Goose	<i>Branta leucopsis</i>
BA	Bar-tailed Godwit	<i>Limosa lapponica</i>
BE	Bean Goose	<i>Anser fabalis</i>
BS	Bewick's Swan	<i>Cygnus columbianus</i>
AS	Black Swan	<i>Cygnus atratus</i>
BH	Black-headed Gull	<i>Chroicocephalus ridibundus</i>
BN	Black-necked Grebe	<i>Podiceps nigricollis</i>
BW	Black-tailed Godwit	<i>Limosa limosa</i>
BV	Black-throated Diver	<i>Gavia arctica</i>
BG	Brent Goose	<i>Branta bernicla</i>
CG	Canada Goose	<i>Branta canadensis</i>
CM	Common Gull	<i>Larus canus</i>
CS	Common Sandpiper	<i>Actitis hypoleucos</i>
CX	Common Scoter	<i>Melanitta nigra</i>
CN	Common Tern	<i>Sterna hirundo</i>
CO	Coot	<i>Fulica atra</i>
CA	Cormorant	<i>Phalacrocorax carbo</i>
CU	Curllew	<i>Numenius arquata</i>
CV	Curllew Sandpiper	<i>Calidris ferruginea</i>
DN	Dunlin	<i>Calidris alpina</i>
GA	Gadwall	<i>Anas strepera</i>
GP	Golden Plover	<i>Pluvialis apricaria</i>
GN	Goldeneye	<i>Bucephala clangula</i>
GD	Goosander	<i>Mergus merganser</i>
GB	Great Black-backed Gull	<i>Larus marinus</i>
GG	Great Crested Grebe	<i>Podiceps cristatus</i>
ND	Great Northern Diver	<i>Gavia immer</i>
NW	Greenland White-fronted Goose	<i>Anser albifrons flavirostris</i>
GK	Greenshank	<i>Tringa nebularia</i>
H.	Grey Heron	<i>Ardea cinerea</i>
GV	Grey Plover	<i>Pluvialis squatarola</i>
GJ	Greylag Goose	<i>Anser anser</i>
HG	Herring Gull	<i>Larus argentatus</i>
JS	Jack Snipe	<i>Lymnocyptes minimus</i>
KF	Kingfisher	<i>Alcedo atthis</i>
KN	Knot	<i>Calidris canutus</i>
L.	Lapwing	<i>Vanellus vanellus</i>
LB	Lesser Black-backed Gull	<i>Larus fuscus</i>
PB	Light-bellied Brent Goose	<i>Branta bernicla hrotra</i>

ET	Little Egret	<i>Egretta garzetta</i>
LG	Little Grebe	<i>Tachybaptus ruficollis</i>
AF	Little Tern	<i>Sterna albifrons</i>
MA	Mallard	<i>Anas platyrhynchos</i>
MU	Mediterranean Gull	<i>Larus melanocephalus</i>
MH	Moorhen	<i>Gallinula chloropus</i>
MS	Mute Swan	<i>Cygnus olor</i>
OC	Oystercatcher	<i>Haematopus ostralegus</i>
PG	Pink-footed Goose	<i>Anser brachyrhynchus</i>
PT	Pintail	<i>Anas acuta</i>
PO	Pochard	<i>Aythya ferina</i>
PS	Purple Sandpiper	<i>Calidris maritima</i>
RM	Red-breasted Merganser	<i>Mergus serrator</i>
RH	Red-throated Diver	<i>Gavia stellata</i>
RK	Redshank	<i>Tringa totanus</i>
RP	Ringed Plover	<i>Charadrius hiaticula</i>
RU	Ruff	<i>Philomachus pugnax</i>
SS	Sanderling	<i>Calidris alba</i>
TE	Sandwich Tern	<i>Sterna sandvicensis</i>
SP	Scaup	<i>Aythya marila</i>
SU	Shelduck	<i>Tadorna tadorna</i>
SV	Shoveler	<i>Anas clypeata</i>
SY	Smew	<i>Mergus albellus</i>
SN	Snipe	<i>Gallinago gallinago</i>
NB	Spoonbill	<i>Platalea leucorodia</i>
DR	Spotted Redshank	<i>Tringa erythropus</i>
T.	Teal	<i>Anas crecca</i>
TU	Tufted Duck	<i>Aythya fuligula</i>
TT	Turnstone	<i>Arenaria interpres</i>
WA	Water Rail	<i>Rallus aquaticus</i>
WM	Whimbrel	<i>Numenius phaeopus</i>
WG	White-fronted Goose	<i>Anser albifrons</i>
WS	Whooper Swan	<i>Cygnus Cygnus</i>
WN	Wigeon	<i>Anas penelope</i>
WK	Woodcock	<i>Scolopax rusticola</i>

APPENDIX 5

Waterbird foraging guilds (after Weller, 1999)

Guild	Foods	Tactics	Examples...
(1) Surface swimmer	Invertebrates, vegetation & seeds	Strain/sieve/sweep/dabble/grab/up-ending	'Dabbling ducks'; e.g. Shoveler, Teal, Mallard, Pintail, Wigeon, Gadwall
(2) Water column diver – shallow ^a	Fish & Invertebrates;	Search/grab	'Diving ducks' e.g. Pochard, Tufted Duck, Scaup, Eider,
(3) Water column diver – greater depths	Fish & Invertebrates	Search/grab	Common Scoter, divers, grebes, Cormorant
(4) Intertidal walker, out of water	Invertebrates	Search (probe)/grab	Sandpipers, plovers
(5) Intertidal walker, out of water	Invertebrates, vegetation	Sieve/grab/graze	Shelduck, Avocet, Spoonbill, Wigeon, Light-Bellied Brent Goose,
(6) Intertidal walker, in water	Fish	Search/strike	Grey Heron
	Fish, Invertebrates	Probe, scythe, sweep/grab	Spoonbill, Greenshank
	Fish	Stalk	Little Egret
	Invertebrates	Probe	Several sandpiper species
(7) Terrestrial, walker (e.g. grassland/marsh)	Vegetation (inc. roots, tubers & seeds)	Graze, peck, probe	Many geese species

^a dives <3m.

Please note that this table refers to generalised foraging strategies and is meant as a guide only. There is a great deal of variation between sites, seasons, tidal states and indeed, individual birds themselves. For example, some waterbird species may deploy several of the methods, e.g. Shelduck may forage by sieving intertidal mud (5) or by up-ending (1) and Pintail, although generally known as a 'dabbling' duck, does occasionally dive for food.

APPENDIX 6

Ballycotton Bay – Waterbird Survey Programme 2010/11 – Count Subsites

Subsite Code	Subsite Name	Subsite Area (ha)
0L575	Ballynamona Lagoon	60
0L576	Ballycotton lower	100
0L577	Knockadoon/Ballymakeagh	61
0L578	Ardnahinch	19
0L579	Shangarry	47
0L580	Ballynamona Marsh	43
0L581	Ballycotton mid	59
0L599	Ballylangane Fields	7
	TOTAL	396 ha

Legend

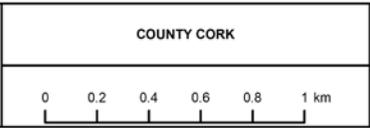
-  Ballycotton Bay Count Subsites
-  OSi Discovery Series County Boundary



 *An Roinn Ealaíon, Oidhreacht agus Gaeltachta*
 Department of Arts, Heritage and the Gaeltacht

**Ballycotton Bay
 Count Subsites used during the
 2010/2011 Waterbird
 Survey Programme**

Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.



