Bannow Bay
Special Protection Area

(Site Code 4033)

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Conservation Objectives Supporting Document

VERSION 1

National Parks & Wildlife Service

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SUMMARY

This document presents conservation objectives for the Special Conservation Interests of Bannow 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 designation process and to the site designated as Bannow Bay Special Protection Area, as well as introducing the concept of conservation objectives and their formulation.

Part Two provides site designation information for Bannow Bay Special Protection Area and Part Three presents the conservation objectives for this site.

Part Four reviews the conservation condition of the Special Conservation Interest (SCI) species including analysis of species wintering (non-breeding) population trends, assignment of site conservation condition, and examination of site trends in light of all-Ireland and international status and trends. Importantly, this section states the current conservation condition of each of the Special Conservation Interest species for this SPA.

Part Five provides supporting information that is intended to assist the interpretation of the site-specific conservation objectives. This section includes a review of the ecological characteristics of the SCI species of Bannow Bay SPA, and examines waterbird distribution recorded during the 2009/10 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 that may interact with waterbirds during the non-breeding season and includes an assessment of those activities that were recorded to cause disturbance to non-breeding waterbirds at Bannow Bay during the 2009/10 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) is responsible for the selection and designation of SPA sites in Ireland. NPWS have developed a set of criteria, incorporating information relating to the selection of wetland sites developed under the Ramsar Convention **(**Ramsar Convention Bureau 1971), which are used to select sites for SPA designation**.** Sites that meet any of the following criteria may be selected as SPAs:

- A site holding 20,000 waterbirds or 10,000 pairs of seabirds;
- A site holding 1% or more of the all-Ireland population of an Annex I species;
- A site holding 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 a regularly occurring migratory species or Annex I listed 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. When a site is selected for SPA designation, a list of Special Conservation Interests is compiled. The **Special Conservation Interests** of a site can be divided into two categories:

Selection species:

The species occurring at a site which identifies the site as qualifying for SPA status i.e. a species that met at least one of the following conditions:

- 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; and/or

- 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) (NPWS, 2011a).

Additional Conservations Interests:

- Relevant Annex I or migratory species which exceed the all-Ireland 1% threshold during the baseline period but were not selection species for the site.

- Wetlands and waterbirds: 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 Bannow Bay Special Protection Area

Situated on the south coast of Co. Wexford, Bannow Bay is a large and sheltered estuarine system with a narrow outlet to the sea. It is up to 14 km along its northeast/south-west axis and has an average width of about 2 km. It is fed by two main rivers; the Corock, and the Owenduff, and by the Tintern stream, as well as numerous other smaller streams to the north and west.

Extensive intertidal mud and sand flats are exposed at low tide. Saltmarsh is well-developed in the sheltered areas of the site while some freshwater habitats occur at the northern end of the site (mosaic of marsh, reedbed and willows).

The site is surrounded by agricultural land and there are no significant populated areas bordering the site.

Bannow Bay supports a good diversity of wintering waterbirds and is one of the most important sites in the south-east. The Site Synopsis 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, 2010). 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[1].

For coastal SPA sites, conservation objectives are defined for attributes[2] relating to waterbird species populations, and for attributes related to the maintenance and protection of habitats that support them. These attributes are:

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

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

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

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

PART TWO – SITE DESIGNATION INFORMATION

2.1 Special Conservation Interests of Bannow Bay Special Protection Area

The **Selection Species** and **Additional Special Conservation Interests**[3] for Bannow Bay SPA are listed below and summarised in Table 2.1. This table also shows the importance of Bannow Bay SPA for SCI species, relative to the importance of other sites within Ireland, within the south-east region and within Co. Wexford.

The Selection Species listed for Bannow Bay SPA are as follows:-

1. During winter the site regularly supports 1% or more of the biogeographical population of Light-bellied Brent Geese (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 561 individuals.

2. 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 3,038 individuals.

3. During winter the site regularly supports 1% or more of the biogeographical population of Black-tailed Godwit (*Limosa limosa*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 546 individuals.

