

**Ballysadare Bay**  
**Special Protection Area**

**(Site Code 4129)**



**Conservation Objectives**  
**Supporting Document**

**VERSION 1**

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## SUMMARY

This document presents conservation objectives for the non-breeding Special Conservation Interests of Ballysadare 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 Ballysadare Bay Special Protection Area, as well as introducing the concept of conservation objectives and their formulation.

Part Two provides site designation information for Ballysadare 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 activities that were recorded to cause disturbance to waterbirds at the site 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 can be any 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 Ballysadare Bay Special Protection Area**

Ballysadare Bay, Co. Sligo is the most southerly of the three bays that comprise the Sligo Bay wetland complex (Crowe, 2005). The bay extends west and north of the town of Ballysadare for approximately 10 km. The estuarine channel of the Ballysadare River winds its way through the bay, finally reaching the open sea near the Strandhill Dunes sand spit. The bay is underlain by sedimentary rocks of limestones, sandstones and shales which are exposed as low cliffs and small sections of bedrock shore at several locations.

The bay contains extensive intertidal sand and mudflats that support good abundances of macroinvertebrates that form an important food source for wintering waterbirds. There are two discrete intertidal seagrass meadows within Ballysadare Bay located within the inlet at Rinnatalleen on the western shore and between Cartronabree and Brughmore on its eastern shore (NPWS, 2013). Saltmarsh is particularly well developed at this site and a notable feature of Ballysadare Bay is that it contains a range of different types of saltmarsh that have developed in different environmental conditions and on different substrates (McCorry & Ryle, 2009). Saltmarsh habitat provides important roosting sites for birds at high tide. Sandy beaches around the Strandhill peninsula are also used by roosting birds.

Ballysadare Bay SPA is of high ornithological importance, supporting a non-breeding population of Light-bellied Brent Goose of international importance, as well as nationally important populations of four other wintering waterbirds and an assemblage of over-wintering waterbirds. The site is also important as the third component of the much larger Sligo Bay complex that also comprises Cumeen Strand and Drumcliff Bay to the north.

The Site Synopsis for Ballysadare 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 network<sup>1</sup>.

Where relevant, conservation objectives are defined for attributes<sup>2</sup> relating to non-breeding 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 Ballysadare Bay Special Protection Area).

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

<sup>2</sup>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 Ballysadare Bay Special Protection Area

The **Special Conservation Interest species**<sup>3</sup> for Ballysadare Bay SPA are listed below and summarised in Table 2.1. This table also shows the importance of Ballysadare Bay SPA and the Sligo Bay wetland complex as a whole, for these SCI species relative to the importance of other sites within Ireland and within the Border region.<sup>4</sup>

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

1. During winter the site regularly supports 1% or more of the biogeographic population of Light-bellied Brent Goose (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 188 individuals.
2. 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 70 individuals.
3. During winter the site regularly supports 1% or more of the all-Ireland population of Dunlin (*Calidris alpina*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 1,420 individuals.
4. During winter the site regularly supports 1% or more of the all-Ireland population of Bar-tailed Godwit (*Limosa lapponica*). The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 251 individuals.
5. During winter the site regularly supports 1% or more of the all-Ireland population of Redshank (*Tringa totanus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 435 individuals.
6. The wetland habitats contained within Ballysadare 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.

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<sup>3</sup> Special Conservation Interest species are listed in taxonomic order.

<sup>4</sup> 'Region' refers to regions as defined by Irish Regions Office and in the case of the Border region takes into account cross-border sites Lough Foyle and Carlingford Lough, as well as Killala Bay/Moy Estuary.

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

Special Conservation Interests	Annex I species	Baseline Population <sup>a</sup>	Population status at baseline	National Importance Rank <sup>1</sup>	Regional Importance Rank <sup>2</sup>
Light-bellied Brent Goose ( <i>Branta bernicla hrota</i> )		188	International importance	21	4
Grey Plover ( <i>Pluvialis squatarola</i> )		70	All-Ireland importance	20	3
Dunlin ( <i>Calidris alpina</i> )		1,420	All-Ireland importance	21	6
Bar-tailed Godwit ( <i>Limosa lapponica</i> )	Yes	251	All-Ireland importance	18	3
Redshank ( <i>Tringa totanus</i> )		435	All-Ireland importance	17	4
Other conservation designations associated with the site <sup>b</sup>	<b>SAC</b>	<b>RAMSAR SITE</b>	<b>IMPORTANT BIRD AREA (IBA)</b>	<b>WILDFOWL SANCTUARY</b>	<b>OTHER</b>
	00622		Yes		pNHA

<sup>a</sup> Baseline data are the 4-year mean peak counts for the period 1995/96 – 1999/00 (I-WeBS) (one season missing data).

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

<sup>1</sup> National importance rank – the number given relates to the importance of the site and the Sligo Bay wetland complex as a whole, for the non-breeding population of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites in Ireland.

<sup>2</sup> Regional importance rank - the number given relates to the importance of the site and the Sligo Bay wetland complex as a whole, for the non-breeding population of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within the Border Region (includes cross-border sites Carlingford Lough and Lough Foyle as well as cross-region site Killala Bay/Moy Estuary).



## PART THREE – CONSERVATION OBJECTIVES FOR BALLYSadARE BAY SPA

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

The overarching Conservation Objective for Ballysadare 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 Ballysadare 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 Ballysadare 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.<sup>5</sup> Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.<sup>6</sup>
- 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.<sup>7</sup>

Factors that can adversely effect 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).

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

<sup>6</sup> Population trend analysis is presented in Section 4.

<sup>7</sup> 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 Ballysadare 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 **2,130 ha**, other than that occurring from natural patterns of variation.

The boundary of Ballysadare 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 Ballysadare Bay SPA this broad category is estimated to be **539 ha**. Subtidal areas are continuously available for benthic and surface feeding ducks and piscivorous/other waterbirds. Various waterbirds roost in subtidal areas.

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 Ballysadare Bay SPA this is estimated to be **1,381 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/loafing<sup>8</sup> 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 Ballysadare Bay SPA this is estimated to be **210 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.

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<sup>8</sup> 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 Ballysadare Bay SPA.**

<b>Objective 1:</b>				
<i>To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Ballysadare Bay SPA, which is defined by the following list of attributes and targets:</i>				
<b>Parameter</b>	<b>Attribute</b>	<b>Measure</b>	<b>Target</b>	<b>Notes</b>
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.
<b>Objective 2:</b>				
<i>To maintain the favourable conservation condition of the wetland habitat at Ballysadare Bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:</i>				
<b>Parameter</b>	<b>Attribute</b>	<b>Measure</b>	<b>Target</b>	<b>Notes</b>
Area	Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,130 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 2,130 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 Ballysadare Bay SPA

Non-breeding waterbirds have been counted at Ballysadare Bay as part of the Irish Wetland Bird Survey (I-WeBS) since 1994/95. The dataset spans the period 1994/95 to 2010/11 and the site was counted at least once in most seasons although a few seasons were not covered at all (1996/97, 2001/02, 2002/03). 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 birds<sup>9</sup>. During I-WeBS the site is divided into various count subsites. Although the SPA area and the I-WeBS count area are similar, they are not coincident.

Table 4.1 presents population<sup>10</sup> data for the non-breeding waterbird SCI species of Ballysadare 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 (four-year mean; data for 1997/98 missing) 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 of all-Ireland or international importance. These thresholds are different for the baseline and recent time periods (refer to Crowe et al. (2008) and Wetlands International (2002) and Wetlands International (2012) for national and international respectively).

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

Site Special Conservation Interests (SCIs)	Baseline Period <sup>1</sup> (1995/96 – 1999/00)	Recent Site Data <sup>2</sup> (2006/07 – 2010/11)
Light-bellied Brent Goose	188 (i)	300 (n)
Grey Plover	70 (n)	0
Dunlin	1420 (n)	1,187 (n)
Bar-tailed Godwit	251 (n)	221 (n)
Redshank	435 (n)	342 (n)

<sup>1</sup>Baseline data is the 4-year mean peak for the period 1995/96 – 1999/00;

<sup>2</sup>recent site data is the mean peak for the 5-year period 2006/07 – 2010/11 (I-WeBS).

(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance; note that thresholds differ for the baseline and recent time periods used (refer to Crowe et al. (2008) and Wetlands International, 2002 and Wetlands International, 2012 for national and international respectively).

<sup>9</sup> 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).

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

## 4.2 Waterbird population trends for Ballysadare 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. A detailed methodology for this trend analysis is provided in Appendix 3. For Ballysadare Bay however, incomplete coverage during I-WeBS precludes the use of this analysis process. Therefore an estimation of population change over time was calculated using the 'generic threshold method' (after JNCC, 2004). This compares population size for two different five-year time periods, the change being expressed as a proportion of the initial population, as follows:

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

where:  $I_y$  = recent population and  $I_x$  = baseline population.

This calculation was undertaken comparing the baseline population with the series of rolling peak means shown in Table 4.2. The results (% change) are shown in Table 4.3.

**Table 4.2 Site Population data for waterbird Special Conservation Interest species of Ballysadare Bay SPA: rolling five-year means**

Data period	Light-bellied Brent Goose	Grey Plover	Dunlin	Bar-tailed Godwit	Redshank
1995/96-1999/00 (baseline)	188 (i)	70 (n)	1,420 (n)	251(n)	435 (n)
2000/01-2004/05*	309 (i)	0	1,067 (n)	102	494 (n)
2003/04-2007/08	279 (i)	0	1,094 (n)	101	452 (n)
2004/05-2008/09	275 (i)	0	1,133 (n)	116	436 (n)
2005/06-2009/10	317 (i)	0	1,213 (n)	166 (n)	385 (n)
2006/07-2010/11	300 (i)	0	1,187 (n)	221 (n)	342 (n)

(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance.

\*all 5-year means except 2000/01 – 2004/05 which is a 3-year mean; data for 2001/02 and 2002/03 missing.

Note that national thresholds differ for the baseline and recent time periods used (refer to Crowe et al. 2008). Different international thresholds also apply; baseline period to 2009/10 (Wetlands International, 2002); and 2006/07–2010/11 (Wetlands International, 2012).

**Table 4.3 Site Population trends – comparison of five-year means**

Data period	Light-bellied Brent Goose	Grey Plover	Dunlin	Bar-tailed Godwit	Redshank
Baseline vs 2000/01-2004/05	+ 65	- 100	- 25	- 59	+ 14
Baseline vs 2003/04-2007/08	+ 45	- 100	- 23	- 60	+ 4
Baseline vs 2004/05-2008/09	+ 47	- 99	- 20	- 54	0
Baseline vs 2005/06-2009/10	+ 69	- 99	- 15	- 34	- 12
Baseline vs 2006/07-2010/11	+ 60	- 99	- 16	- 12	- 21

**Light-bellied Brent Goose** – there has been a consistent trend for increasing numbers at Ballysadare Bay, in line with the national trend where numbers have increased at an annual rate of 5.1% over the period 1994/95 to 2008/09 (Boland & Crowe, 2012).

**Grey Plover** – since the 1999/00 season, Grey Plover have been largely absent from counts; just three individuals recorded in 2008/09.

**Dunlin** – the overall trend for decline is consistent with the national trend and that observed in Britain and Northern Ireland. Mean peak numbers in recent seasons however (2008/09, 2009/10, 2010/11) have been on a par with the baseline mean peak numbers.

**Bar-tailed Godwit** – the long-term dataset shows great variability in numbers between years. Some caution must be applied when interpreting the trend for this species because Bar-tailed Godwits are a relatively mobile wader species and readily move in response to local food conditions; therefore low count coverage in some seasons may have failed to adequately record numbers using the site. Nationally, numbers have remained broadly stable throughout I-WeBS, while a decline has been evident in Britain since the early 2000's with some recovery in recent seasons (Boland & Crowe, 2012; Calbrade et al. 2010).

**Redshank** – mean peak numbers have shown almost progressive decline since the season 2003/04. Nationally, numbers of Redshank have increased since I-WeBS began. This contrasts to Britain and Northern Ireland where numbers of wintering birds have decreased in recent years (Boland & Crowe, 2012; Calbrade et al. 2010).

#### 4.3 Ballysadare Bay SPA – site conservation condition of waterbird SCI species

Conservation condition of SCI species was determined using a species estimated site trend based on the comparison of the baseline peak mean with the most recent peak mean. Conservation condition was 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 five waterbird species of Special Conservation Interest listed for Ballysadare Bay SPA, and based population trend for the site, it has been determined that (Table 4.4):-

1. 1 species is currently considered as **Highly Unfavourable** (Grey Plover);
2. 3 species are currently considered as **Intermediate Unfavourable** (Dunlin, Bar-tailed Godwit & Redshank);
3. 1 species is currently considered as **Favourable** (Light-bellied Brent Goose).