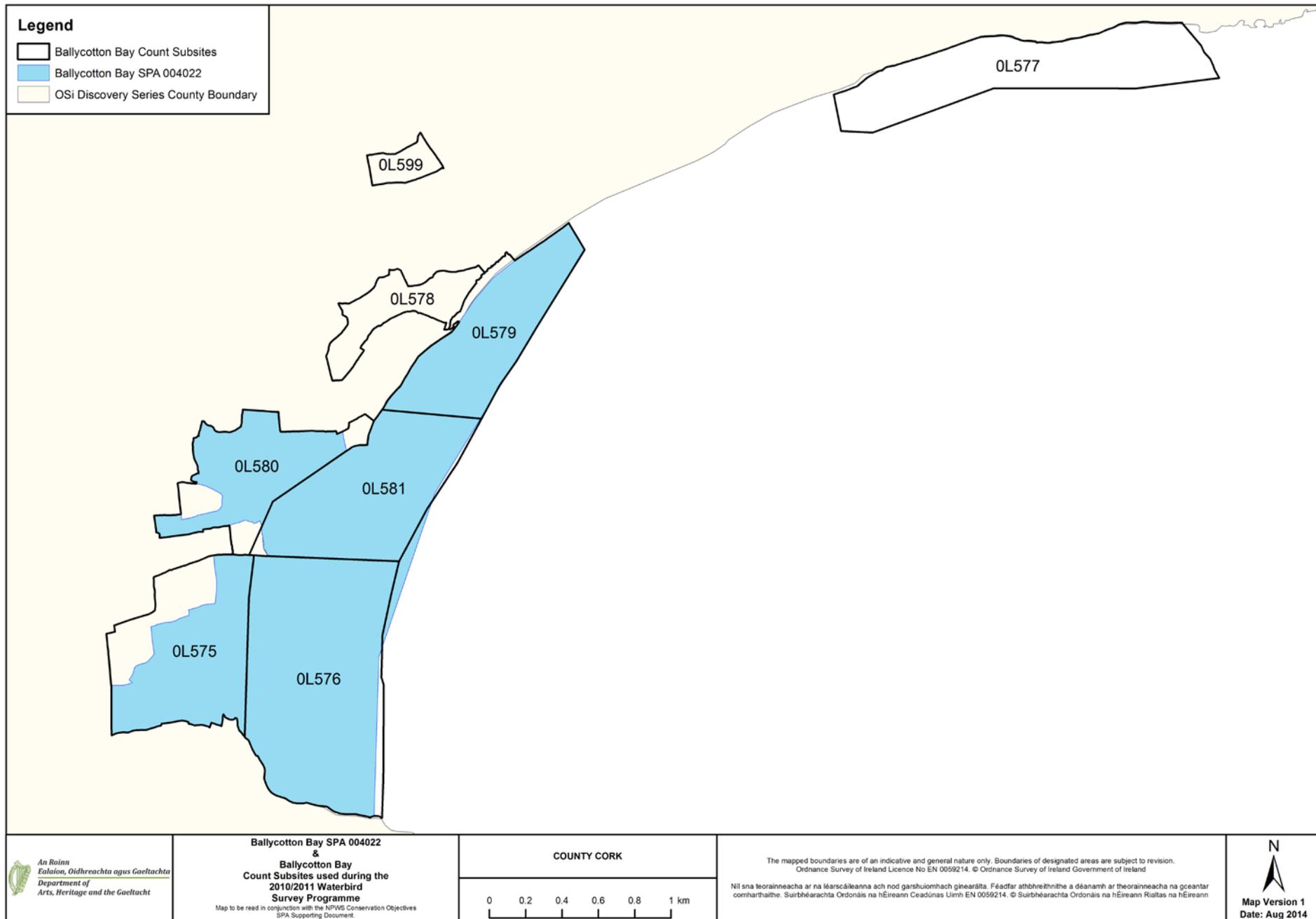
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
 Ordnance Survey of Ireland Licence No EN 0059214. © Ordnance Survey of Ireland Government of Ireland

Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbheithníthe a déanamh ar theorainneacha na gceantar comharthaíthe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh EN 0059214. © Suirbhéarachta Ordonáis na hÉireann Rialtas na hÉireann

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Map Version 1
Date: Aug 2014