4. During winter the site regularly supports 1% or more of the biogeographical 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 471 individuals.

Additional Special Conservation Interests for Bannow Bay SPA are as follows:

5. During winter the site regularly supports 1% or more of the all-Ireland population of Shelduck (*Tadorna tadorna*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 500 individuals.

6. During winter the site regularly supports 1% or more of the all-Ireland population of Pintail (*Anas acuta*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 52 individuals.

7. During winter the site regularly supports 1% or more of the all-Ireland population of Oystercatcher (*Haematopus ostralegus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 711 individuals.

8. During winter the site regularly supports 1% or more of the all-Ireland population of Golden Plover (*Pluvialis apricaria*). The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 1,955 individuals.

9. 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 142 individuals.

[3] Note that Special Conservation Interest species are listed in the order of Selection Species followed by additional Special Conservation Interest species. Within these two categories, species are listed in taxonomic order.

10. During winter the site regularly supports 1% or more of the all-Ireland population of Lapwing (*Vanellus vanellus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 2,950 individuals.

11. During winter the site regularly supports 1% or more of the all-Ireland population of Knot (*Calidris canutus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 508 individuals.

12. During winter the site regularly supports 1% or more of the all-Ireland population of Curlew (*Numenius arquata*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 891 individuals.

13. 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 377 individuals.

14. The wetland habitats contained within Bannow Bay SPA are identified of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore the wetland habitats are considered to be an additional Special Conservation Interest.

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

	Special Conservation Interests	Annex I species	Baseline Population[a]	Population status at baseline	National Importance Rank[1]	Regional Importance Rank[2]	County Importance Rank[3]
Selection Species	Light-bellied Brent Goose		561	International Importance	11	3	2
	Dunlin		3,038	All-Ireland Importance	8	2	1
	Black-tailed Godwit		546	International Importance	10	4	2
	Bar-tailed Godwit	Yes	471	All-Ireland Importance	10	4	3
Additional Special Conservation Interests	Shelduck		500	All-Ireland Importance	9	3	2
	Pintail		52	All-Ireland Importance	11	3	3
	Oystercatcher		711	All-Ireland Importance	16	3	2
	Golden Plover	Yes	1,955	All-Ireland Importance	29	7	4
	Grey Plover		142	All-Ireland Importance	15	5	3
	Lapwing		2,950	All-Ireland Importance	20	7	4
	Knot		508	All-Ireland Importance	10	2	1
	Curlew		891	All-Ireland Importance	12	3	2
	Redshank		377	All-Ireland Importance	19	4	2
Other conservation designations associated with the site[b]		**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**	**OTHER**
		Yes	Yes	Yes	Yes		

[a] Baseline data is the 5-year mean peak count for the period 1995/96 – 1999/00 (I-WeBS).
[b] Note that other designations associated with Bannow Bay may relate to different areas and/or some of these areas may extend outside the SPA boundary.
[1]National importance rank – the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites in Ireland.
[2]Regional importance rank – the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within the South East region.
[3]County importance rank – the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within Co Wexford.

PART THREE – CONSERVATION OBJECTIVES FOR BANNOW BAY SPA

3.1 Conservation Objectives for the Special Conservation Interests of Bannow Bay SPA

The overarching Conservation Objective for Bannow 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 Bannow Bay Special Protection Area, based on the principles of favourable conservation status, are described below and summarised in Table 3.1. Note that 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 waterbird Special Conservation Interest species listed for Bannow 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.[4] Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.[5]

- 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.[6]

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

- ❖ Habitat modification: activities that modify discreet 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).

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

[5] Population trend analysis is presented in Section 4.

[6] Waterbird distribution from the 2009/2010 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 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 Bannow 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 **1,364 ha**, other than that occurring from natural patterns of variation.