Site conservation condition and population trends were also reviewed in light of species' national and international trends (Table 4.4). National trends were provided by the I-WeBS Office while International trends follow Wetlands International (2012).

**Table 4.4 SCI species of Ballysadare Bay SPA – Current Site Conservation Condition**

Special Conservation Interests	BoCCI Category <sup>a</sup>	Site Population Trend <sup>b</sup>	Site Conservation Condition	Current National Trend <sup>c</sup>	Current International Trend <sup>d</sup>
Light-bellied Brent Goose	Amber	+ 60	Favourable	+ 62.3	Increase
Grey Plover	Amber	- 99	Highly Unfavourable	- 33.1	Decreasing?
Dunlin	Amber	- 16	Intermediate (unfavourable)	- 46.5	Stable ( <i>alpina</i> )
Bar-tailed Godwit	Amber	- 12	Intermediate (unfavourable)	+ 35	Increase
Redshank	Red	- 21	Intermediate (unfavourable)	+ 22.7	Stable/Increasing

<sup>a</sup>After Lynas *et al.* (2007); <sup>b</sup> based on the comparison between baseline and recent mean, Table 4.3; <sup>c</sup>recent national trend is for the 12 year period 1998/99 to 2010/11; <sup>d</sup>international trend after Wetland International (2012).

Table 4.4 also shows the relationship between a species' long-term site trend and the current national trend for the 12-year period 1998/99 to 2010/11). The colour coding used represents the following cases:-

- **Green** – species whose populations are stable or increasing at both site level and national level.
- **Beige** – species whose populations are declining at both site level and national 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 1.0 – 24.9% decline at site level but are stable or increasing at national level.
- **Pink** - species whose populations are exhibiting a 25.0 – 49.9% decline at site level but are stable or increasing at national level.
- **Red** - species whose populations are exhibiting a decline of >50.0% at site level but are stable or increasing at national level.

The pink and red categories highlight where populations are stable at national 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 Ballysadare Bay SPA.

Section 5.2 provides selected ecological summary information for non-breeding waterbirds of Ballysadare 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 Ballysadare 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 March 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 1994/95 – 2010/11 the I-WeBS database shows a total of 54 waterbird species that have been recorded at Ballysadare Bay. These species represent eleven waterbird families: *Gaviidae* (divers), *Podicipedidae* (grebes), *Anatidae* (swans, geese and ducks), *Rallidae* (Water Rail, Moorhen & Coot), *Haematopodidae* (oystercatchers), *Charadriidae* (plovers and lapwings), *Scolopacidae* (sandpipers and allies) and *Laridae* (gulls and terns) plus *Phalacrocoracidae* (Cormorants), *Ardeidae* (Herons) 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 season<sup>11</sup> or species that use the site at certain times only (e.g. as a cold weather refuge).

21 waterbird species that are not listed as SCI species occurred on a regular basis within Ballysadare Bay during the I-WeBS period 1994/95 – 2009/10.<sup>12</sup> These are listed in Table 5.1.

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<sup>11</sup> Non-breeding season is defined as September – March inclusive.

<sup>12</sup> Regular is defined as a species that has occurred in 12 out of the 15-year data period (three seasons missing data).



**Table 5.1 Regularly-occurring non SCI waterbird species that occur at Ballysadare Bay during the non-breeding season**

Species	Baseline Data Period <sup>1</sup> (1995/96 – 1999/00)	Recent Site Average <sup>2</sup> (2005/06 – 2009/10)
Mute Swan ( <i>Cygnus olor</i> )	14	7
Shelduck ( <i>Tadorna tadorna</i> )	55	20
Wigeon ( <i>Anas penelope</i> )	617	298
Teal ( <i>Anas crecca</i> )	179	126
Mallard ( <i>Anas platyrhynchos</i> )	304	188
Red-breasted Merganser ( <i>Mergus serrator</i> )	26	39 (n)
Great Northern Diver ( <i>Gavia immer</i> )	5	10
Cormorant ( <i>Phalacrocorax carbo</i> )	43	35
Grey Heron ( <i>Ardea cinerea</i> )	16	11
Oystercatcher ( <i>Haematopus ostralegus</i> )	518	397
Ringed Plover ( <i>Charadrius hiaticula</i> )	96	139
Lapwing ( <i>Vanellus vanellus</i> )	467	169
Sanderling ( <i>Calidris alba</i> )	10	183 (n)
Snipe ( <i>Gallinago gallinago</i> )	5	5
Curlew ( <i>Numenius arquata</i> )	508	403
Greenshank ( <i>Tringa nebularia</i> )	22	35 (n)
Turnstone ( <i>Arenaria interpres</i> )	40	48
Black-headed Gull ( <i>Chroicocephalus ridibundus</i> )	261	55
Common Gull ( <i>Larus canus</i> )	203	201
Herring Gull ( <i>Larus argentatus</i> )	51	49
Great Black-backed Gull ( <i>Larus marinus</i> )	14	13

Grey shading denotes an Annex I species; (n) = numbers of all-Ireland importance (thresholds after Crowe et al. (2008).

<sup>1</sup> Baseline data is the 4-year mean peak for the period 1995/96 – 1999/00 (I-WeBS); <sup>2</sup> recent mean is for the 5-year period 2006/07 – 2010/11 (I-WeBS).

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 Ballysadare Bay SPA. Information is provided for the following categories<sup>13</sup>:-

- 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).

<sup>13</sup> 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 (*Anser albifrons flavirostris*) or Bewick's Swan (*Cygnus columbianus bewickii*) 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 <sup>A</sup>	Trophic Guild <sup>B</sup>	Food/Prey Requirements <sup>C</sup>	Principal supporting habitat within site <sup>D</sup>	Ability to utilise other/alternative habitats <sup>E</sup>	Site Fidelity <sup>F</sup>
Light-bellied Brent Goose <i>Branta bernicla hrota</i>	Anatidae (geese)	Localised	1, 5	Highly specialised	Intertidal mud and sand flats, <i>Zostera</i> beds	2	High
Grey Plover <i>Pluvialis squatarola</i>	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Dunlin <i>Calidris alpina</i>	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	3	High
Bar-tailed Godwit <i>Limosa lapponica</i>	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	Moderate
Redshank <i>Tringa totanus</i>	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate

<sup>A</sup> 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).

<sup>B</sup> 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.

<sup>C</sup> 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).

<sup>D</sup> Principal supporting habitat present within Ballysadare Bay.

<sup>E</sup> 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.

<sup>F</sup> 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.

Ballysadare Bay forms part of the larger Sligo Bay complex that comprises Cummeen Strand (sometimes called Sligo Harbour) with Drumcliff Bay to the north, and Ballysadare Bay to the south. Waterbirds are thought to range across these sites collectively, so Cummeen Strand and Drumcliff Bay were surveyed on the same day and Ballysadare Bay was surveyed, where possible, on the next day.

At Ballysadare Bay, a standard survey programme of four low tide counts (October and November 2010, January and February 2011) and two high tide counts (January and February 2011)<sup>14</sup> were undertaken. Note that the planned December 2010 low tide count was rescheduled for January 2011 due to bad weather conditions (e.g. Met Eireann, 2010).

Waterbirds were counted within a series of 10 count subsites (map given in Appendix 6). It should be noted that the count boundaries and SPA boundaries are not coincident therefore from here on the site referred to as Ballysadare Bay relates to the count area rather than the SPA area.

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 1<sup>st</sup> December 2010. During this survey waterbird roost sites were located, species and numbers of waterbirds counted and the position of roosts marked onto field maps.

<sup>14</sup> Low tide counts on 22/10/10, 23/11/10, 08/01/11 and 07/02/11 plus high tide counts on 28/01/11 and 10/02/11.

### 5.3.2 Waterbird data, analyses and presentation

The aim of data analyses was to understand how waterbirds are distributed across the site of Ballysadare 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:

- 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 single 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).

Intertidal foraging density was calculated for selected species and 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 or subtidal habitat<sup>15</sup> 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.

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<sup>15</sup> Note that birds within supratidal or terrestrial habitat are not included within these maps.

## Notes on data interpretation and methodological limitations

Waterbirds are thought to range across the three component sites of Sligo Bay (Cummeen Strand, Drumcliff Bay and Ballysadare Bay) although the extent to which they do this is largely unknown. Every effort was made to record bird movements during surveys and the two adjoining sites, Cummeen Strand and Drumcliff Bay were surveyed on the same day. However, these features and the possibility of bird movements and double-counting etc should be borne in mind when examining count data.

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

Light-bellied Brent Goose, Dunlin and Redshank were recorded within all counts of the main survey programme. Grey Plover were recorded in low numbers on one occasion only. Numbers of Bar-tailed Godwit were variable and they were not recorded in the bay on 22/10/10 although 85 and 143 individuals respectively were counted a day earlier at Drumcliff Bay and Cummeen Strand.

Table 5.4 shows peak numbers (whole site) for SCI species recorded during the low tide (LT) and high tide (HT) surveys at Ballysadare Bay.

Average subsite occupancy is the average proportion of subsites in which a species occurred during low tide counts. One exception in Table 5.4 is for Grey Plover where the peak is shown because this wader was recorded in one low tide count only. Redshank and Light-bellied Brent Goose were the most widespread species, occurring on average, in over 50% of subsites. All other species occurred on average in less than half of the subsites and Grey Plover, recorded on one occasion only, was recorded in two (20%) 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. The highest average percentage area occupancy was recorded for Redshank (93%); Light-bellied Brent Goose the second highest with 72%. Dunlin also occurred, on average, in over half of the survey area.

**Table 5.4 Ballysadare Bay 2010/2011 waterbird surveys – summary data**

Site Special Conservation Interests (SCIs)	Peak number - LT surveys <sup>i</sup>	Peak number - HT surveys <sup>i</sup>	Average subsite % occupancy <sup>iii</sup>	Average % area occupancy <sup>iii</sup>
Light-bellied Brent Goose	460 (i)	635 (i)	65 (19)	72 (32)
Grey Plover	3	-	20*	15*
Dunlin	2,961 (n)	1,472 (n)	48 (21)	55 (22)
Bar-tailed Godwit	348 (n)	316 (n)	37 (6)	44 (14)
Redshank	891 (n)	338 (n)	85 (10)	93 (10)

(i) denotes numbers of international importance (after Wetlands International, 2012); (n) denotes numbers of all-Ireland importance (1% thresholds; 1999/00 – 2003/04 Crowe et al. 2008); <sup>i</sup> 4 low-tide counts undertaken on 22/10/10, 23/11/10, 08/01/11 & 07/02/11; <sup>ii</sup> High-tide counts undertaken on 28/01/11 and 10/02/11; <sup>iii</sup> Mean ( $\pm$  s.d.) averaged across four low tide surveys except Bar-tailed Godwit that was averaged across three counts, and Grey Plover\* that relates to the peak subsite occupancy as it was recorded in one low tide count only.

Whole site species richness (total number of species) ranged from 29 species (07/02/11) to a maximum 35 species (08/01/11). 32 species were recorded during both high tide surveys.

Low tide average subsite species richness ranged from two (0C452 Strandhill) to an average 20 species (0C472 (Streamstown) and 0C473 (Tanrego)). All but one subsite supported on average ten or more species during low tide surveys; this proportion matched during high tide surveys. 0C473 (Tanrego) supported the greatest number of species during both high tide surveys.

**Table 5.5 Subsite species richness**

Subsite Code	Subsite name	Mean ( $\pm$ S.D) LT Survey	HT Survey (1/2)	Peak Overall (H/L)
0C451	Marleys Point	11 (5)	12/8	15 (L)
0C452	Strandhill	2 (2)	3/0	5 (L)
0C453	Culleanmore Strand	11 (2)	13/13	13 (L/H)
0C454	Woodpark – Kellystown	14 (3)	12/15	18 (L)
0C471	The Inishes	15 (2)	16/15	16 (L/H)
0C472	Streamstown	20 (3)	20/20	24 (L)
0C473	Tanrego	20 (2)	21/24	24 (H)
0C474	Ballinlig	15 (3)	19/20	20 (H)
0C475	Portavaud	18 (2)	16/13	21 (L)
0C486	Ballysadare Quarry	15 (1)	11/15	15 (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). When 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, intertidal and subtidal habitat 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 Ballysadare Bay. Waterbird distribution dot-density maps are provided in Appendix 7; summary roost data are presented in Appendix 8.