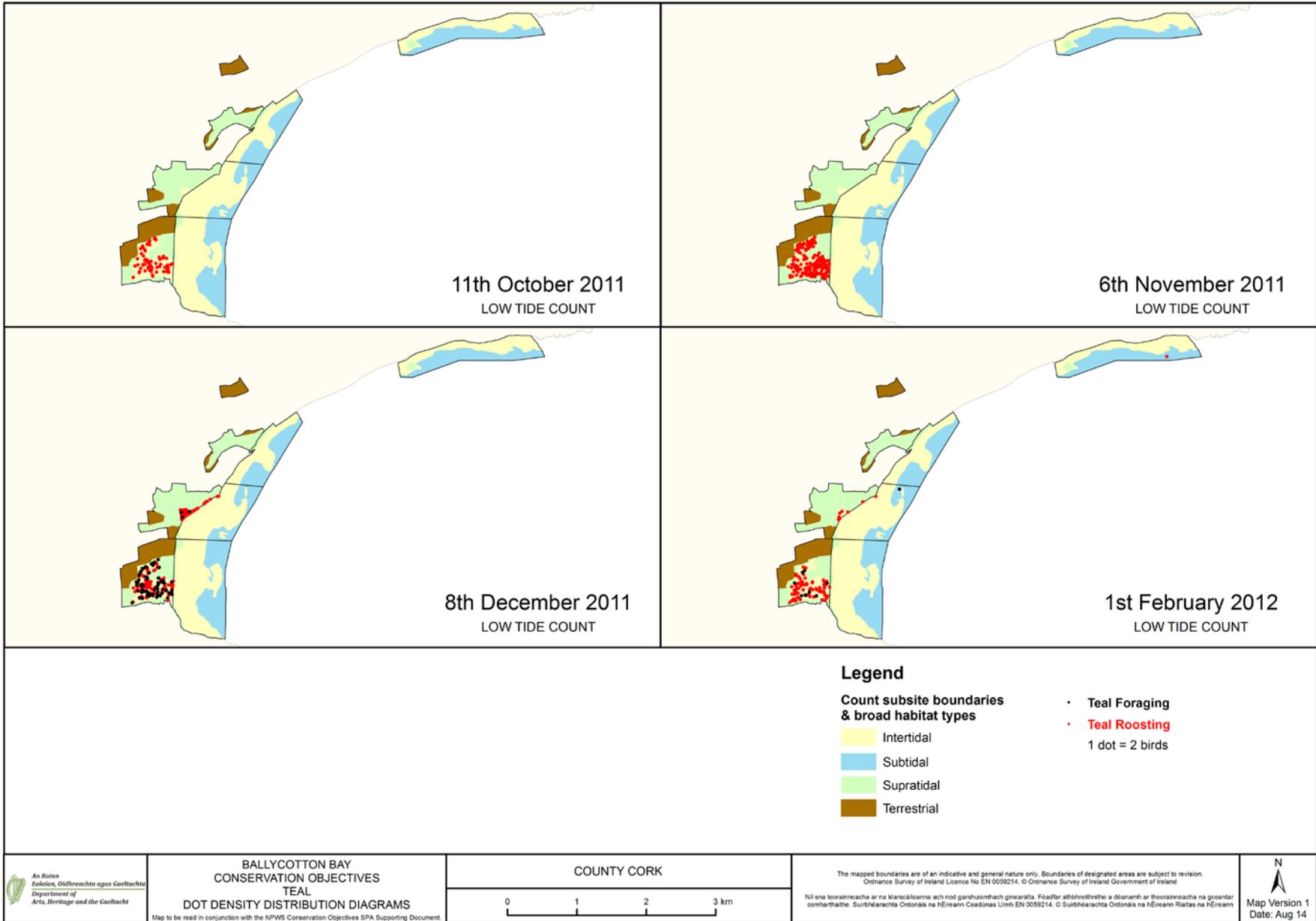


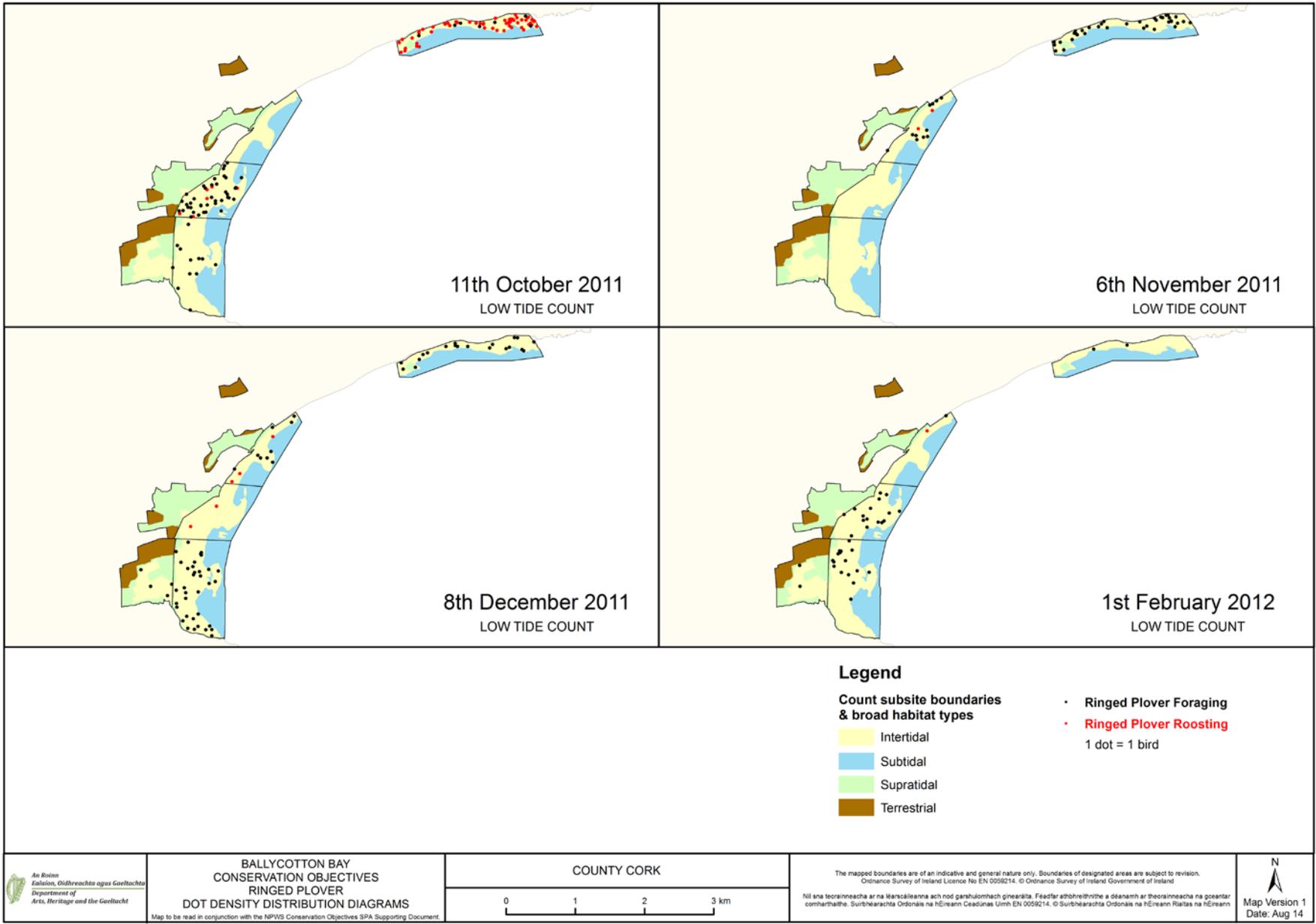
APPENDIX 7

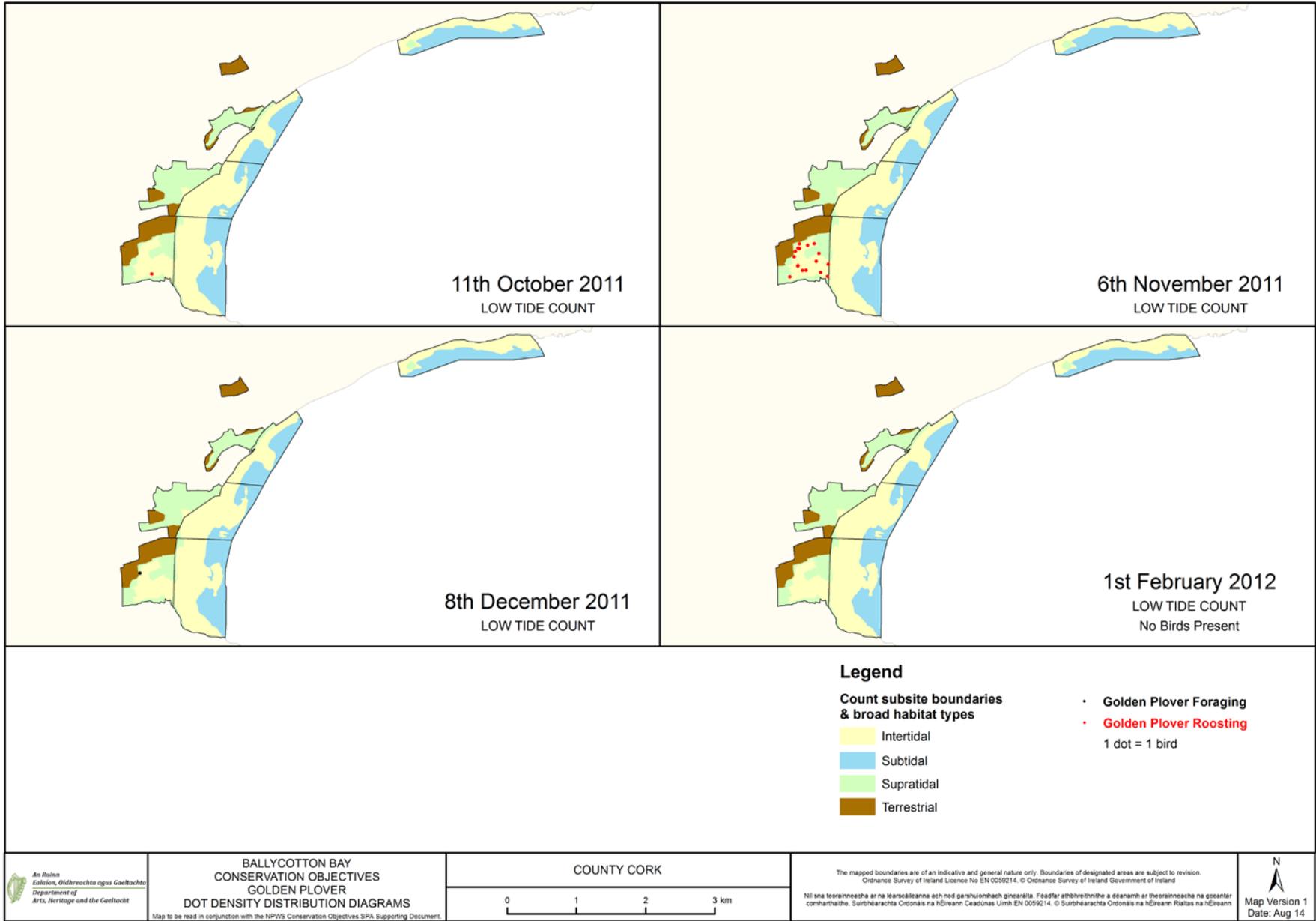
Ballycotton Bay

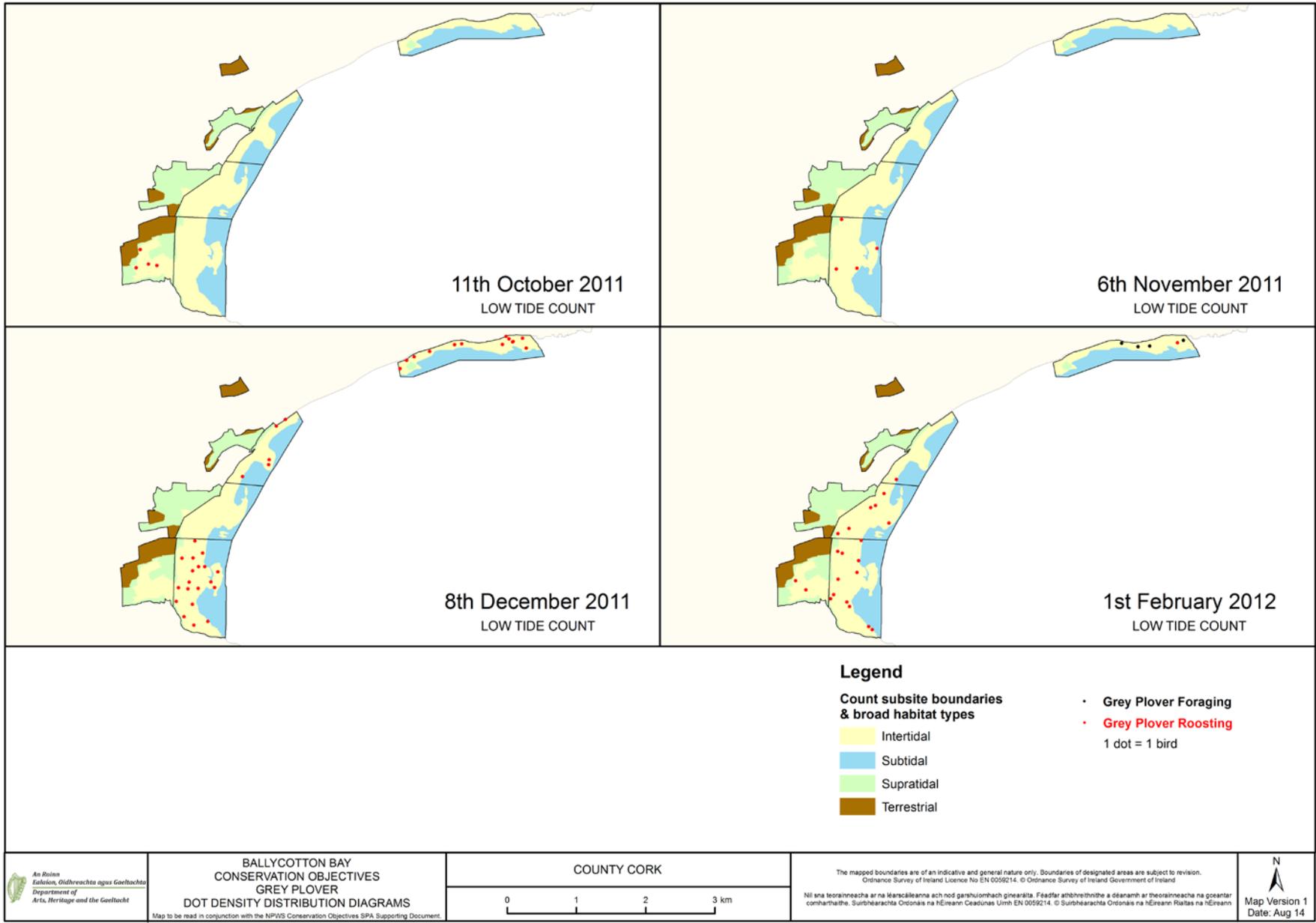
Waterbird distribution (dot-density diagrams) recorded during low tide surveys
(October 2010 – February 2011)