The boundary of Bannow 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 though 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 Bannow Bay SPA this broad category is estimated to be **361 ha**. Subtidal areas are continuously available for benthic feeding or dabbling ducks (e.g. Shelduck, Pintail) and other aquatic-feeding waterbirds (e.g. Light-bellied Brent Geese). 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 watermark. For Bannow Bay SPA this is estimated to be **908 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[7] areas. When the intertidal area is inundated by the tide it becomes available for ducks and aquatic-feeding 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 Bannow Bay SPA this is estimated to be **95 ha**. Supratidal areas are used by a range of waterbird species as a roosting habitat 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.

[7] 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 Bannow Bay SPA.

Objective 1: *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Bannow Bay SPA, which is defined by the following list of attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Population	Population trend	Percentage change as per population trend assessment using waterbird count data collected through the Irish Wetland Bird Survey and other surveys.	The long term population trend should be stable or increasing	Waterbird population trends are presented in Part Four of this document.
Range	Distribution	Range, timing and 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 2009/10 waterbird survey programme is reviewed in Part Five of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at Bannow bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Area	Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 1,364 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 1,364 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 Bannow Bay SPA

Non-breeding waterbirds have been counted regularly at Bannow Bay each winter as part of the Irish Wetland Bird Survey (I-WeBS), which commenced in 1994 (Crowe, 2005). Bannow Bay is counted as one single unit (i.e. not subdivided).

Table 4.1 presents population[8] data for the non-breeding waterbird Special Conservation Interest (SCI) species of Bannow Bay SPA. For the calculation of the individual species populations shown, the annual maxima was identified and used to calculate the five-year mean peak. The baseline period was 1995/96 – 1999/00 and the most recent five-year mean is for the period 2005/06 – 2009/10. Data are from the I-WeBS database.

The mean of peak counts are used because they reflect more accurately the importance of a site for a particular species. The assessment of five-year periods helps to account for fluctuations in numbers or where there are inconsistencies in data gathering (e.g. incomplete coverage, bad weather). In general and taking into account all potential sources of error in counting wetland birds, resulting data are regarded to be underestimates of population size (Underhill & Prŷs-Jones, 1994).

Table 4.1 highlights where the numbers shown surpass thresholds of International or all-Ireland importance. Note that these thresholds are different for the baseline and recent time periods used. International thresholds are outlined in Wetlands International (2002) and Wetlands International (2006) for the baseline and recent site data respectively, while all-Ireland thresholds are given within Crowe et al. (2008).

Table 4.1 Population data for waterbird Special Conservation Interest Species of Bannow Bay SPA

Site Special Conservation Interests (SCIs)	Baseline Period[1] (1995/96 – 1999/00)	Recent Site Data[2] (2005/06 – 2009/10)
Light-bellied Brent Goose*	561 (i)	997 (i)
Dunlin*	3,038 (n)	824
Black-tailed Godwit*	546 (i)	1,514 (i)
Bar-tailed Godwit*	471 (n)	839 (n)
Shelduck	500 (n)	198 (n)
Pintail	52 (n)	9
Oystercatcher	711 (n)	612
Golden Plover	1,955 (n)	3, 843 (n)
Grey Plover	142 (n)	68 (n)
Lapwing	2,950 (n)	6,212 (n)
Knot	508 (n)	291 (n)
Curlew	891 (n)	612 (n)
Redshank	377 (n)	425 (n)

* denotes site selection species. [1]Baseline data is the 5-year mean peak count for the period 1995/96 – 1999/00; [2]recent site data is the five-year mean for 2005/06 – 2009/10 (I-WeBS).
(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance.

4.2 Waterbird population trends at Bannow 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

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

for monitoring changes in the numbers of non-breeding waterbirds over a range of spatial scales and time periods (Appendix 3).

For Bannow Bay, annual population indices were calculated for waterbird SCI species for the data period 1994/95 to 2008/09. This analysis was undertaken using data from the Irish Wetland Bird Survey (I-WeBS). Trends are given for the 'long-term' 12-year period (1995/96–2007/08) and the recent ('short-term') five-year period (2002/03 - 2007/08) (Table 4.2). The values given represent the percentage change in index (population) values across the specified time period. Positive values equate to increases in population size while negative values reflect a decrease in population size.