**Table 5.6 (a) Ballysadare 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).

Species ▶	PB	GV	DN	BA	RK
<b>Subsites</b>					
0C451	V	H		V	M
0C452	M				
0C453	M				L
0C454	V		L	V	M
0C471	V		V	V	V
0C472	H		V	M	H
0C473	H		H	L	H
0C474	M		L		L
0C475	V	V	H		M
0C486			H		H

**Table 5.6 (b) Ballysadare Bay Subsite assessment – ranked total numbers HT Surveys (across all habitats) - highest rank from either high tide survey**

Species ▶	PB	GV	DN	BA	RK
<b>Subsites</b>					
0C451	2	<i>not recorded</i>		1	5
0C452	8				
0C453	2				8
0C454	1				6
0C471	4		1	1	1
0C472	5		1	3	1
0C473	3		4	3	3
0C474	1			2	4
0C475	7				5
0C486			3		2

**Table 5.6 (c) Ballysadare Bay Subsite assessment – total numbers foraging intertidally<sup>I</sup> and subtidally<sup>II</sup>** (L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods)

Species ▶	PB <sup>I</sup>	PB <sup>II</sup>	GV	DN	BA	RK
<b>Subsites</b>						
0C451	V	V	H			M
0C452	M					
0C453		H				L
0C454		M		L	V	H
0C471	V			V	H	V
0C472	H			V	M	V
0C473	V	V		M	L	H
0C474	L	M		M		M
0C475	V	V	V	H		M
0C486				H		H

**Table 5.6 (d) Ballysadare Bay Subsite assessment – ranked peak intertidal foraging density for selected species - LT surveys**

Species ▶	PB	DN	BA	RK
<b>Subsites</b>				
0C451	3		4	8
0C452	6			
0C453				9
0C454		7	1	3
0C471	2	2	2	2
0C472	4	4	3	4
0C473	5	5	5	7
0C474	7	6		5
0C475	1	3		6
0C486		1		1

**Table 5.6 (e) Ballysadare Bay Subsite assessment – total numbers (roosting/other behaviour) during LT surveys (Intertidal<sup>I</sup>, Subtidal<sup>II</sup>)** L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods)

Species ▶	PB <sup>I</sup>	PB <sup>II</sup>	GV <sup>I</sup>	DN <sup>I</sup>	BA <sup>I</sup>	RK <sup>I</sup>
<b>Subsites</b>						
0C451			<i>not recorded</i>			H
0C452						
0C453	H					
0C454						
0C471	V				V	V
0C472						
0C473	V	V			V	V
0C474	V	V			H	H
0C475		H				
0C486						M

**Table 5.6 (f) Ballysadare Bay Subsite assessment – ranked total numbers (roosting/other behaviour) during HT surveys (Intertidal<sup>I</sup>, Subtidal<sup>II</sup>) - highest rank from either high tide survey**

Species ▶	PB <sup>I</sup>	PB <sup>II</sup>	GV <sup>I</sup>	DN <sup>I</sup>	BA <sup>I</sup>	RK <sup>I</sup>	
<b>Subsites</b>							
0C451			<i>not recorded</i>		1	3	
0C452							
0C453							
0C454		1				2	
0C471	1	1			1	1	2
0C472		4					
0C473		2			2	3	1
0C474						2	4
0C475	1						3
0C486							2

## **Ballysadare 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 NPWS (2013) and ASU (2011).

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

### Light-bellied Brent Goose *Branta bernicla hrota* - Family (group): Anatidae (geese)

Migratory Light-bellied Brent Geese (hereafter called 'Brent Geese') that spend winter within Ireland belong to the East Canadian High Arctic population. Almost all of this population spends winter within Ireland.

Brent Geese begin to arrive in Ireland in late August when almost three-quarters of the biogeographic population congregate at Strangford Lough in Northern Ireland before dispersing to other sites (Robinson et al. 2004).

#### Numbers

Low tide numbers of Brent Geese at Ballysadare Bay ranged from 39 individuals (08/01/11) to a peak of 460 (23/11/10). The high tide surveys recorded 389 and 635 Brent Geese respectively for 28/01/11 and 10/02/11.

Brent Geese were recorded in nine subsites across the survey period, all except the inner subsite 0C486. Seven subsites recorded the species in three or more low tide surveys (0C451, 0C453, 0C471, 0C472, 0C473, 0C474 and 0C475). 0C474 and 0C475 supported individuals in all four survey plus the two high tide surveys.

Peak numbers were held by 0C475, 0C471, 0C451 and 0C454 for the four low tide surveys respectively. The subsite peak count of 175 Brent Geese was recorded for 0C471 (The Inishes) on 23/11/10.

#### Foraging Distribution

Brent Geese are grazers and are known for their preference for foraging in intertidal areas with the Eelgrass *Zostera* sp. (Robinson et al. 2004). Where this food source is absent or becomes depleted, the birds feed upon algae species, saltmarsh plants and may also undertake terrestrial grazing. There are two discrete intertidal seagrass meadows within Ballysadare Bay located within the inlet at Rinnatalleen on the western shore and between Cartronabree and Brughmore on its eastern shore (NPWS, 2013).

Most low tide surveys recorded a greater proportion of Brent Geese foraging intertidally with the exception of 23/11/10 when a greater number foraged subtidally. Intertidal foraging was recorded most regularly (more than once) in four subsites: 0C471 (The Inishes), 0C472 (Streamstown), 0C473 (Tanrego) and 0C475 (Portavaud).

Peak numbers were held by 0C475 (Portavaud) on 22/10/10 & 07/02/11; relatively large numbers (108) on 22/10/10 foraging near Portavaud Point in habitat best described as a mixed sediment shore that supports various seaweeds. Peak numbers were also supported by 0C471 (The Inishes) (23/11/10), 0C451 (Marleys Point) (08/01/11) and 0C472 (Tanrego) (jointly on 07/02/11).

0C471 (The Inishes) supports an extensive seagrass bed between Cartronabree and Brughmore; the community is dominated by *Zostera noltii*. Almost half of the Brent Geese foraging within this subsite on 23/11/10 were positioned within the areas of *Zostera*. Brent geese also foraged in seagrass areas of this subsite in October 2010 (44 individuals). 0C472 (Tanrego) which supported peak numbers of foraging geese on 07/02/11 supports the second area of seagrass within the bay.

Subtidal foraging was irregularly recorded with the exception of 23/11/10 when 226 foraged across five subsites, the majority (77%) within 0C475 (Portavaud).

Terrestrial foraging was recorded in areas adjacent to the SPA and this is likely to occur regularly. On 07/02/11, 153 Brent foraged adjacent 0C454; a further nine foraged adjacent to 0C474. Largest numbers foraged terrestrially during the February high tide count when 207 Brent were recorded adjacent to four subsites: 0C454 (Woodpark – Kellystown), 0C472 (Streamstown), 0C473 (Tanrego) and 0C474 (Ballinlig).

The peak intertidal foraging density was 1 Brent Goose ha<sup>-1</sup> recorded for 0C475 (Portavaud) on 22/10/10. The second highest peak density recorded was 0.7 individuals ha<sup>-1</sup> (0C471 The Inishes). The whole site average intertidal foraging density was 0.2 Brent Goose ha<sup>-1</sup>.

#### Roosting Distribution

Relatively little roosting/other behaviour was recorded during low tide surveys. Low numbers roosted/other irregularly in intertidal habitat of five subsites: 0C453, 0C472, 0C473, 0C474 and 0C475; and subtidally in three subsites: 0C473, 0C474 and 0C475.

Most individuals foraged during the January 2011 high tide survey (mostly subtidally). 219 Brent Geese roosted subtidally in four subsites during the February 2011 high tide survey (0C454, 0C471, 0C472 and 0C473); the greatest proportions within 0C454 and 0C471 that held 81 and 76 individuals respectively.

The roost survey on 01/12/10 recorded three roosts; two in 0C471 (The Inishes) and one in 0C475 (Portavaud). The largest single roost was 72 individuals that roosted subtidally within 0C471 (The Inishes), just west of the mapped extent of the seagrass bed. A further 20 individuals roosted subtidally a little further north and again, close to the seagrass bed that extends from Cartronabree and Brughmore. 36 individuals were also recorded in 0C475; these birds were observed foraging and roosting/other subtidally in the north eastern corner of the subsite.

### 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

Grey Plovers were largely absent during the survey programme at Ballysadare Bay. Three individuals were recorded on 08/01/11; one in 0C451 (Marley's Point) and two in 0C475 (Portavaud).

Grey Plovers were also absent from the October 2010 low tide count at Cummeen Strand and low tide numbers peaked there on 02/02/11 (ten individuals). Although this wader was recorded in all surveys undertaken at Drumcliff Bay, numbers were low and peaked with 29 individuals on 22/11/10; all other surveys recording ten individuals or less.

#### 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).

The three individuals recorded on 08/01/11 (one in 0C451 (Marley's Point) and two in 0C475 (Portavaud) were foraging intertidally.

#### Roosting Distribution

No roosting individuals were recorded during either the main programme of surveys or the roost survey on 01/12/10.

### Dunlin *Calidris alpina* - Family (group): Scolopacidae (wading birds)

The Dunlin is a Holarctic and highly migratory wader, breeding widely in Arctic zones across Europe, Asia and North America. The nominate form *alpina* breeds from northern Scandinavia eastwards across European Russia and western Siberia to 85° E (Delaney et al. 2009). This race migrates southwest to winter along the coasts of Western Europe, south to Iberia, western Mediterranean and beyond.

The majority of Dunlin wintering in Ireland are *C. a. alpina* that originate from the western part of their breeding range and moult mainly in the Wadden Sea before starting to arrive in Ireland during October (Crowe, 2005). Ireland has a small and declining breeding population of *Calidris alpina schinzii* which are believed to winter mainly in west Africa (Delaney et al. 2009).

#### Numbers

Dunlin were present in every count and low tide numbers peaked at 2,961 (23/11/10); exceeding the threshold of all-Ireland importance. The high tide surveys recorded 1,472 and 698 Dunlin respectively for 28/01/11 and 10/02/11. Numbers in Ballysadare Bay far exceeded those recorded in either Cummeen Strand or Drumcliff Bay.

Dunlin were recorded in seven subsites overall (0C454, 0C471, 0C472, 0C473, 0C474, 0C475 and 0C486). 0C471 (The Inishes), 0C472 (Streamstown) and 0C486 (Ballysadare Quarry) recorded Dunlin in all surveys completed.

0C471 (The Inishes) held peak numbers on 22/10/10, 23/11/10 and 07/02/11 while 0C472 (Streamstown) held peak numbers on 08/01/11. The subsite peak count of 1,845 Dunlin was recorded for 0C471 (The Inishes) on 23/11/10. This exceeds the threshold of all-Ireland importance.

#### Foraging Distribution

The Dunlin diet is relatively wide and although this versatile species often shows a preference for muddier areas within sites (e.g. Hill et al. 1993; Santos et al. 2005), their distribution can often be widespread with no clear patterns.

Between 85% and 100% of Dunlins counted during low tide surveys were foraging and seven subsites were used overall. 0C471 (The Inishes) held peak numbers on 22/10/10, 23/11/10 and 07/02/11. On 22/10/10, 380 Dunlin foraged in two flocks north and south of the channel in the south east of the subsite (south of Inishmore). This area is classified as 'muddy sand to sand with *Hediste diversicolor*, *Corophium volutator*, and *Peringia (Hydrobia) ulvae* community complex (NPWS, 2013). The foraging Dunlin were similarly positioned in the November low tide survey. In contrast the low tide survey on 07/02/11 recorded all foraging Dunlin (800) in the north of the subsite; the sediment community here is also classified as above.

0C472 (Streamstown) held peak numbers on 08/01/11. These birds foraged mainly in flocks in the south of the subsite; the broad sediment community again classified as 'muddy sand to sand with *Hediste diversicolor*, *Corophium volutator*, and *Peringia (Hydrobia) ulvae* community complex (NPWS, 2013). One flock comprising 380 individuals was observed briefly in 0C473; this subsite is classified as the intertidal broad habitat 'intertidal sand with *Angulus tenuis*' and distinguished by the bivalve *Angulus tenuis* and the polychaetes *Nephtys cirrosa* and *Pygospio elegans*.

Good numbers were held by 0C475 (Portavaud) on two occasions, maximum number 494 foraging individuals. This subsite has a sandier substrate and is classified as 'intertidal sand with *Angulus tenuis*' but this again grades to muddier sediment in the innermost reaches.

0C486 (Ballysadare Quarry) held good numbers regularly (maximum number 519). This upper estuarine subsite is again classified as 'muddy sand to sand with *Hediste diversicolor*, *Corophium volutator*, and *Peringia (Hydrobia) ulvae* community complex (NPWS, 2013).

The peak intertidal foraging density was 8 Dunlin ha<sup>-1</sup> recorded for 0C486 (Ballysadare Quarry) on 23/11/10. The second highest peak density was 7 individuals ha<sup>-1</sup> recorded for 0C471 (The Inishes) on the same date. 0C475 (Portavaud) recorded a peak density of 6 individuals ha<sup>-1</sup>. The whole site average intertidal foraging density was 1.0 Dunlin ha<sup>-1</sup>.