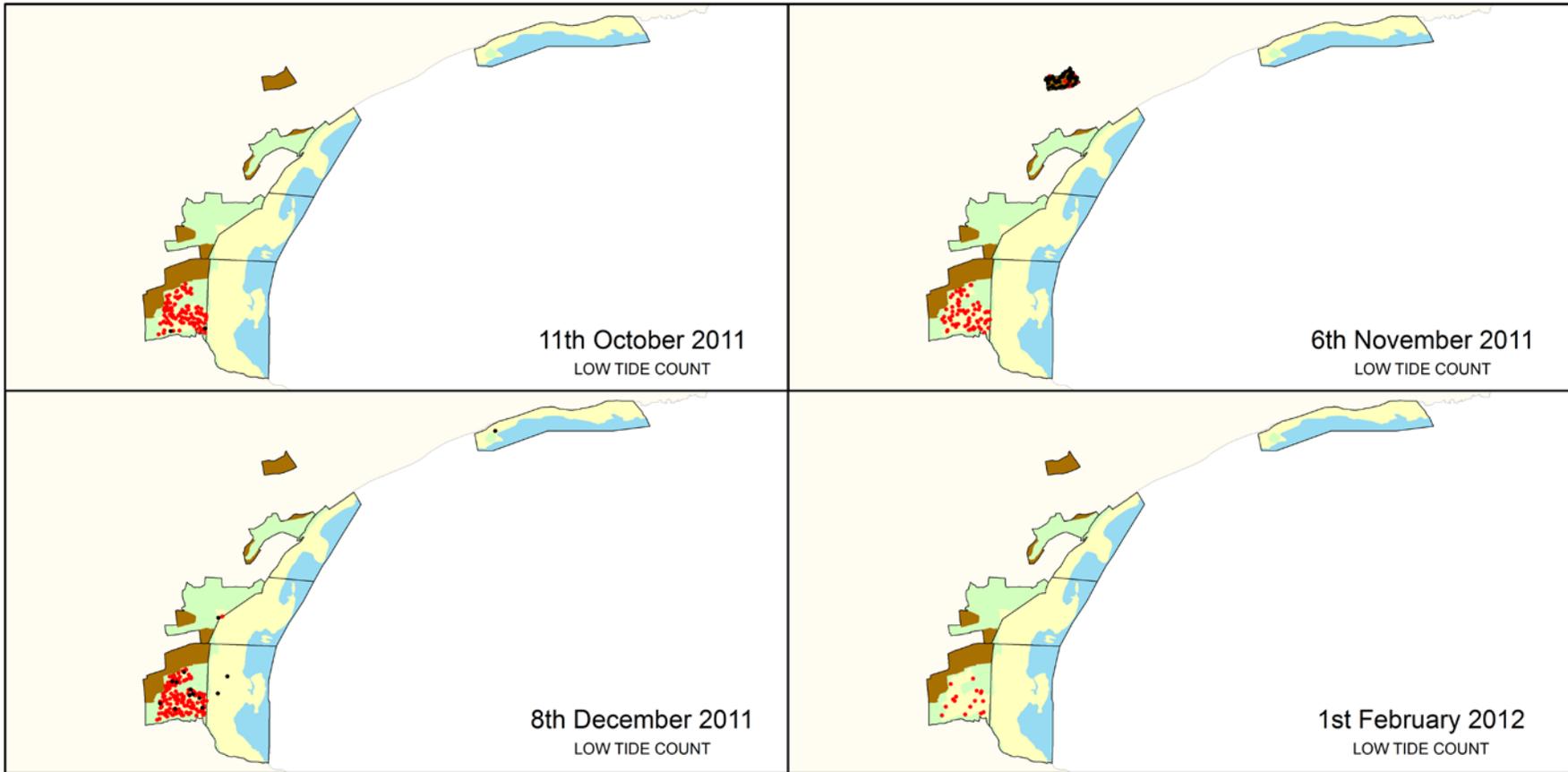
**(NB data are presented for birds located in intertidal, subtidal and terrestrial habitats;
birds in supratidal habitat not shown)**