Whilst count coverage of Bannow Bay has been reasonably consistent, I-WeBS counts were not undertaken during two winters (2000/01 and 2003/04). This inevitably leads to a higher proportion of imputed data points for those seasons (see Appendix 3 for methodology) which should be borne in mind when interpreting the trends. Population indices were not calculated for Pintail because this species has been largely absent since 2000/01.

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

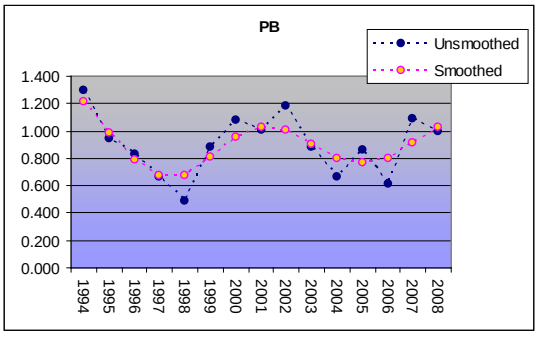
Table 4.2 Site Population Trends for waterbird Special Conservation Interest species of Bannow Bay SPA

Site Special Conservation Interests (SCIs)	Site Population Trend[1] 12 Yr	Site Population Trend[2] 5 Yr
Light-bellied Brent Goose*	- 6.99	- 9.44
Dunlin*	- 75.7	- 57.5
Black-tailed Godwit*	+ 27.2	+ 39.6
Bar-tailed Godwit*	+ 10.1	- 10.6
Shelduck	- 52.6	- 48.9
Pintail	n/c	n/c
Oystercatcher	+ 0.4	- 13.1
Golden Plover	- 2.6	- 29.0
Grey Plover	- 72.1	- 52.8
Lapwing	- 3.0	- 35.4
Knot	- 53.0	- 15.8
Curlew	- 17.3	- 22.7
Redshank	- 4.6	- 21.4

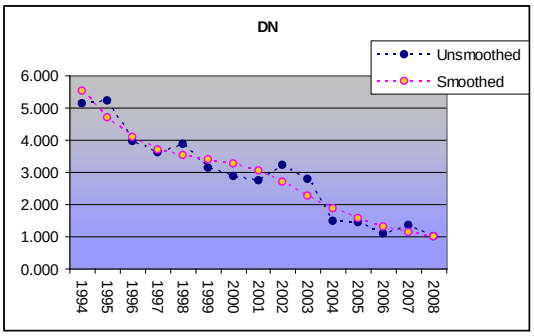
* denotes site selection species.
[1]Site population trend analysis: 12 yr = 1995/96 – 2007/08
[2]Site population trend analysis: 5 yr = 2002/03 – 2007/08.
n/c not calculated.

For selected species, explanatory notes are given below to aid the interpretation of trends. Graph headings use waterbird species codes and a list of these is provided in Appendix 4.

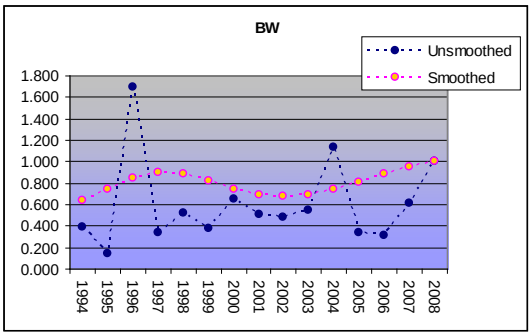
Light-bellied Brent Goose – numbers have fluctuated, with successive periods of decline and increase in numbers during the 15-year data period.