#### Roosting Distribution

Roosting/other behaviour was rarely recorded during low tide surveys with the exception of 220 Dunlin that roosted intertidally in 0C473 (Tanrego) on 07/02/11.

110 Dunlin roosted intertidally in 0C471 (The Inishes) during the high tide survey on 10/02/11. A further 563 roosted supratidally in 0C472 (Streamstown).

Dunlin were recorded roosting across six subsites during the high tide roost survey on 01/12/10 (0C451, 0C471, 0C472, 0C473, 0C474 and 0C486). The single largest roost (450 birds) was recorded in 0C471 (The Inishes); these birds part of a larger mixed species roost on the southern tip of the Inishmore Point. Other large roosts were positioned on rocks (visible on OS 6" maps) at Carrigenfadda (200 individuals), Carrigeengare (200 individuals) and along the northern tip of Inishmore Point (300 individuals).

All other subsites held substantially smaller roosts; the largest being 49 individuals along the western shore of 0C451.

### 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 across the higher latitudes of Northern Europe, Russia and Siberia and west 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

No Bar-tailed Godwits were recorded in the bay on 22/10/10 but the species was present in all other counts. Low tide numbers peaked on 08/01/11 (348) and high tide numbers peaked on 10/02/11 (316).

Overall, numbers varied between the three Sligo Bay sites during the survey programme with no evident patterns and it is highly likely that this species ranges across the three sites.

At Ballysadare Bay, Bar-tailed Godwits were recorded in six subsites overall (0C451, 0C454, 0C471, 0C472, 0C473 & 0C474) and most regularly (3 low tide surveys) in just two: 0C454 (Woodpark - Kellystown) and 0C471 (The Inishes).

Peak numbers were recorded for 0C451, 0C454, 0C471, and the subsite peak count was 146 Bar-tailed Godwits recorded for 0C471 (The Inishes) on 08/01/11.

#### 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. The species is characteristic of sites with sandy substrates (e.g. Hill et al. 1993; Summers et al. 2002).

Bar-tailed Godwits were recorded foraging within five subsites overall (0C451, 0C454, 0C471, 0C472 & 0C473) but most regularly (3 low tide surveys) within just two: 0C454 (Woodpark - Kellystown) and 0C471 (The Inishes).

0C454 (Woodpark - Kellystown) held peak numbers on two occasions (maximum number 142). 0C451 (Marleys Point) held peak numbers on one occasion but this was just five individuals (total nine recorded on that date).

0C454 lies along the northern shore of Ballysadare Bay and is classified as the intertidal broad habitat 'intertidal sand with *Angulus tenuis*'. The sediment within this complex is sand, with the fine sand fraction ranging from 24.4% to 90.94% and medium sand from 2.2% to 70.6% (NPWS, 2013). This community complex is distinguished by the bivalve *Angulus tenuis* and the polychaetes *Nephtys cirrosa* and *Pygospio elegans*. *A. tenuis* is recorded throughout the complex and occurs in its highest densities on the eastern shore from Kellystown to the Culleenamore Strand, an area that encompasses subsite 0C454. The habitats in 0C454 were assigned the marine biotope LS.LSa.FiSa.Po.Aten (polychaetes in littoral fine sand) by ASU (2011).

Both 0C471 (The Inishes) and 0C472 (Streamstown) held good numbers on at least one occasion; numbers peaking at 66 and 57 respectively during the low tide survey on 08/01/11. 0C471 (The Inishes) is classified as the broad habitat 'muddy sand to sand with *Hediste diversicolor*, *Corophium volutator*, and *Peringia (Hydrobia) ulvae* community complex (NPWS, 2013). This grades further north-east into the sandier community described above.

The highest intertidal foraging density recorded for a single subsite was 1.2 Bar-tailed Godwits ha<sup>-1</sup> (0C454 Woodpark - Kellystown) on 08/01/11. No other subsite recorded densities greater than 1 Bar-tailed Godwits ha<sup>-1</sup>. The whole site mean feeding density (intertidal habitat) was 0.1 Bar-tailed Godwits ha<sup>-1</sup>.

#### Roosting Distribution

During low tide surveys, Bar-tailed Godwits were rarely recorded roosting intertidally. An exception was 80 individuals that roosted intertidally within 0C471 (The Inishes) on 08/01/11.

A total of 93 Bar-tailed Godwits roosted intertidally during the high tide survey on 28/01/11; 73% of these were in 0C451 (Marleys Point) where 46 individuals foraged and roosted in the north of the subsite and 22 individuals roosted on Marley's Point along with 29 Oystercatchers and a few Cormorants and Shags. 12 individuals roosted in 0C473 (Tanregu) and a further 13 in 0C474 (Ballinlig).

A total of 298 Bar-tailed Godwits roosted intertidally during the high tide survey on 10/02/11; the majority (85%) within 0C471 (The Inishes).

The high tide roost survey on 01/12/10 recorded roosting individuals in just two subsites – 0C471 and 0C473 although the latter held very low numbers; the largest flock recorded being just four individuals. 0C471 was therefore the favoured subsite by roosting Bar-tailed Godwits and the largest single roost comprised 300 birds that was positioned intertidally near Carrigeenfadda in the north of the subsite. Two further roosts of 50 individuals each were also recorded; one on Carrigeenagare and one along the northern shore of Inishmore Point, these latter roosts being larger mixed-species roosts. The total count of roosting individuals in this subsite (400) exceeds any count obtained during the main survey programme.

### Redshank *Tringa totanus* - Family (group): Scolopacidae (wading birds)

*Tringa totanus* breeds widely across the Palearctic in a band that extends both into the low arctic and Mediterranean zones, from Iceland through continental Europe and Russia to eastern Siberia, China and Mongolia. The taxonomy of the species has proved complex but five populations are recognised currently including *T. t. britannica*, a small and declining population that breeds in Britain and Ireland, and *T. t. robusta* which breeds in Iceland and the Faeroes and winters in Britain, Ireland and the North Sea area (Delaney et al. 2009).

#### Numbers

Redshanks were recorded during all surveys and whole-site low tide numbers peaked at 891 on 23/11/10. The high tide surveys recorded 338 and 182 Redshanks respectively on 28/01/11 and 10/02/11. Two surveys (23/11/10 and 07/02/11) recorded numbers that exceeded the threshold of all-Ireland importance.

Redshanks were widespread and recorded within nine subsites overall (all subsites except 0C452). One subsite however proved to be the most favoured and 0C471 (The Inishes) held peak numbers in three low tide surveys, and second highest numbers in another. The subsite peak count of 498 Redshanks exceeded the threshold of all-Ireland importance.

Redshanks were recorded within all three sites of the Sligo Bay complex, numbers highest in Ballysadare Bay and Cummeen Strand.

#### Foraging Distribution

Redshanks forage mainly by pecking at the surface or probing within intertidal mudflats; favouring the muddier sections of sites where they prey upon species such as the Ragworm *Hediste diversicolor* or Mud Snail *Peringia (Hydrobia) ulvae*. A particularly favoured prey is the burrowing amphipod *Corophium volutator*.

Redshanks foraged intertidally across nine subsites (all except 0C452). 0C471 (The Inishes) held peak numbers on 22/10/10 and 23/11/10 and numbers ranked as second highest during the final two low tide surveys. This subsite is classified as the broad habitat 'muddy sand to sand with *Hediste diversicolor*, *Corophium volutator*, and *Peringia (Hydrobia) ulvae* community complex (NPWS, 2013). This complex is distinguished by the polychaetes *Hediste diversicolor* and *Pygospio elegans*, the crustacean *Corophium volutator*, the gastropod *Peringia (Hydrobia) ulvae* and the oligochaetes *Heterochaeta costata* and *Tubificoides benedii*. *H. diversicolor*, *C. volutator* and *H. costata* are recorded in high abundances in the inner reaches of the bay. *P. ulvae* occurs in moderate abundances in the inner reaches of the bay and in total across the site was recorded in 20 of the 25 stations sampled during benthic survey work (ASU, 2011).

0C472 (Streamstown) held peak numbers on 08/01/11 and 07/02/11. This subsite has a sandier substrate in its outer reaches, the inner parts classified as 'muddy sand to sand' as described above. Flock position maps recorded Redshanks largely in the innermost muddier sections of the subsite.

0C473 (Tanrego) was notable in supporting numbers ranked as third highest in three low tide surveys. This subsite is sandier in nature and classified 'intertidal sand with *Angulus tenuis*', distinguished by the bivalve *Angulus tenuis* and the polychaetes *Nephtys cirrosa* and *Pygospio elegans*. The gastropod mollusc *Peringia (Hydrobia) ulvae* occurs in moderate numbers and is not uniformly distributed (NPWS, 2013).

0C454 (Woodpark – Kellystown) held numbers ranked in the top five during all surveys. This subsite is also sandier in nature and classified as 'intertidal sand with *Angulus tenuis*', as above.

The peak intertidal foraging density was 2.2 Redshank ha<sup>-1</sup> recorded for 0C486 (Ballysadare Quarry) on 23/11/10. 0C471 (The Inishes) recorded a peak density of 1.9 Redshank ha<sup>-1</sup>. No other subsite recorded greater than 1 Redshank ha<sup>-1</sup>. The whole site average intertidal foraging density was 0.3 Redshanks ha<sup>-1</sup>.

#### Roosting Distribution

Almost all Redshanks recorded during low tide surveys were foraging. Irregular roosting/other records were made for the following subsites: 0C451, 0C471, 0C473, 0C474, and 0C486.

19 Redshanks roosted intertidally during the high tide survey on 28/01/11; the majority within 0C473 (Tanrego). 67 Redshanks however roosted terrestrially adjacent 0C486 (Ballysadare Quarry).

50 Redshank roosted intertidally during the high tide survey on 10/02/11. 0C473 (Tanrego) again held the largest number (21). 0C451, 0C471, 0C474, 0C475 and 0C486 held ten Redshanks or less. A further 72 Redshanks roosted terrestrially adjacent 0C472 (Streamstown).

The high tide roost survey (01/12/10) recorded roosting Redshanks in eight subsites: 0C451, 0C453, 0C454, 0C471, 0C472, 0C473, 0C474 and 0C475. The largest single roost of 81 individuals was in 0C472 (Streamstown); this roost positioned intertidally along the inner southern shore. A flock of 60 individuals roosted along the northern shore of 0C471. 0C473 (Tanrego) recorded eight separate roost positions, the largest being 39 Redshanks, part of a larger mixed-species roost that were positioned intertidally. In total 24 different roost positions were recorded for Redshanks, the majority of these in intertidal habitat.



## 5.4 Ballysadare 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 Ballysadare 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. Sligo County Council, 2010, 2011), Western River Basin District documents (e.g. WRBD, 2009) 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 140+ 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 to occur in and around Ballysadare 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 Ballysadare Bay;
- U** 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 Ballysadare 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 Ballysadare Bay

Activities and events identified to occur in and around Ballysadare 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 disturbance; and (5) others.

#### Habitat loss, modification and adjacent landuse

Ballysadare Bay extends for about 10km westwards from the town of Ballysadare, and is the most southerly of three inlets of the larger Sligo Bay Complex. The Ballysadare River flows into the head of the bay and forms the main estuarine channel; other small rivers and streams flow into the bay at various points around the shoreline.

The landscape around the bay varies considerably. Most of the surrounding land is quite rural with only one populated centre close to the site; Ballysadare Town at the estuary head. There is scattered habitation all around the site, with frequent access points to the shoreline.

Knockarea Hill overlooks the north-east part of the bay and there are steeper slopes adjacent to the shoreline. The north-west section is more low-lying than the rest of the bay and some adjacent land has been reclaimed in the past (McCorry & Ryle, 2009).

Some saltmarsh habitat at the head of the bay has been modified in the past due to the construction of the Dublin-Sligo Railway embankment and Dublin-Sligo dual-carriageway, which crosses marshland at Ballydrehid (McCorry & Ryle, 2009). There are some tracks across the saltmarsh at various locations that have been created by grazing livestock or for access by farmers (McCorry & Ryle, 2009).

Other areas of land claim are evident. At Streamstown some saltmarsh has been modified by attempted reclamation in the past. The southern and western shorelines have been modified by the construction of a long seawall and embankment in the 19th century. Extensive low-lying land behind these embankments in Lisduff and Tanrego Intake has been reclaimed. Low-lying ground at Lisduff now contains conifer plantation and wet grassland. A large area of intertidal flats was formerly present between Derinch Island and the mainland (in the Tanrego Intake) but this area now contains wet and improved grassland. Extensive former saltmarsh at Lisduff and further west at Beltra was reclaimed here (McCorry & Ryle, 2009).