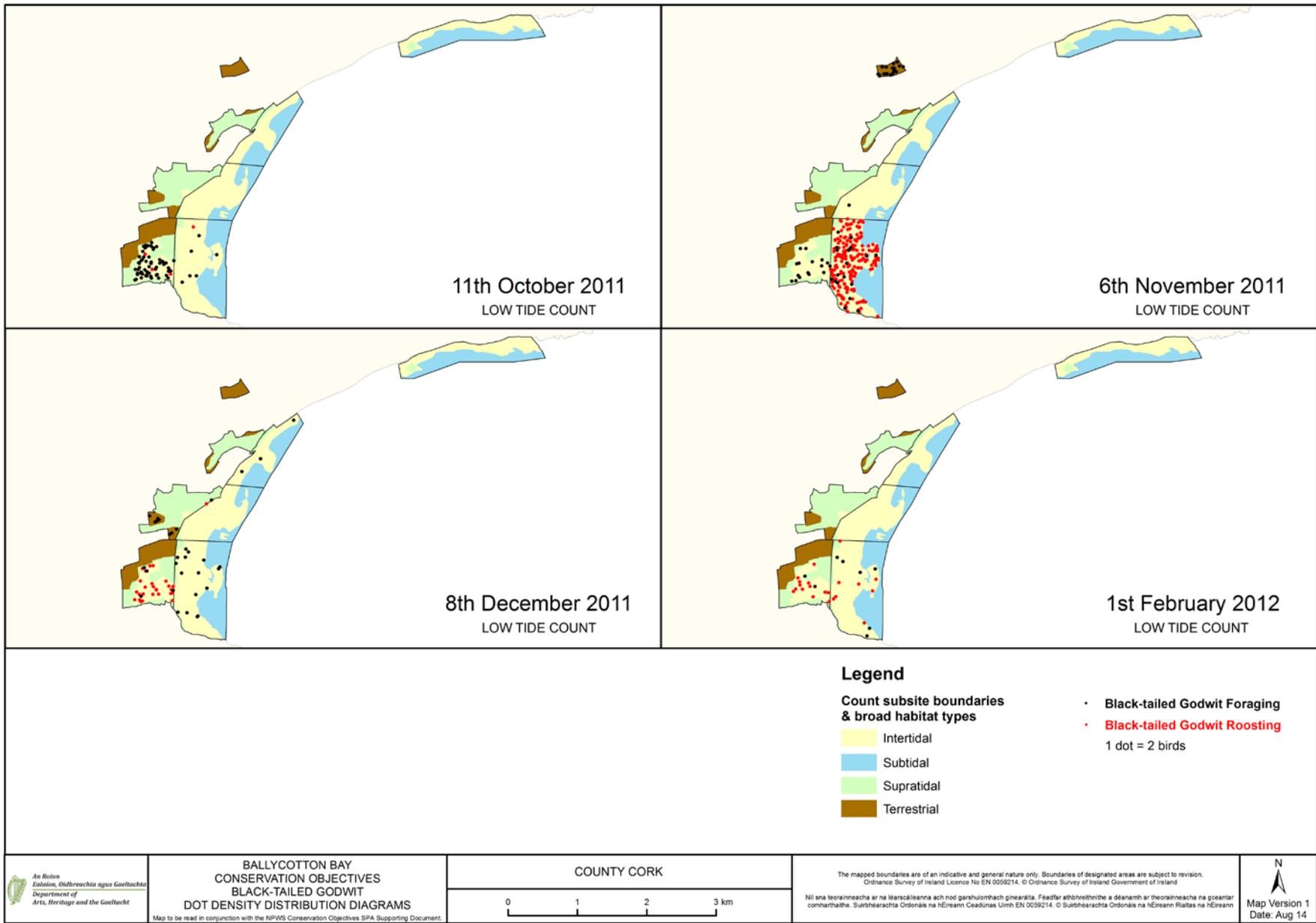


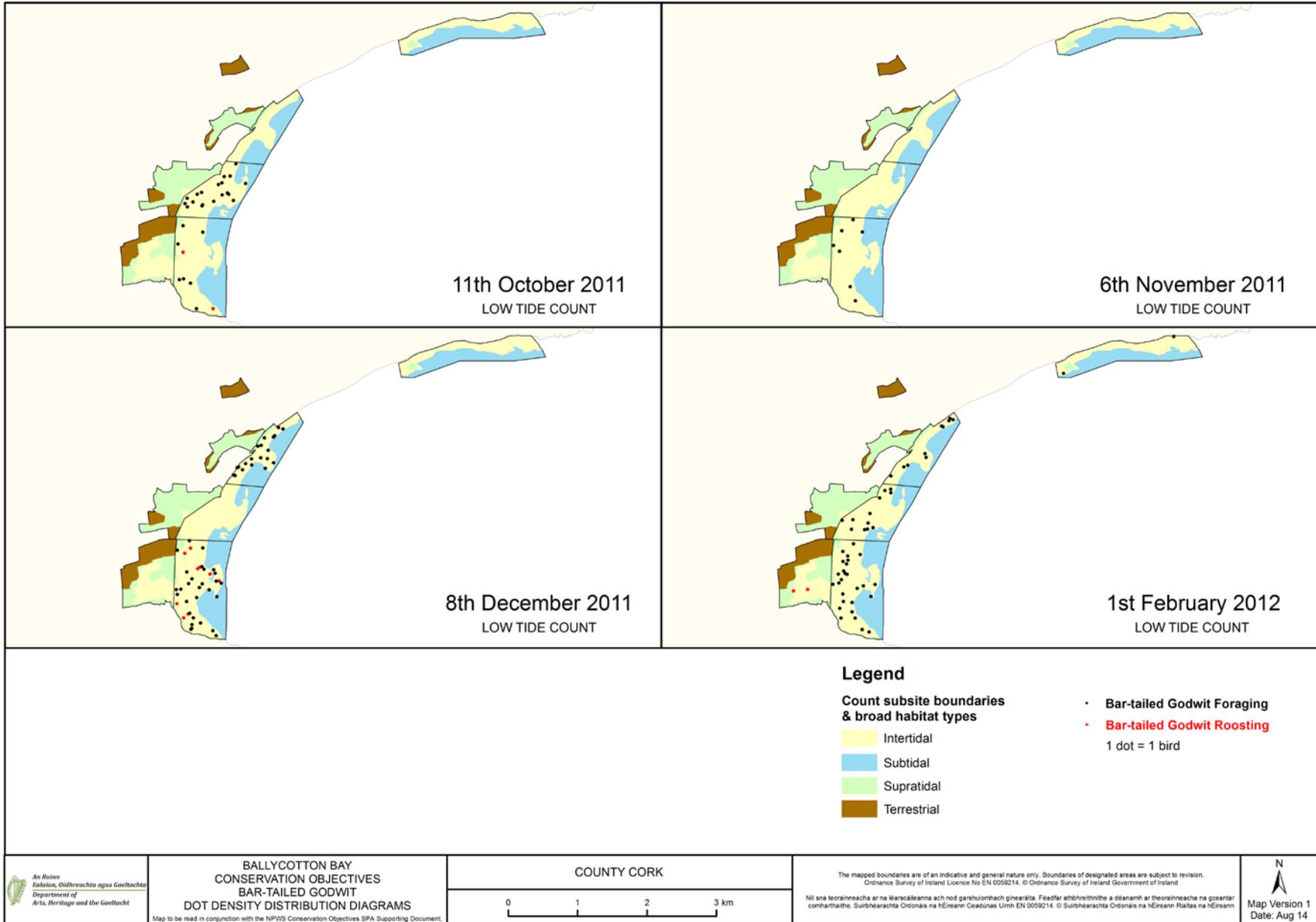


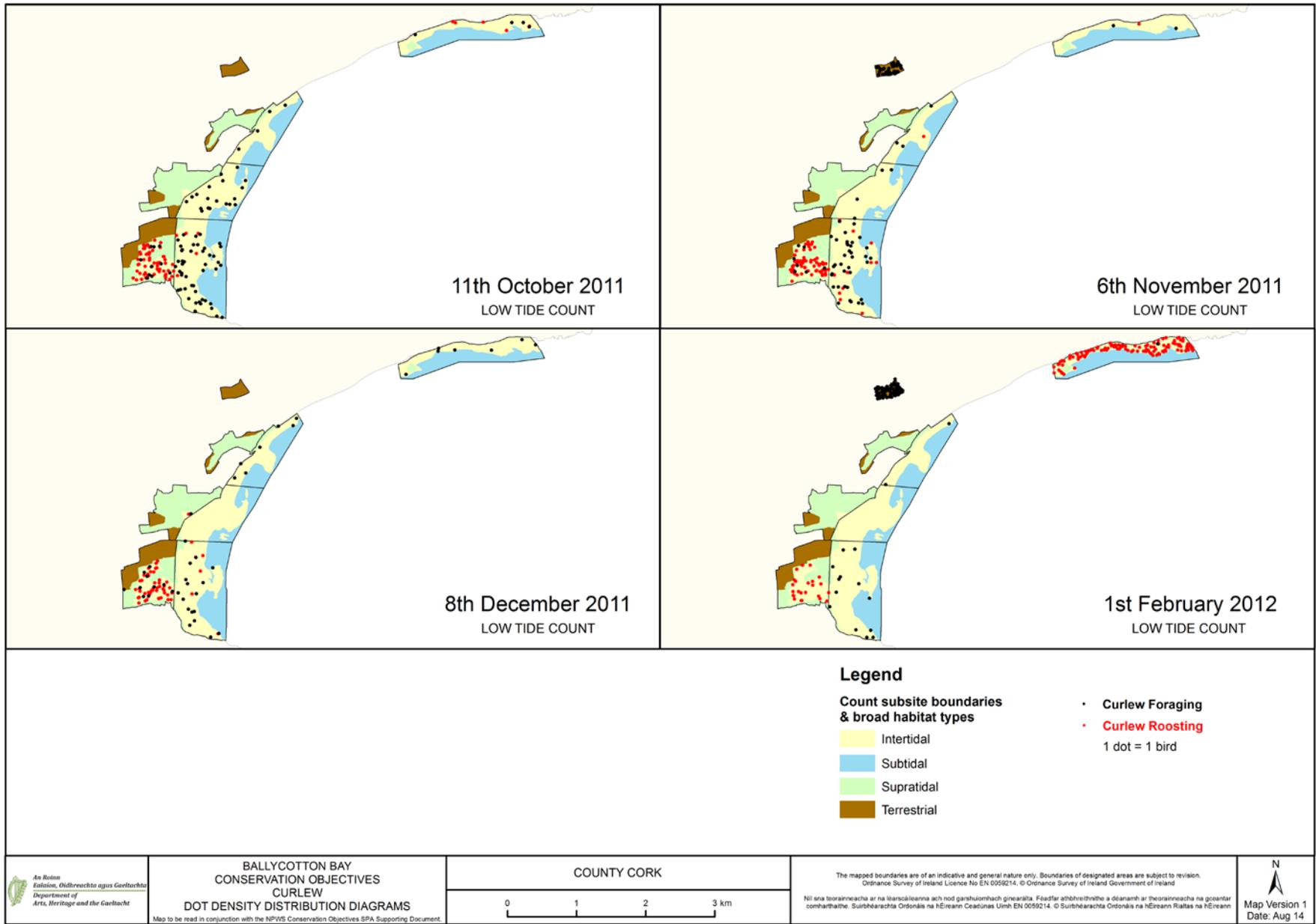
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