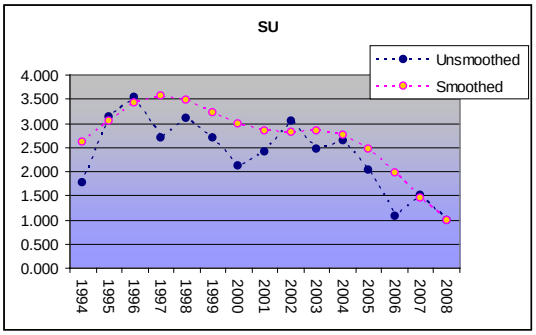
Dunlin – numbers have declined progressively at Bannow Bay. This is in line with the national trend (Crowe et al. 2008) and that evident in Northern Ireland and Britain (Calbrade et al. 2010).



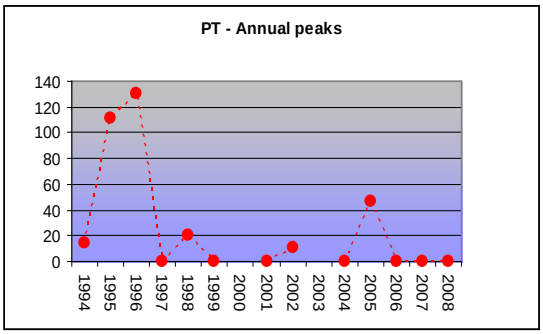
Black-tailed Godwit – this species has had widely fluctuating numbers with notable peaks recorded in 1996/97 and again in 2004/05. But the underlying trend is stable with some increase shown in the short term. This is in line with the national trend (Crowe et al. 2008) and that evident in Northern Ireland and Britain (Calbrade et al. 2010).



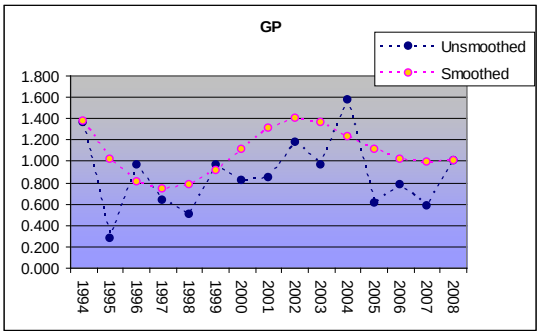
Shelduck – numbers have fluctuated with notable peaks in 1996/97 and 2002/03. The smoothed trend highlights an almost progressive decline in numbers since 1995/96. This decline is at variance with the observed national trend for increase (Crowe et al. 2008).



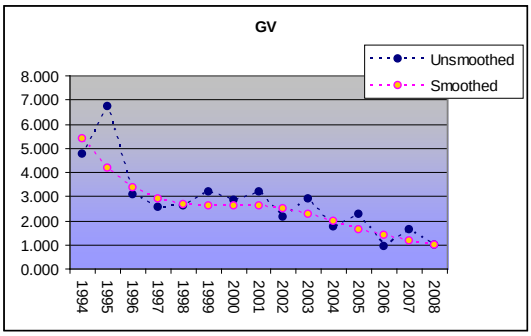
Pintail - population indices were not calculated for Pintail because this species was largely absent from counts conducted since 2000/01. Nationally-important concentrations were recorded during two consecutive seasons only (1995/96 and 1996/97). Annual peaks have since remained low, below 25 birds, with the exception of 2005/06 when 47 were recorded. The all-Ireland trend is currently stable (Crowe et al. 2011) having been one of decline previously (Crowe et al. 2008).



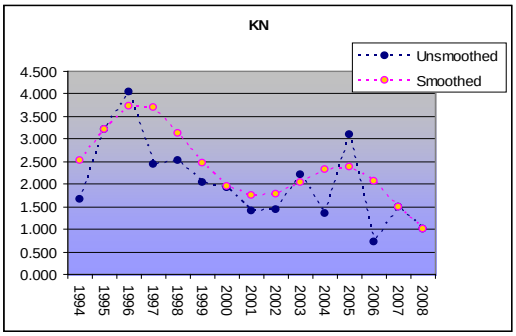
Golden Plover – numbers have fluctuated throughout I-WeBS at the site, with an especially steep decline in numbers recorded between 1994/95 and 1995/96 followed by an increase to peak numbers recorded in 2004/05. A short term decline is evident.