A large quarry is located at Abbeystown (adjacent subsite 0C486). This quarry is located on the site of a former lead and zinc mine works and there is only a narrow strip of land dividing it from coastal habitats. Saltmarsh is developing on quarry waste at the mouth of Ballysadare Bay and further west adjacent to the quarry. There have been problems of piled spoil and quarried material overhanging the adjacent saltmarsh and other habitats. Former dumping of spoil has allowed saltmarsh and brackish marsh to expand across intertidal habitat in this area.

#### Water quality

The Western River Basin District (WRBD) River Basin Management Plan 2011 – 2015 covers the implementation of the Water Framework Directive (WFD) (2000/60/EEC) for the west coast of Ireland and covers Ballysadare Bay and its inflowing rivers.

The current water quality status of Ballysadare Estuary is “moderate” and the outer bay is classified as “good” according to the Western River Basin Transitional and Coastal Waters Action Programme (WRBD, 2009). The ‘moderate’ status of the estuary is therefore unsatisfactory and attributed to below standard fish abundance/diversity; contributory factors being identified as inadequate wastewater treatment and Section 4 local authority licenced discharges (WRBD, 2009).

The Environmental Protection Agency (EPA) monitors the status of estuarine and coastal water bodies using their Trophic Status Assessment Scheme (TSAS), a requirement under the Urban Waste Water Treatment Directive (UWWT) (91/271/EEC)<sup>16</sup> and Nitrates Directive (91/676/EEC). Following assessment, waterbodies are classified as eutrophic, potentially eutrophic, intermediate, or unpolluted (O’Boyle et al. 2010). The most recent assessment classified Ballysadare estuary and the outer bay as ‘moderate’, a decline in status from previous assessments.

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<sup>16</sup> Transposed by the Urban Waste Water Treatment Regulations S. I. No 254 of 2001, as amended by S.I. No 48 of 2010.

In addition to nutrient enrichment, other parameters are monitored by the EPA in relation to achieving the environmental objectives established by the Water Framework Directive. For the period 2007-2009, Ballysadare estuary and bay was found to be compliant for factors such as dissolved inorganic nitrogen (DIN), phosphorus (as molybdate reactive phosphorus MRP) and biological oxygen demand (BOD) while the overall ecological status based on a standard set of ecological criteria was classified as 'moderate' and therefore unsatisfactory (O'Boyle et al. 2010).

A Waste Water Treatment Plant (WWTP) is located at Ballysadare and discharges to the estuary. It was upgraded in 2005 and has sufficient treatment capacity for projected p.e. increases up to 2026 (EPA, 2010).

The Sligo Main Drainage Waste Water Treatment Plant (WWTP) officially opened in 2009 and this has already had a discernable positive effect on water quality in the estuary (O'Boyle et al. 2010). WWTPs are also located at Strandhill and Rosses Point; the current status of their proposed upgrades is unknown.

An assessment of water quality within the Sligo Bay Shellfish Area (DoEHLG, 2009) found that there are 3,908 on-site waste water treatment systems (OSWWTS) in the catchment and that their density is much higher than the national average. The risk of diffuse pollution of surface waters and groundwaters from pathogens and phosphorus is considered high throughout the catchment as is the likelihood of inadequate percolation. The majority of the systems are therefore likely to be located in hydrologically unsuitable conditions (DoEHLG, 2009).

Agricultural discharges are a second type of diffuse pollution to Ballysadare Bay and could potentially be affecting water quality.

While improvements in WWTP treatment are aimed at meeting objectives of the Urban Waste Water Treatment Regulations (EU Council Directive 91/271/EEC, as transposed by S.I. No. 254 of 2001 as amended by S.I. 48 of 2010) and the Water Framework Directive (2000/20/EC as transposed by the European Communities (Water Policy) (Amendment) Regulations, 2010)), a reduction in organic and nutrient loading to an estuary may have various consequences for the ecology of the estuarine system. For example, there could be a reduction in the abundance of benthic invertebrate prey species (e.g. Burton et al. 2002) particularly those invertebrates that thrive (proliferate) in organically-enriched sediments.

Related to this is the subject of macroalgal mats which are a common feature in Ballysadare Bay. Algal mats can have both negative and positive effects upon waterbird foraging ecology; some species avoiding them or being negatively affected by lowered invertebrate abundances beneath them (Lewis & Kelly, 2001; Lopes et al. 2006) while herbivores such as Light-bellied Brent Goose and Wigeon benefit from the algae being a source of food. Given that sustained high levels of macroalgal growth is linked to organic enrichment, there is a potential for a reduction in macroalgal abundance as a result of improvements to sewage discharges. Although such factors are complex and may operate over the long-term, it is advised that they be considered in future assessments of waterbird distribution patterns at this site.

#### Fisheries & aquaculture

There is no designated Shellfish Water in Ballysadare Bay. Various commercial inshore fishing activities are likely to occur adjacent to the site (detail and spatial scale unknown). Line fishing and other static methods (e.g. pots) are likely to be widespread across the outer bay.

The Ballysadare River is promoted by the North Western Regional Fisheries Board as a good place for Salmon (*Salmo salar*) fishing as well as Sea trout (*Salmo trutta*) which are seen in the estuary on the rising tide (CRFB, 2008). Fish recorded in Ballysadare Bay include Sand

Goby (*Pomatoschistus minutes*), Flounder (*Platichthys flesus*) and Common Goby (*Pomatoschistus microps*) in decreasing order of abundance (CRFB, 2008).

#### Recreational disturbance

Culleanmore Strand (0C453) is the only sandy beach within the bay. Use of this strand by walkers and dogs was described as '*almost constant*' by one waterbird survey fieldworker; while 0C452 (Strandhill) was also used regularly.

#### Others

Wildfowling is known to occur at the site, particularly in areas of saltmarsh. It 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 (8<sup>th</sup> – 30<sup>th</sup> December 2010 inclusive).

#### 5.4.4 Disturbance Assessment

During 2010/11 survey work six activities/events were recorded that had the potential to cause disturbance to waterbirds. These were: aircraft, walking (including with dogs), motorised vehicles, horse-riding, bait-diggers and hand-gathering of molluscs (winkle picking).

Walking (including with dogs) was by far the most widespread activity occurring in eight subsites overall and accounting for the peak disturbance score in seven of these (Table 5.8). The presence of dogs generally led to a higher score as a result of the higher 'intensity' of the activity.

Horse riding was an irregular activity and recorded in one subsite only. Aircraft fly over the site and were observed to cause a disturbance to foraging birds. Vehicles were rarely observed, one-off sightings within three subsites. In all events they were related to farming, farmers on tractors or quad bikes crossing the tidal flats or saltmarsh to tend to cattle or fencing.

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 (2011/12 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
0C451	Marleys Point	-	-	
0C452	Strandhill	1	7	<ul style="list-style-type: none"> <li>Walking (incl. with dogs)</li> </ul>
0C453	Culleanmore Strand	2	7	<ul style="list-style-type: none"> <li>Walking (incl. with dogs)</li> </ul>
0C454	Woodpark – Kellystown	3	6	<ul style="list-style-type: none"> <li>Walking (incl. with dogs)</li> </ul>
0C471	The Inishes	3	6	<ul style="list-style-type: none"> <li>Walking (incl. with dogs)</li> <li>Aircraft</li> <li>Motorised vehicles</li> </ul>
0C472	Streamstown	2	6	<ul style="list-style-type: none"> <li>Motorised vehicles</li> </ul>
0C473	Tanrego	4	6	<ul style="list-style-type: none"> <li>Aircraft</li> <li>Walking (incl. with dogs)</li> <li>Motorised vehicles</li> </ul>
0C474	Ballinlig	1	6	<ul style="list-style-type: none"> <li>Walking (incl. with dogs)</li> </ul>
0C475	Portavaud	-	-	
0C486	Ballysadare Quarry	1	5	<ul style="list-style-type: none"> <li>Walking (incl. with dogs)</li> </ul>

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

Species ▶	PB	GV	DN	BA	RK
<b>Subsites</b> ▼					
0C451	V	H		V	M
0C452	M				
0C453	M				L
0C454	V		L	V	M
0C471	V		V	V	V
0C472	H		V	M	H
0C473	H		H	L	H
0C474	M		L		L
0C475	V	V	H		M
0C486			H		H

#### 5.4.5 Discussion

Many of the 'activities' identified at the Ballysadare Bay may act so as to modify the wetland habitats. While physical loss might be considered more historic in nature (e.g. land claim, the in-filling of saltmarsh), on-going modifications to intertidal and coastal habitats may occur due to changes in natural processes (e.g. sedimentation/accretion or erosion rates) as a result of former physical events. These processes are evident at Ballysadare Bay (McCorry & Ryle, 2009).

Human recreational activities at coastal sites occur less frequently during winter months and the range of activities is much reduced. With fewer sandy beaches, less accessibility and little aquaculture, Ballysadare Bay is probably the least disturbed of the three inlets that make up the Sligo Bay Complex. Nevertheless recreational activity in the form of walkers (with/without dogs) occurred in all but two of the count subsites and was a regular activity in several (e.g. 0C452, 0C453).

Any activity that causes disturbance can lead to the displacement of waterbirds. 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 fitness<sup>17</sup> (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 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 (1<sup>st</sup> 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;

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<sup>17</sup> defined as a measure of the relative contribution of an individual to the gene pool of the next generation.

- 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: BALLYSDARE BAY SPA**

**SITE CODE: 004129**

Ballysadare Bay extends for approximately 10 km westwards from the town of Ballysadare, County Sligo. It is the most southerly of three inlets that form the eastern part of the larger Sligo Bay complex. The estuarine channel of the Ballysadare River winds its way through the bay, finally reaching the open sea near the Strandhill Dunes sand spit. The bay is underlain by sedimentary rocks of limestones, sandstones and shales which are exposed as low cliffs and small sections of bedrock shore at several locations.

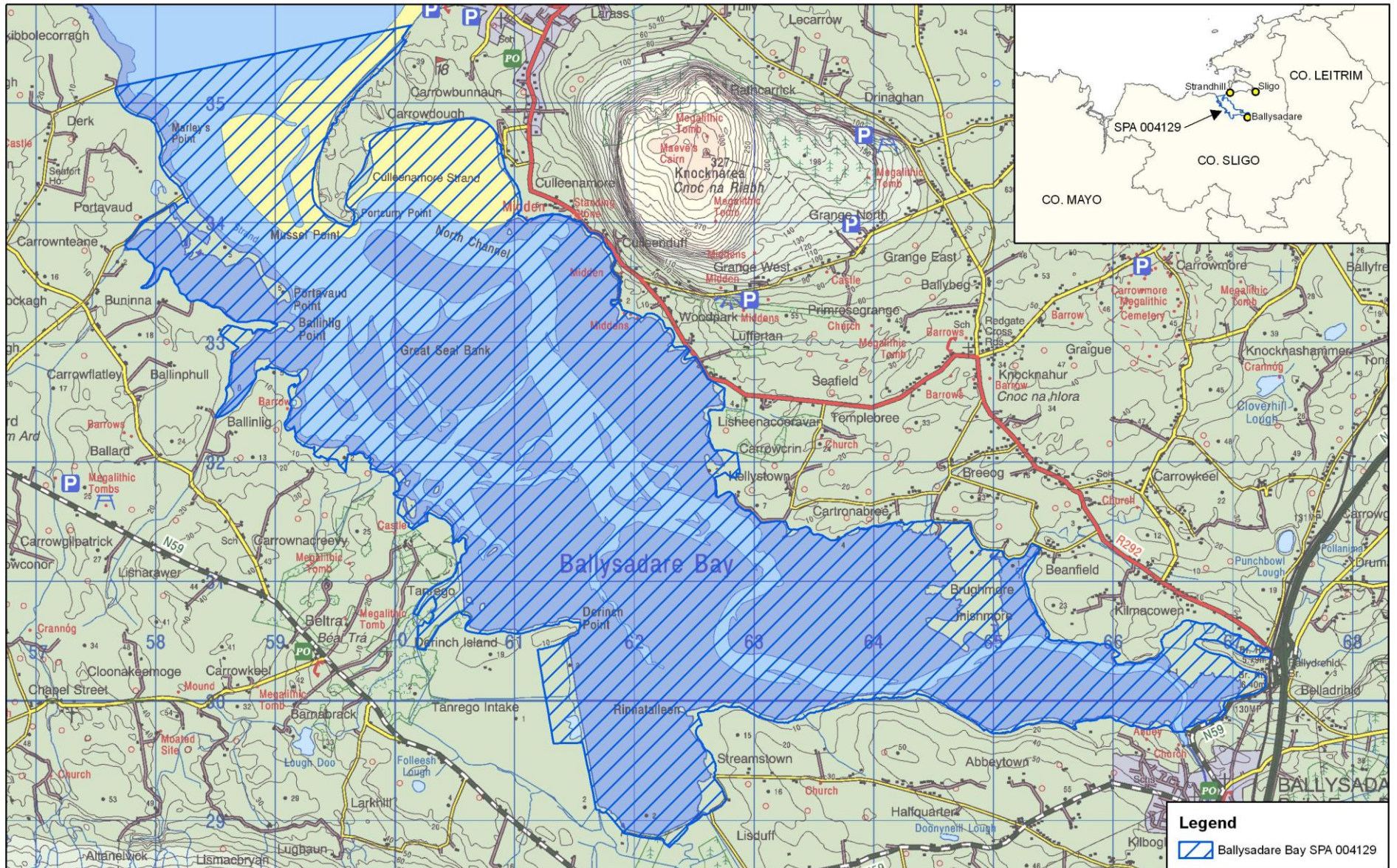
The bay contains extensive intertidal sand and mudflats. The flats support good populations of macro-invertebrates which are important food items for wintering waterfowl. Common species present include the polychaete worms *Hediste diversicolor*, *Arenicola marina*, *Lanice conchilega* and *Nephtys hombergii*, and the bivalves *Cerastoderma edule*, *Macoma balthica* and *Scrobicularia plana*. Also present on the intertidal flats are the vascular plants Eelgrass (*Zostera marina*) and Beaked Tasselweed (*Ruppia maritima*), which provide food for herbivorous wildfowl. Well-developed salt marshes, which provide roosting sites for birds at high tide, occur at several locations around the bay. The sandy beaches around the Strandhill Peninsula are used by roosting birds.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Light-bellied Brent Goose, Grey Plover, Dunlin, Bar-tailed Godwit and Redshank. 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.