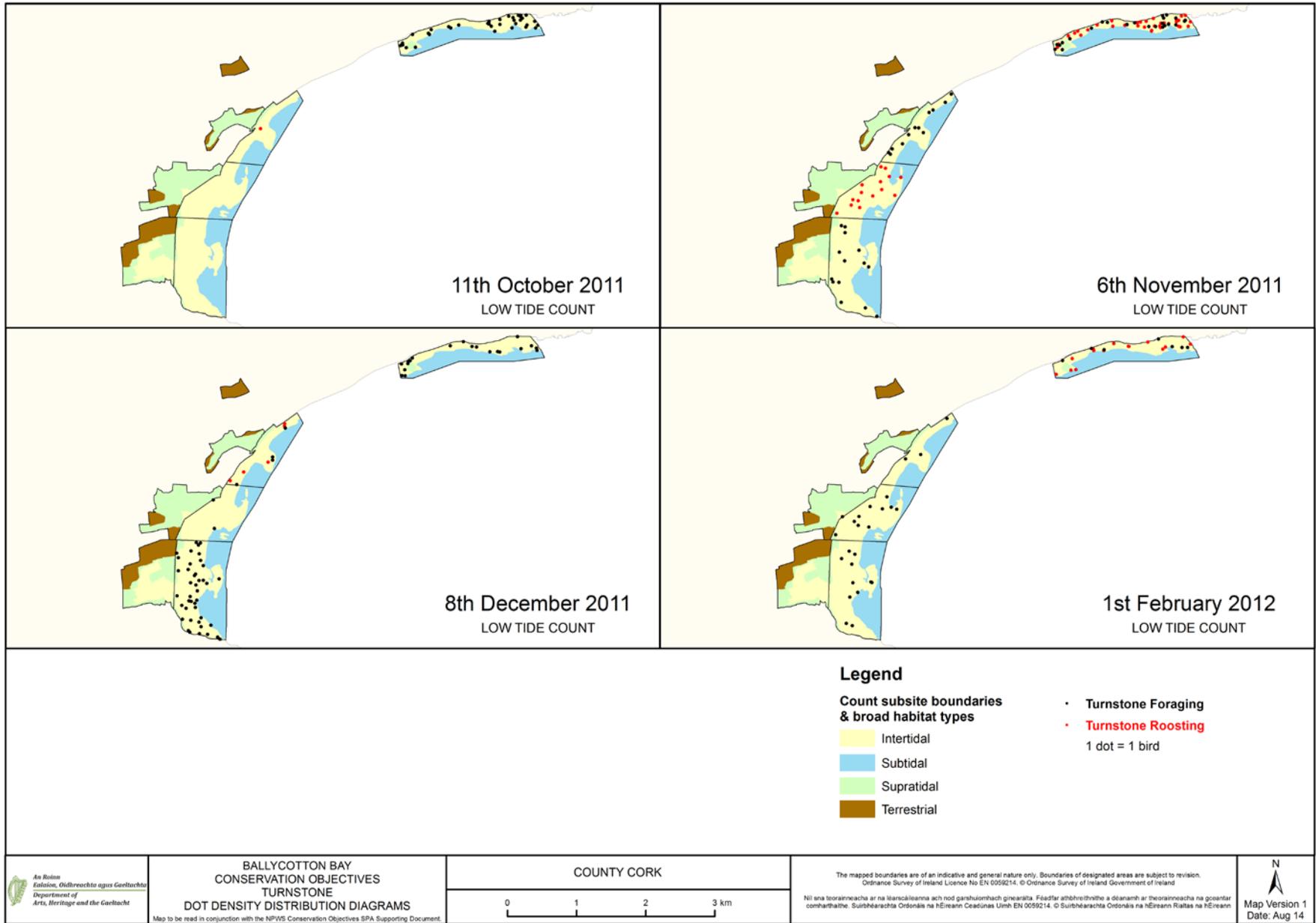
- Count subsite boundaries & broad habitat types**
- Intertidal
 - Subtidal
 - Supratidal
 - Terrestrial
- Lapwing Foraging
 - Lapwing Roosting
 - 1 dot = 1 bird