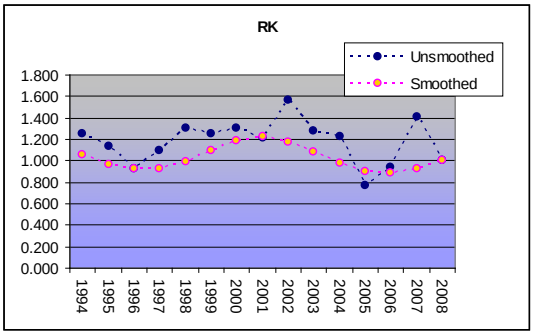
Grey Plover – numbers declined more steeply in the early seasons of I-WeBS and the underlying long-term trend is also for decline.



Knot - numbers have fluctuated widely between years but the smoothed trend indicates an overall decline despite peaks recorded in 1996/97 and again in 2005/06.



Redshank – numbers have remained largely stable throughout I-WeBS. The short-term trend is influenced by the peak number recorded in 2002/03.



4.3 Bannow Bay SPA – site conservation condition of non-breeding waterbirds

Conservation condition of waterbird species was determined using the longer-term site population trend and 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 13 non-breeding waterbird species of Special Conservation Interest for Bannow Bay SPA, and based on the long-term population trend for the site, it has been determined that (Table 4.3):-

1. 4 species are currently considered as **Highly Unfavourable** (Dunlin, Shelduck, Grey Plover & Knot);
2. 5 species are currently considered as **Intermediate (Unfavourable)** (Light-bellied Brent Goose, Golden Plover, Lapwing, Curlew & Redshank);
3. 3 species are currently considered as **Favourable** (Black-tailed Godwit, Bar-tailed Godwit & Oystercatcher);
4. 1 species has not been assessed (Pintail).

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

Special Conservation Interests	Site Population Trend[a]	Site Conservation Condition	BoCCI Category[b]	Current all-Ireland Trend[c]	Current International Trend[d]
Light-bellied Brent Goose*	- 6.99	Intermediate (Unfavourable)	Amber	+ 58	Increase
Dunlin*	- 75.7	Highly Unfavourable	Amber	- 46.5	Stable (*alpina*)
Black-tailed Godwit*	+ 27.2	Favourable	Amber	+ 70.2	Increase
Bar-tailed Godwit*	+ 10.1	Favourable	Amber	+ 1.5	Stable
Shelduck	- 52.6	Highly Unfavourable	Amber	+ 4.46	Stable
Pintail	n/c	n/c	Red	+ 26.8	Stable
Oystercatcher	+ 0.4	Favourable	Amber	+ 23.5	Decline
Golden Plover	- 2.6	Intermediate (Unfavourable)	Red	- 2.2	Decline
Grey Plover	- 72.1	Highly Unfavourable	Amber	- 33.1	Decline
Lapwing	- 3.0	Intermediate (Unfavourable)	Red	- 40.12	Decline
Knot	- 53.0	Highly Unfavourable	Red	- 2.91	Decline
Curlew	- 17.3	Intermediate (Unfavourable)	Red	- 25.7	Decline
Redshank	- 4.6	Intermediate (Unfavourable)	Red	+ 22.7	Stable/Decline

*Denotes site selection species; n/c = not calculated
[a] Site population trend analysis; see Table 4.2 and text of Section 4.2 for more details; [b]After Lynas *et al.* (2007); [c]all-Ireland trend calculated for period 1994/95 to 2008/09; [d]international trend after Wetland International (2006)

Table 4.3 also shows species' all-Ireland and international trends (Table 4.3). The calculation of all-Ireland trends (island of Ireland) for the long-term (12-year) data period was facilitated by the provision of indices from the I-WeBS and the WeBS database[9]; International trends follow Wetlands International (2006).

Table 4.3 also shows the relationship between a species' long-term site trend and the current all-Ireland trend for the same time period (1994/95 to 2008/09). The colour coding used represents the following cases:-

[9] kindly provided by the I-WeBS Office and the British Trust for Ornithology.