Ballysadare Bay is important for a range of waterfowl species in autumn and winter. The population of Light-bellied Brent Goose (188) is of international importance (all figures are mean peak counts for four winters in the period 1995/96 to 1999/2000). The populations of four other species are of national importance, i.e. Grey Plover (70), Dunlin (1,420), Bar-tailed Godwit (251) and Redshank (435). A range of other species occurs, including Whooper Swan (15), Shelduck (55), Wigeon (617), Teal (179), Mallard (304), Goldeneye (17), Red-breasted Merganser (26), Cormorant (43), Oystercatcher (518), Ringed Plover (96), Golden Plover (301), Lapwing (467), Curlew (508), Greenshank (22), Turnstone (40), Black-headed Gull (261) and Common Gull (203).

Ballysadare Bay SPA is of high ornithological importance - it supports a Light-bellied Brent Goose population of international importance as well as nationally important populations of four other wintering waterfowl species. The presence of Bar-tailed Godwit, Golden Plover and Whooper Swan is of particular note as these species are listed on Annex I of the E.U. Birds Directive. The site forms an important component of the larger Sligo Bay complex.





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 Department of Arts, Heritage and the Gaeltacht

**BALLYSADARE BAY SPA CONSERVATION OBJECTIVES SPA DESIGNATION**

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

**SITE CODE:**  
 SPA 004129; version 1.03. CO. SLIGO

0 0.5 1 1.5 2 km

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).

Níl sna teorainneacha ar na léarscálanna ach nod garshuíomhach ginearálta. Feadfar athbhreithniú a déanamh ar theorainneacha na gceantar comharthaíthe. Macas amháil d'abhar na Suirbhreachta Ordonais le chead na Rialtas (Ceadúnas Uimh. EN 0059212)

**Legend**  
 Ballysadare Bay SPA 004129

**N**  
 Map Version 1  
 Date: Oct 2013



## 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' 12-year period (1995–2007) and the recent five-year period (2002–2007). 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 (2007):-

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

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 (2008) 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 Index	Smoothed Index
1994	0.715	0.753
1995	0.604	0.804
1996	0.739	0.835
1997	0.594	0.826
1998	0.711	0.782
1999	0.745	0.727
2000	0.618	0.691
2001	0.694	0.692
2002	0.300	0.739
2003	0.530	0.827
2004	1.348	0.936
2005	0.836	1.028
2006	0.773	1.069
2007	0.734	1.051
2008	1	1.000

Term	Change
5YR	+ 42.80
10YR	+ 27.24
ALL YR	+ 30.72

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)

<b>Guild</b>	<b>Foods</b>	<b>Tactics</b>	<b>Examples...</b>
(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 <sup>a</sup>	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

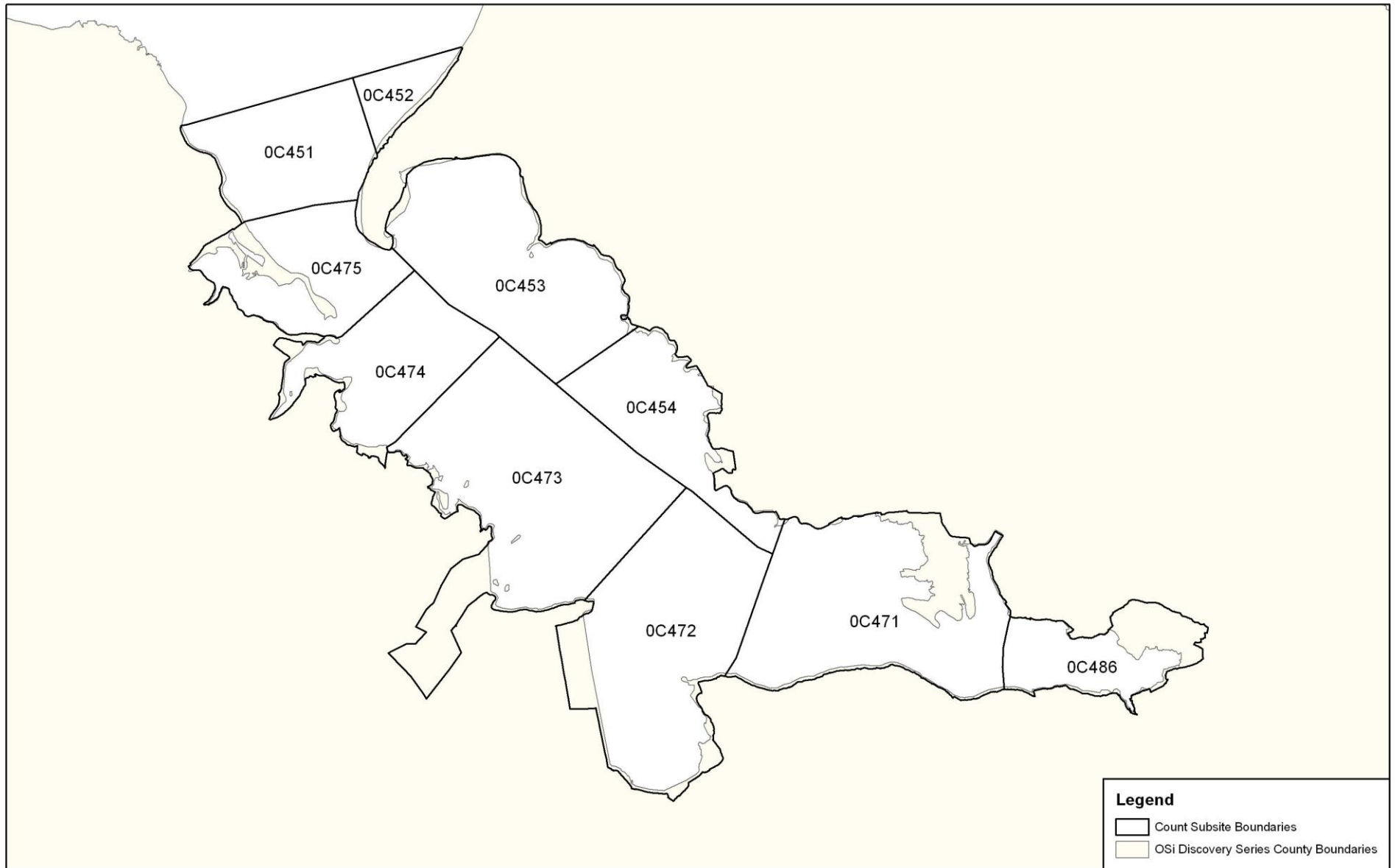
<sup>a</sup> dives <3m.


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


### Ballysadare Bay – Waterbird Survey Programme 2010/11 – Count Subsites

Subsite Code	Subsite name	Subsite Area (ha)
0C451	Marleys Point	157
0C452	Strandhill	44
0C453	Culleanmore Strand	277
0C454	Woodpark – Kellystown	157
0C471	The Inishes	344
0C472	Streamstown	337
0C473	Tanrego	419
0C474	Ballinlig	176
0C475	Portavaud	167
0C486	Ballysadare Quarry	122
	<b>Total</b>	<b>2199</b>



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**Ballysadare 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.

**COUNTY SLIGO**  


The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).  
Níl sna teorainneacha ar na léarscálleanna ach nod garstuíomhach ginearálta. Féadfar athbheithníthe a deanamh ar theorainneacha na gceantar comharthaíthe. Macasamhail d'ábhar na Suirbhearachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059212)