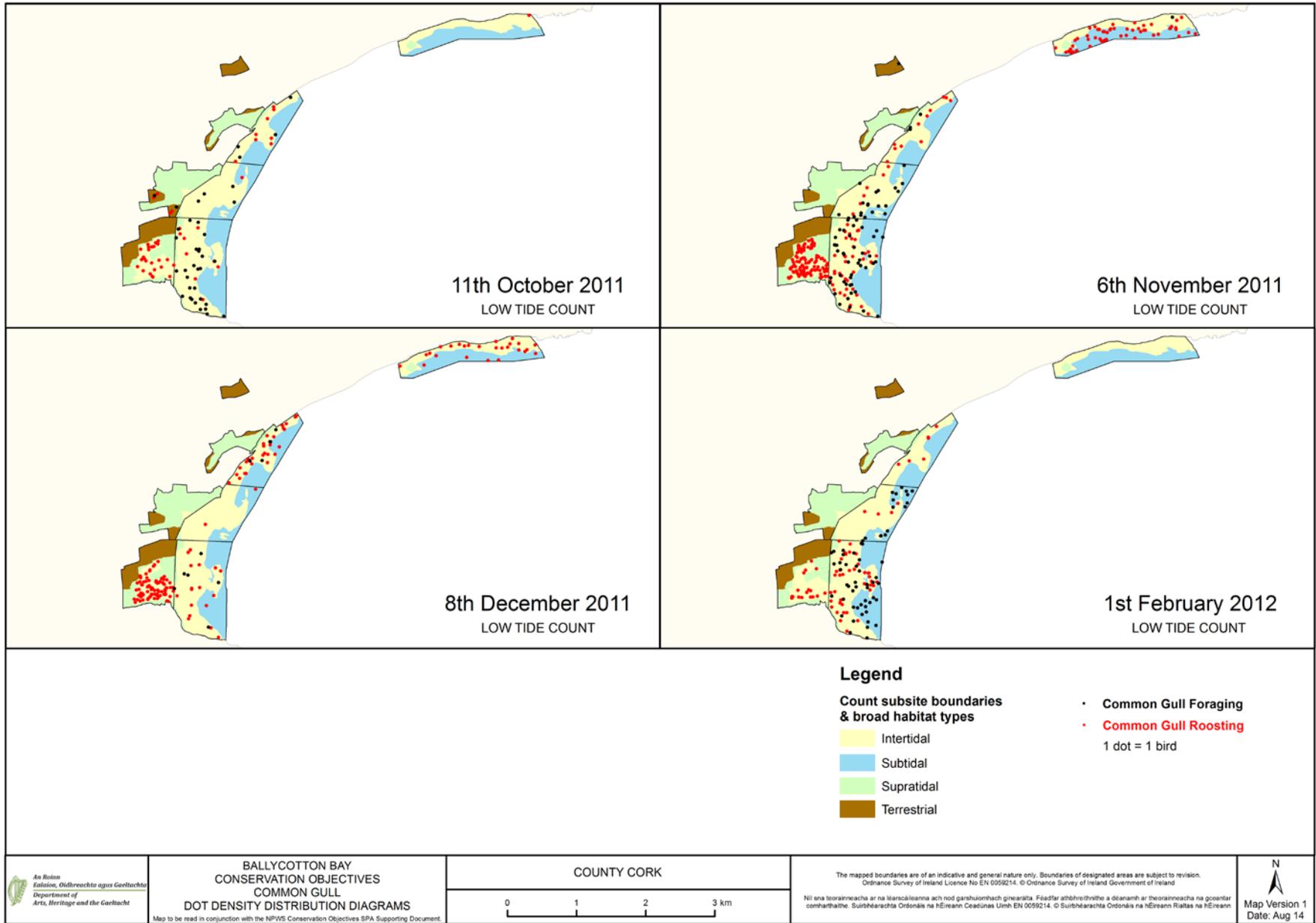
<p><i>An Roinn Eolais, Oidhreacht agus Gaeltachta</i> Department of Arts, Heritage and the Gaeltacht</p>	<p>BALLYCOTTON BAY CONSERVATION OBJECTIVES LAPWING DOT DENSITY DISTRIBUTION DIAGRAMS</p> <p><small>Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.</small></p>	<p>COUNTY CORK</p>	<p>The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Ordnance Survey of Ireland Licence No EN 0059214. © Ordnance Survey of Ireland Government of Ireland</p> <p>Níl sna teorainneacha ar na léarscáilleana ach nod garshuíomhach ginearálta. Feadfar athbheirthe a déanamh ar theorainneacha na gceantar comharthaite. Suirbhéarachtá Ordois na hÉireann Ceadúnas Uimh EN 0059214. © Suirbhéarachtá Ordois na hÉireann Riailas na hÉireann</p>	<p>N</p> <p>Map Version 1 Date: Aug 14</p>
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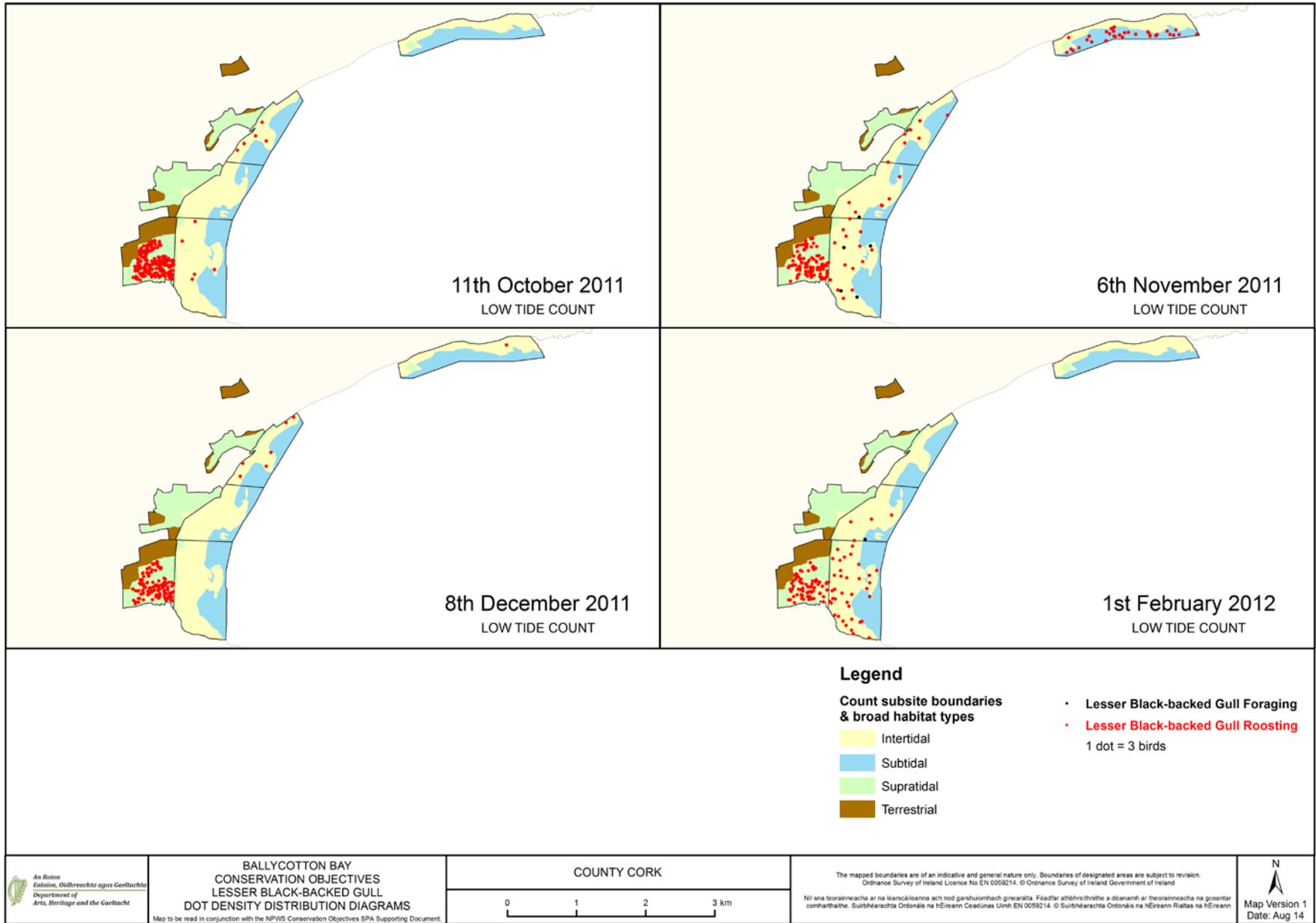












APPENDIX 8

Ballycotton Bay

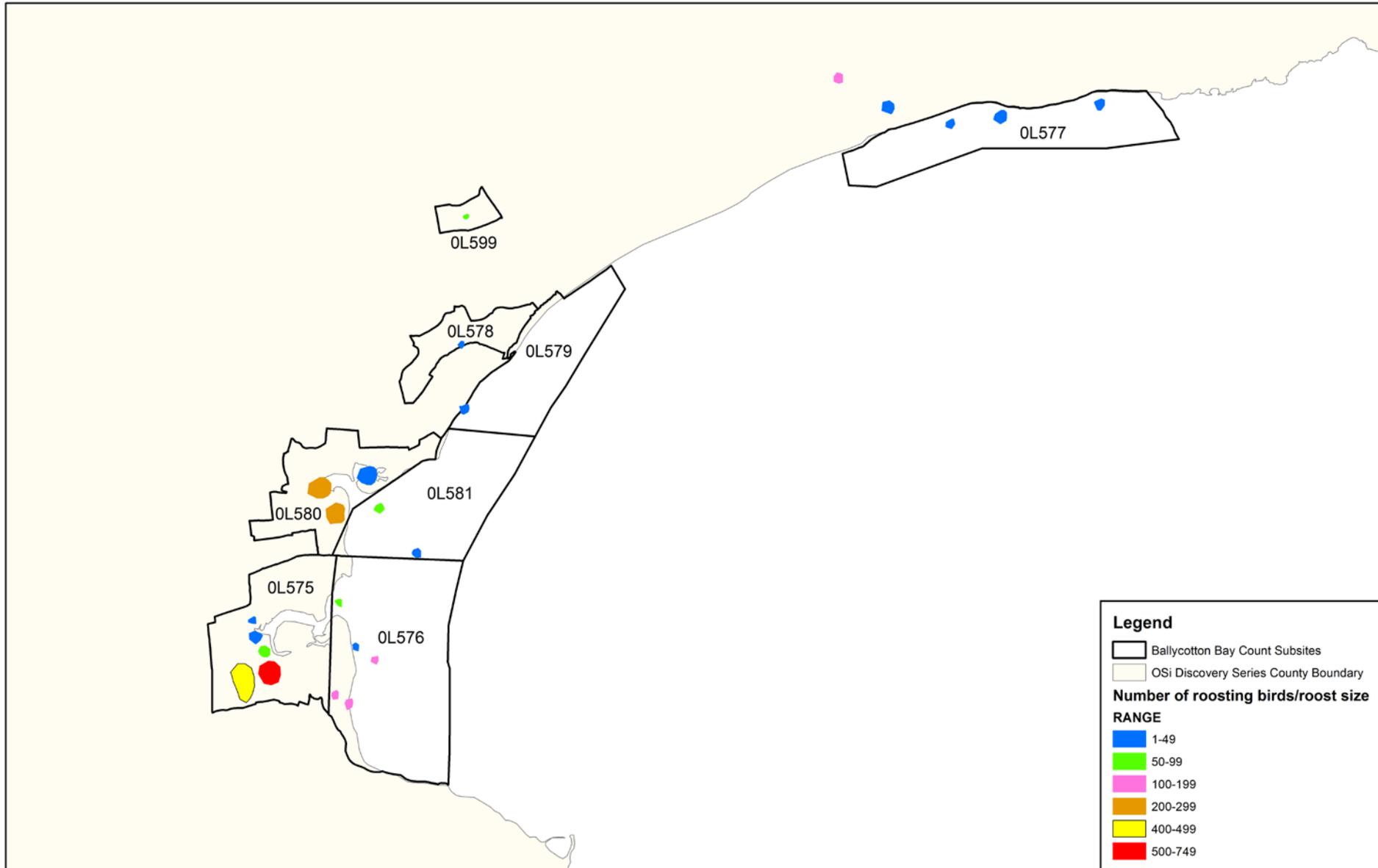
(1a) Summary data and roost location maps from the roost survey 2nd November 2010

(Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations)

Subsite Code	Subsite Name	No. roost locations	No. species	Species
0L575	Ballynamona Lagoon	5	15	BH, BW, CM, CU, ET, GB, H., HG, L., LB, MA, OC, RK, SU, T.
0L576	Ballycotton lower	5	15	BA, BH, CM, CU, ET, GB, H., HG, L., LB, MA, OC, RK, SU, TT
0L577	Knockadoon/Ballymakeagh	5	6	BH, CU, GK, HG, LB, OC
0L578	Ardnahinch	1	1	BH
0L579	Shangarry	1	3	CA, GV, OC
0L580	Ballynamona Marsh	3	9	BH, CU, ET, GK, H., L., RK, SU, T.
0L581	Ballycotton mid	2	4	BH, CM, OC, RP
0L599	Ballylangane Fields	1	2	CU, L.