- Grey - assessment not undertaken.
- Green – species whose populations are stable or increasing at both site level and all-Ireland level.
- Beige – species whose populations are declining at both site level and all-Ireland level. Therefore there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level.
- Orange - species whose populations are exhibiting a 1.0 – 24.9% decline at site level but are stable or increasing at all-Ireland level.
- Pink - species whose populations are exhibiting a 25.0 – 49.9% decline at site level but are stable or increasing at all-Ireland level.
- Red - species whose populations are exhibiting a >50.0 % decline at site level but are stable or increasing at all-Ireland level.

The red category as assigned to Shelduck in Table 4.3 highlights where a population is stable at national level, but where significant declines are seen at site level. In such a case it would be reasonable to suggest that site-based management issues may be responsible for the observed decline (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 Bannow Bay SPA.

Section 5.2 provides selected ecological summary information for the non-breeding waterbirds of Bannow Bay SPA. Section 5.3 presents results from the 2009/10 Waterbird Survey Programme. Finally, Section 5.4 provides summary information for activities and events that occur in and around Bannow Bay SPA that may either act upon the habitats within the site, or may interact with waterbirds using the site.

The information provided is intended to:-

- provide information 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 this information does not aim to provide a comprehensive assessment on which to assess plans and projects as required under the Habitats Directive, but rather should inform the scope of these assessments and help direct where further detailed examinations are required. The information presented in this report was compiled in November 2011.

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. The I-WeBS database shows a total of 53 waterbird species recorded at Bannow Bay SPA during the period 1994/95 – 2009/10 representing ten 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) and *Ciconiiformes* (Herons).

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 other waterbird species which are part of the total waterbird assemblage of the site but are not specifically listed as Special Conservation Interests. These species may include those that stopover at the site during passage[10], those that are present in months of the year outside of the non-breeding season[11] or species that use the site at certain times only (e.g. as a cold weather refuge).

Of the total 53 waterbird species listed in the I-WeBS database for Bannow Bay during the period 1994/95 – 2009/10, 23 species occurred on a regular basis along with five gull species

[10] 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 are 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).

[11] Non-breeding season is defined as September – March inclusive

that were recorded on a regular basis during the recent five-year period.[12] Data for all regularly-occurring species, that are not listed as SCI species for the site, are shown below (Table 5.1).

Table 5.1 Regular-occurring non SCI waterbird species that occur at Bannow Bay SPA during the non-breeding season

Species	Baseline Data Period[1] (1995/96 – 1999/00)	Recent Site Average[2] (2005/06 – 2009/10)
Wigeon (*Anas penelope*)	412	277
Teal (*Anas crecca*)	256	148
Mallard (*Anas platyrhynchos*)	189	98
Red-breasted Merganser (*Mergus serrator*)	16	20
Cormorant (*Phalacrocorax carbo*)	29	47
Little Egret (*Egretta garzetta*)	2	53
Grey Heron (*Ardea cinerea*)	9	13
Ringed Plover (*Charadrius hiaticula*)	38	13
Greenshank (*Tringa nebularia*)	8	17
Turnstone (*Arenaria interpres*)	50	44
Black-headed Gull (*Chroicocephalus ridibundus*)	-	1,114 (x)
Common Gull (*Larus canus*)	-	150
Lesser Black-backed Gull (*Larus fuscus*)		28
Herring Gull (*Larus argentatus*)	-	50
Great Black-backed Gull (*Larus marinus*)	-	30

[1] Baseline data is the 5-year mean peak count for the period 1995/96 – 1999/00;
[2] Recent site data is the five-year mean for 2005/06 – 2009/10 (I-WeBS).
(n) denotes numbers of all-Ireland importance (thresholds given in Crowe et al. 2008)
(x) denotes surpassing 'threshold of significance' as applied by Crowe (2005).