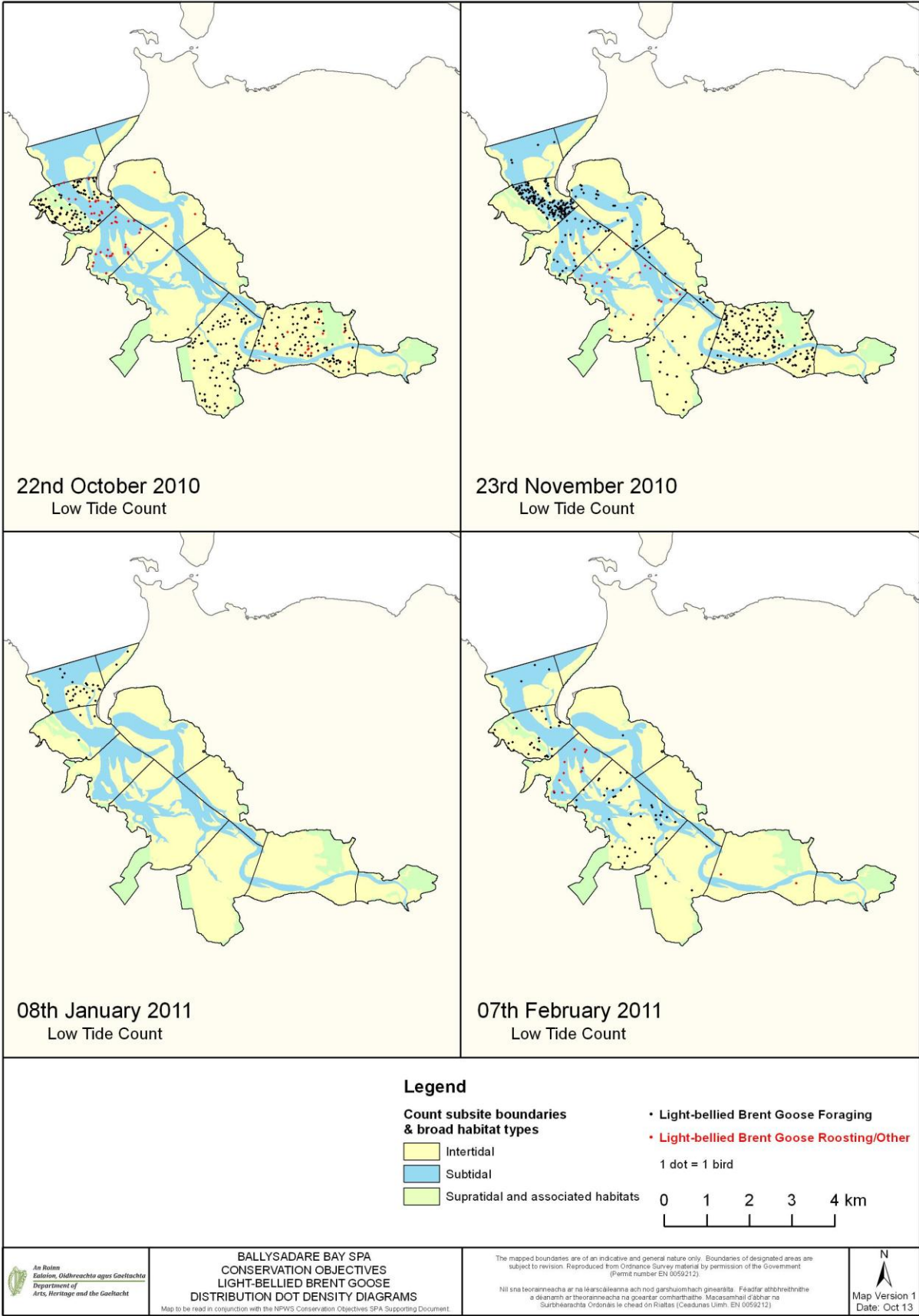
  
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Date: Oct 2013**

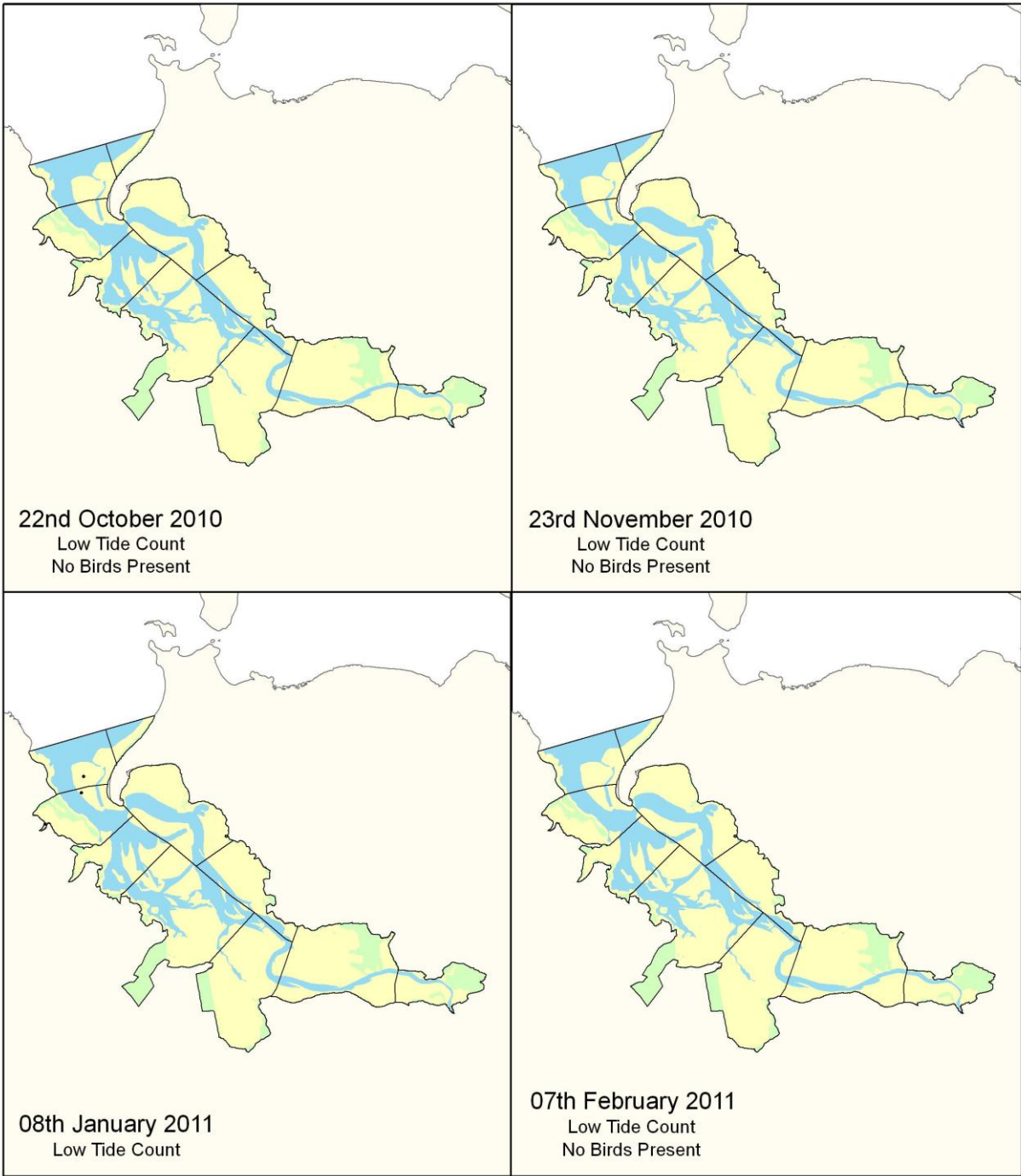
## APPENDIX 7

### Ballysadare Bay

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

**(NB data are presented for birds located in intertidal and subtidal habitats only)**





**Legend**

**Count subsite boundaries & broad habitat types**

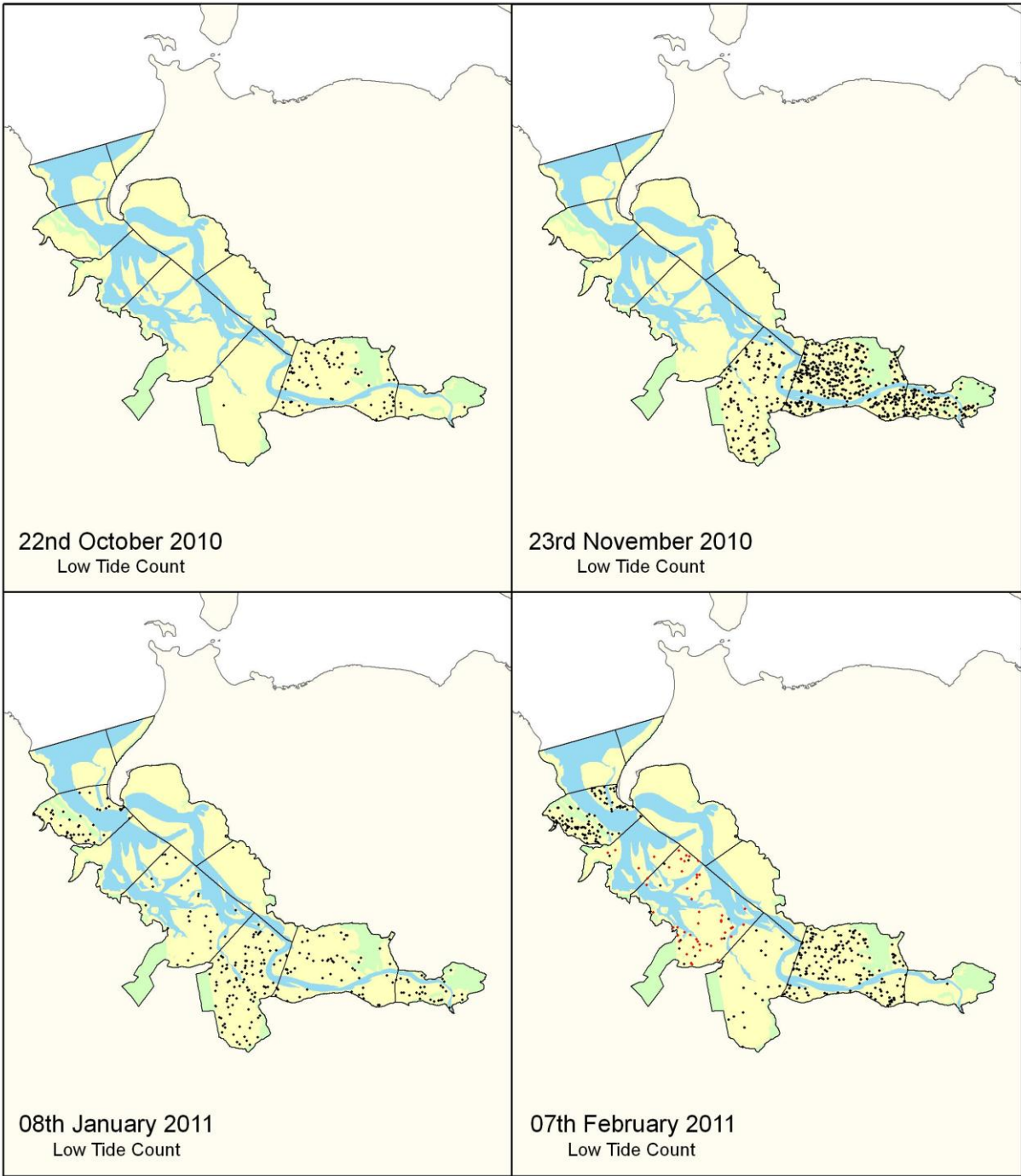
- Intertidal
- Subtidal
- Supratidal and associated habitats

**• Grey Plover Foraging**

1 dot = 1 bird







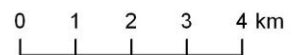
**Legend**

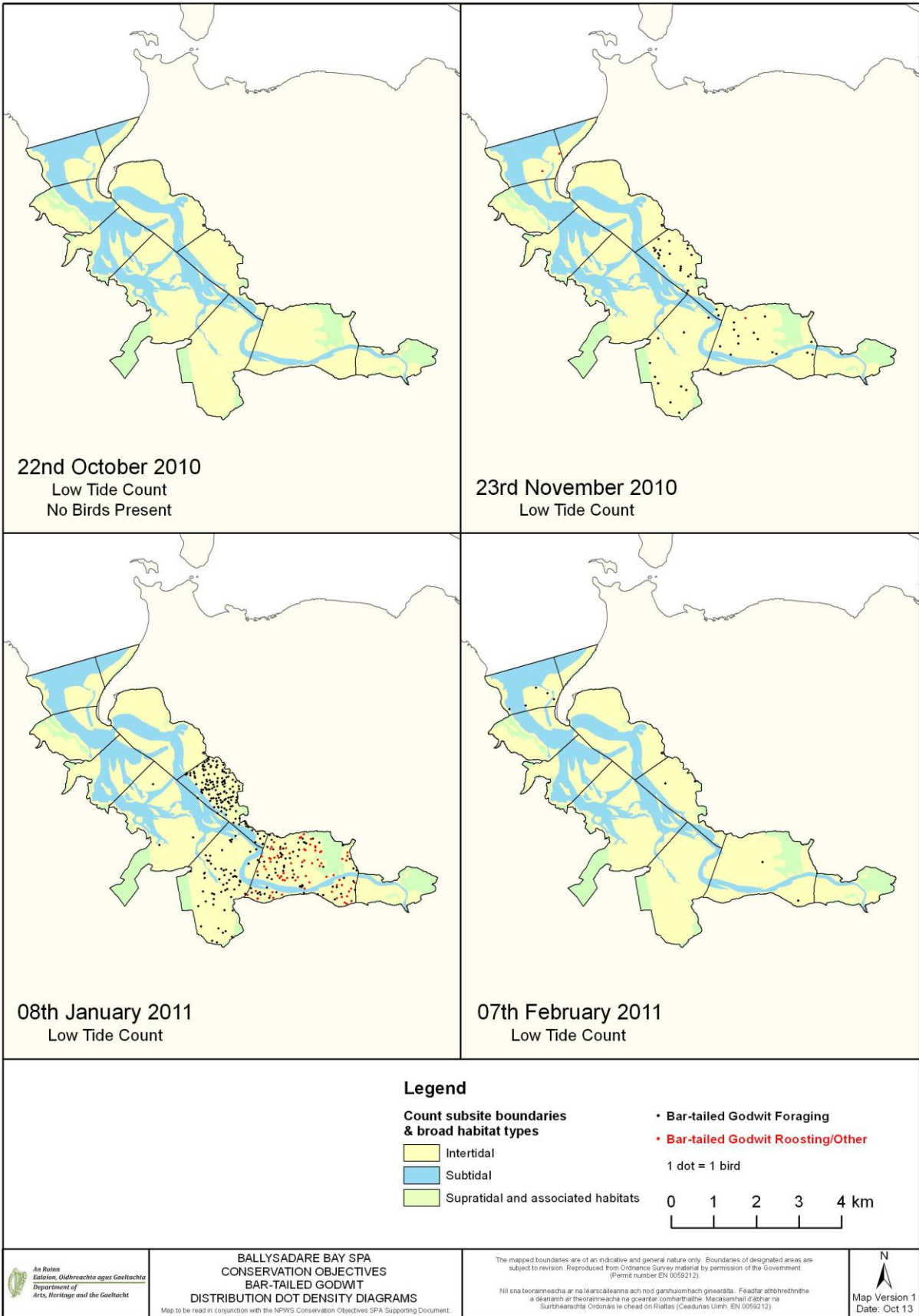
**Count subsite boundaries & broad habitat types**