(1b) Ballycotton Bay SPA (4022) SCI species and recorded roosts 02/11/10 - shows number of roost locations within subsite, and in brackets, the peak number recorded at a single roost location

Subsites	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
Species								
T.	1 (240)					2 (212)		
RP		1 (71)					1 (3)	
GP	<i>not recorded</i>							
GV					1 (3)			
L.	1 (5)					2 (44)		1 (7)
BW	1 (16)	1 (1)						
BA		1 (7)						
CU	1 (68)		1 (1)			1 (5)		1 (72)
TT		1 (2)						
CM	1 (62)	2 (21)					1 (5)	
LB	1 (248)	1 (2)	2 (130)					



Legend

- Ballycotton Bay Count Subsites
- OSi Discovery Series County Boundary

Number of roosting birds/roost size

RANGE

- 1-49
- 50-99
- 100-199
- 200-299
- 400-499
- 500-749

APPENDIX 9

Ballycotton Bay - Activities & Events

Please note that this list is based on the current review process and is not exhaustive.

Legend:	
O	<u>o</u> bserved or known to occur in or around Ballycotton Bay.
U	known to occur but <u>u</u> nknown area (subsites)/spatial extent; hence all potential subsites are included (e.g. fisheries activities).
H	<u>h</u> istoric, known to have occurred in the past.
P	<u>p</u> otential to occur in the future.
	Grey highlighting refers to activities that have the potential to cause disturbance to waterbirds.

Activity/Event	OL575	OL576	OL577	OL578	OL579	OL580	OL581	OL599
1. Coastal protection, sea defences & stabilisation					O			
1.1 Linear defences					O			
1.4 <i>Spartina</i> planting/growing	O			O				
1.6 Other modifications	O	O						
2. Barrage schemes/drainage								
2.2 Altered drainage/river channel				O	H	O		H
2.5 Other				O				
6. Pollution								
6.1 Domestic & urban waste water					O			
6.4 Agricultural & forestry effluents	O	O						
6.7 Solid waste incl. fly-tipping	O	O			O		O	
7. Sediment extraction (marine & terrestrial)								
7.4 Removal of beach materials	H	H	H		H		H	
8. Transport & communications								
8.2 Flight path/aircraft						O		
8.5 Road schemes	O							
8.6 Car parks		O	O		O			
9. Urbanisation								
9.1 Urbanised areas, housing					O			
9.3 Hotel & leisure complex					O			
12. Tourism & recreation								
12.4 Caravan parks & chalets				O	O			
12.7 Jet-skiing		O	O		O			
12.9 Sailboarding & wind-surfing		O			O		O	
12.12 Surfing					O		O	
12.15 Angling		O	O		O		O	

Activity/Event	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
12.17 Bathing & general beach recreation		O	O		O		O	
12.18 Walking, incl. dog walking	O	O	O		O	O	O	
12.19 Birdwatching	O	O	O		O	O	O	
12.21 4WD, trial & quad bikes	O	O	O		O	O	O	
12.22 Motorised vehicles			O		O		O	
12.23 Horse-riding	O	O	O		O	O	O	
13. Wildfowl & hunting								
13.1 Wildfowling	H		H	H		H		H
13.2 Other hunting-related activities	H					H		
14. Bait-collecting								
14.1 Digging for lugworms/ragworms		O	O		O		O	
15. Fisheries & Aquaculture								
15.1 Professional passive fishing (e.g. longlining)		U	U		U		U	
15.4 Fish traps & other fixed devices & nets		U	U		U		U	
15.5 Leisure fishing		U	U		U		U	
15.6 Molluscs - hand-gathering		O	O		O		O	
16. Agriculture & forestry								
16.1 Saltmarsh grazing/harvesting						H		
16.2 Grazing: intensive (terrestrial)	O		O			O		H
16.9 Removal of hedges, scrub			H			H		H
16.10 Mowing/grassland cutting	O					H		H
16.14 In-filling of ditches, ponds, pools, marshes/ pits				H				
16.17 Forest planting on open ground						O		
18. Wildlife habitat management								
18.1 Control of <i>Spartina</i> or other vegetation						H		
19. Natural events								
19.1 Storms, floods and storm surges	O	O		O	O	O	O	

APPENDIX 10

Disturbance Assessment

Scoring system - definitions & rationale

Frequency/Duration	Score	Rationale
Continuous	3	Continuous motion or noise; not necessarily 24-hours per day but zones of fairly continuous activity such as a port or marina.
Frequent	2	Frequently observed during the survey programme, can be up to several times per 6 hour tidal cycle; and/or known to occur on a frequent basis.
Infrequent	1	Observed only once or twice during the survey programme and known/considered likely to be infrequent.
Rare	0	Known to occur but not observed during the survey programme and considered likely to be rare in occurrence.
Intensity	Score	Rationale
Active, high-level	3	Would indicate an active event that is likely to displace waterbirds during its presence e.g. active shipping channel, speed boats, quad bikes, loose dogs.
Medium-level	2	Lower intensity events such as non-powered watercraft, vehicles, people walking along a shoreline (without dogs) – that are likely to result in waterbirds moving but birds will be less 'alarmed' than (1) and response will be species-specific.
Low-level	1	Although activity may be of a nature to displace waterbirds, birds move only slightly, resume normal behaviour quickly or show no determinable response at all; e.g. solitary walkers close to site but not impacting on waterbirds' immediate location; cars passing on an adjacent road...
Very low-level	0	Any activities considered to impart little effect upon waterbirds.
Response	Score	Rationale
Most birds disturbed all of the time	3	Birds do not return - therefore equivalent to habitat loss.
Most birds displaced for short periods	2	Birds return once disturbance has ceased.
Most species tolerate disturbance	1	Weak response, birds may move slightly away from disturbance source.
Most birds successfully habituate to the disturbance	0	Little determinable effects.

The scores assigned to the three attributes were then added together to give an overall 'disturbance score' which is used to define the extent of the impact as follows:-

Scores 0 – 3 = **Low**
 Scores 4 – 6 = **Moderate**
 Scores 7 – 9 = **High**

Scoring system – worked example

Disturbance event – humans walking along a beach; the beach is a popular recreational area and this activity was recorded frequently during surveys.		
Attribute	Score	Rationale
Frequency/Duration	2	Recorded frequently during the survey period; known area of beach recreation.
Intensity	2	Medium level - considered likely to result in waterbirds moving away from the source of disturbance although response will be species-specific and some species may even habituate to the activity.
Response	2	Most birds are displaced for short periods and therefore will resume their previous behaviour in the area when the activity ceases.
TOTAL SCORE	6	MODERATE

Results - based on records from the 2010/11 Waterbird Survey Programme

Activity/Event	0L575	0L576	0L577	0L578	0L579	0L580	0L581	0L599
8. Transport & communications								
8.2 Flight path/aircraft						6		
12. Tourism & recreation								
12.6 Power boating/powered water craft					5		5	
12.9 Sailboarding & wind-surfing		6						
12.18 Walking, incl. dog walking		7	6		7	7	7	
12.23 Horse-riding		5			5		5	
14. Bait-collecting								
14.1 Digging for lugworms/ragworms							3	
15. Fisheries & Aquaculture								
15.6 Molluscs - hand-gathering		3					3	