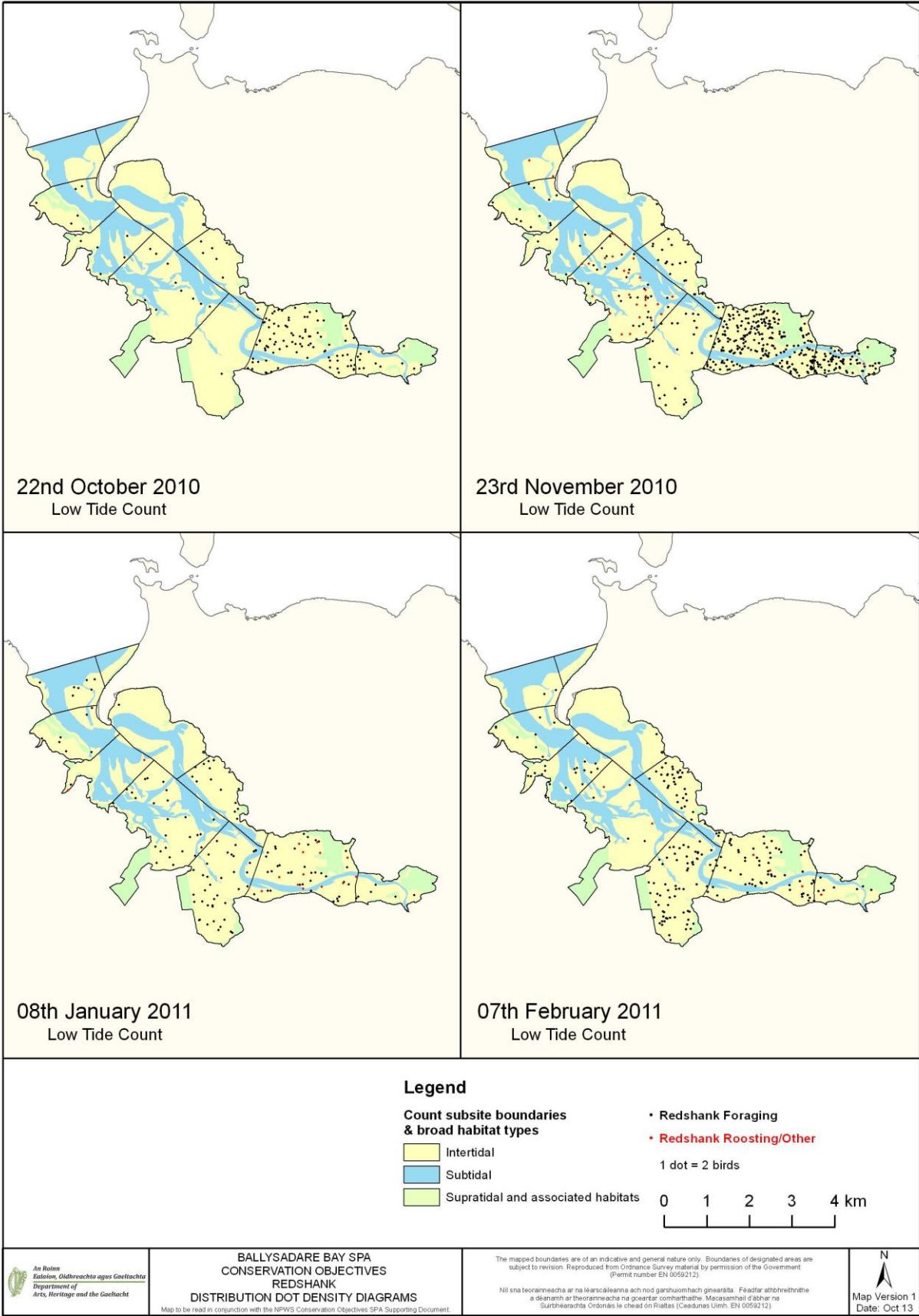
- Intertidal
- Subtidal
- Supratidal and associated habitats

- Dunlin Foraging
- Dunlin Roosting/Other

1 dot = 5 birds







## APPENDIX 8

### Ballysadare Bay

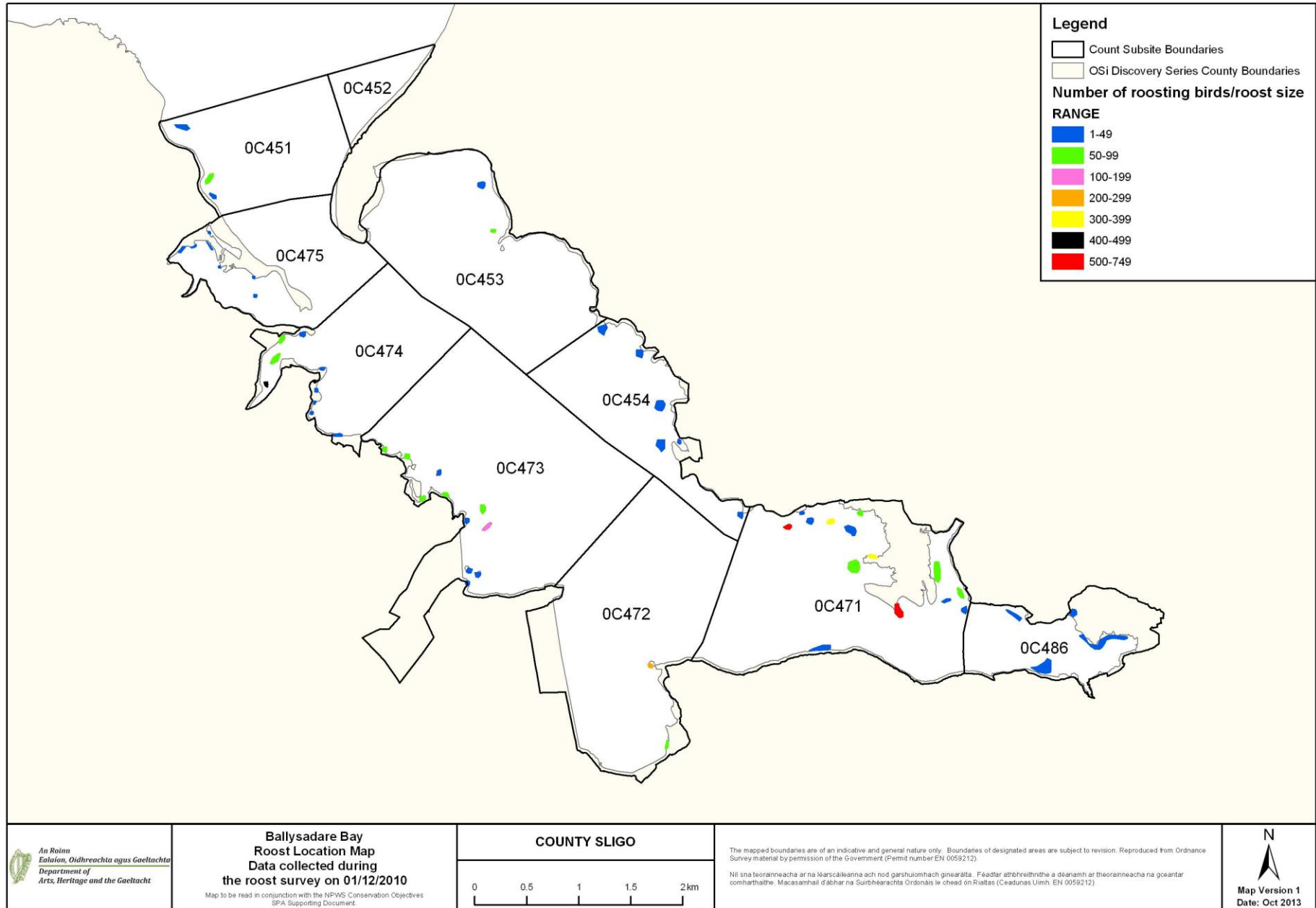
#### (1a) Summary data and roost location maps from the roost survey 1<sup>st</sup> December 2010

(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
0C451	Marleys Point	3	12	BW, CU, DN, GB, L., MA, OC, RK, RP, SS, TT, WN
0C452	Strandhill	-	-	
0C453	Culleanmore Strand	2	4	CU, OC, RK, TT
0C454	Woodpark – Kellystown	6	4	CU, GK, OC, RK
0C471	The Inishes	14	12	BA, CU, DN, GK, KN, MA, OC, PB, RM, RK, T., WN
0C472	Streamstown	2	8	BH, CM, CU, DN, H., ET, OC, RK
0C473	Tanrego	11	14	BA, CM, CA, CU, DN, GB, GK, HG, MA, OC, RK, TT, T., WN
0C474	Ballinlig	9	15	BH, CU, DN, GP, GK, H., MA, OC, RK, RP, SU, SV, T., TT, WN
0C475	Portavaud	7	10	CU, GK, MS, OC, PB, RM, RK, T., TT, WN
0C486	Ballysadare Quarry	4	9	BH, CA, CU, DN, H., HG, L., RP, T.

#### (1b) Ballysadare Bay SPA (4129) SCI species and recorded roosts 01/12/10 - shows number of roost locations within subsite, and in brackets, the peak number recorded at a single roost location

Subsite Code	PB	GV	DN	BA	RK	
0C451		<i>not recorded</i>	2 (49)		1 (8)	
0C452						
0C453					1 (3)	
0C454					2 (5)	
0C471	2 (72)			4 (450)	3 (300)	3 (60)
0C472				1 (7)		2 (81)
0C473				1 (2)	3 (4)	8 (39)
0C474				2 (6)		4 (4)
0C475	1 (36)					3 (3)
0C486				1 (15)		





## APPENDIX 9

### Ballysadare Bay - Activities & Events

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

Legend:	
<b>O</b>	<u>o</u> bserved or known to occur in or around Ballysadare Bay.
<b>U</b>	known to occur but <u>u</u> nknown area (subsites)/spatial extent; hence all potential subsites are included (e.g. fisheries activities).
<b>H</b>	<u>h</u> istoric, known to have occurred in the past.
<b>P</b>	<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	0C451	0C452	0C453	0C454	0C471	0C472	0C473	0C474	0C475	0C486
<b>1. Coastal protection, sea defences &amp; stabilisation</b>										
1.1 Linear defences		O				H	O	O		
1.5 Marram grass planting		O	O							
<b>2. Barrage schemes/drainage</b>										
2.1 Weirs and barrages for river management						O				
2.2 Altered drainage/river channel						O	O			
<b>4. Industrial, port &amp; related development</b>										
4.3 Slipway	O	O			O				O	
4.4 Pier							O			
<b>6. Pollution</b>										
6.1 Domestic & urban waste water										O
6.3 Landfill						H				
6.4 Agricultural & forestry effluents	O					O				
6.8 Others										O
<b>7. Sediment extraction (marine &amp; terrestrial)</b>										
7.2 Quarrying										O
<b>8. Transport &amp; communications</b>										
8.2 Flight path					O		O			
8.5 Road schemes		O	O	O						
8.6 Car parks			O							
<b>9. Urbanisation</b>										
9.1 Urbanised areas, housing		O	O	O						O
9.2 Commercial & industrial areas		O								
<b>12. Tourism &amp; recreation</b>										
12.2 Non-marina moorings							O	O	O	
12.12 Surfing		O								
12.14 Tourist boat trips									O	

12.15 Angling	○		○						○	
12.16 Other non-commercial fishing									○	
12.17 Bathing & general beach recreation		○	○						○	
12.18 Walking, incl. dog walking		○	○	○	○	○	○	○	○	○
12.19 Birdwatching	○	○	○	○	○	○			○	
12.21 4WD, trial & quad bikes							○			
12.22 Motorised vehicles					○	○	○			
12.23 Horse-riding			○			○				
12.25 Golf courses		○	○							
<b>13. Wildfowl &amp; hunting</b>										
13.1 Wildfowling					○	○	○		○	
<b>14. Bait-collecting</b>										
14.1 Digging for lugworms/ragworms				○		○				
<b>15. Fisheries &amp; Aquaculture</b>										
15.2 Professional active fishing	U								U	
15.4 Fish traps & other fixed devices & nets	U		U					U	U	
15.6 Molluscs - hand-gathering			○	○	○	○	○			
<b>16. Agriculture &amp; forestry</b>										
16.1 Saltmarsh grazing/harvesting				○	○		○	○	○	○
16.2 Grazing: intensive (terrestrial)								○	○	
16.3 Grazing: non-intensive (terrestrial)							○			
16.4 Sand dune grazing									○	
16.5 Stock feeding								○	○	
16.12 Polderisation						○	○			
16.13 Agricultural land-claim						○	○			
16.14 In-filling of ditches, ponds, pools, marshes				○		○				○



## 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.
<b>TOTAL SCORE</b>	<b>6</b>	<b>MODERATE</b>

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

Activity/Event	0C451	0C452	0C453	0C454	0C471	0C472	0C473	0C474	0C475	0C486
8.2 Flight path					6		6			
12.18 Walking, incl. dog walking		7	7	6	6	4	6	6		5
12.22 Motorised vehicles					6	6	6			
12.23 Horse-riding			4							
14.1 Digging for lugworms/ragworms				5						
15.6 Molluscs - hand-gathering				3			4			