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[13] provides selected ecological information for waterbird SCI species of Bannow Bay SPA. Information is provided for Selection Species and for additional Conservation Interests in the following categories:

- waterbird family (group);
- winter distribution – species distribution range during winter. Please note this is based on the period 1996/97 – 2000/01 (after Crowe, 2005);
- 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).

A single wetland site seldom meets all 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

[12] Regular is defined as a species that has occurred in 10 out of the 13-year data period; gulls that occurred in four of the five most recent seasons are included because gulls were not routinely monitored during the earlier part of the dataset.

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

move between different areas used (e.g. commuting corridors between feeding and roosting areas).

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 as '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, 1996b). 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 areas designated as Special Protection Areas represent a variable portion of the overall range of the listed species. To this end, field data, where available, are being compiled on waterbird alternative habitat use. Such a resource is warranted for the effective conservation management of mobile waterbird species. Indeed, the isolated protection of single sites may be inadequate to provide effective species protection thereby underlining the need for wider countryside conservation measures (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 habitats, and their significance to the listed bird species.

Table 5.2a Waterbirds – Ecological characteristics, requirements & specialities – waterbird selection species.

	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Light-bellied Brent Goose *Branta bernicla hrota*	Anatidae (geese)	Highly restricted	1, 5	Highly specialised	Intertidal mud and sand flats; shallow subtidal	2	High
Dunlin *Calidris alpina*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	3	High
Black-tailed Godwit *Limosa limosa*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	High
Bar-tailed Godwit *Limosa lapponica*	Scolopacidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	2	Moderate

[A] Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on Crowe (2005).

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

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

[D] Principal supporting habitat present within Bannow Bay SPA. Note that this is the main habitat used when foraging.

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

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

Table 5.2b Waterbirds – Ecological characteristics, requirements & specialities – additional SCIs

	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Shelduck *Tadorna tadorna*	Anatidae (shelducks)	Intermediate	1, 5	Wide	Intertidal mud and sand flats; shallow subtidal	3	High
Pintail *Anas acuta*	Anatidae (dabbling ducks)	Localised	1	Wide	Shallow subtidal	1	Weak
Oystercatcher *Haematopus ostralegus*	Haematopodidae (wading birds)	Intermediate	4	Narrower	Intertidal mud and sand flats	2	High
Golden Plover *Pluvialis apricaria*	Charadriidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Grey Plover *Pluvialis squatarola*	Charadriidae (wading birds)	Localised	4	Wide	Intertidal mud and sand flats	3	High
Lapwing *Vanellus vanellus*	Charadriidae (wading birds)	Very widespread	4	Wide	Intertidal mud and sand flats	2	Moderate
Knot *Calidris canutus*	Scolopacidae (wading birds)	Localised	4	Narrower	Intertidal mud and sand flats	3	Moderate
Curlew *Numenius arquata*	Scolopacidae (wading birds)	Very widespread	4	Wide	Intertidal mud and sand flats	2	High
Redshank *Tringa totanus*	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	Moderate

[A] Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on Crowe (2005).
[B] Waterbird foraging guilds. 1 = Surface swimmer, 2 = water column diver (shallow), 3 = water column diver (deeper), 4/5 = intertidal walker (out of water), 6 = intertidal walker (in water), 7 = terrestrial walker. Further details are given within Appendix 5.
[C] Food/prey requirements - species with a wide prey/food range; species with a narrower prey range (e.g. species that forage upon a few species/taxa only), and species with highly specialised foraging requirements (e.g. piscivores).
[D] Principal supporting habitat present within Bannow Bay SPA. Note that this is the main habitat used when foraging.
[E] Ability to utilise alternative habitats refers to the species ability to utilise other habitats adjacent to the site. 1 = wide-ranging species with requirement to utilise the site as and when required; 2 = reliant on site but highly likely to utilise alternative habitats at certain times (e.g. high tide); 3 = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements.
[F] Site fidelity on non-breeding grounds: Unknown; Weak; Moderate; or High (based on published literature).

5.3 The 2009/10 waterbird survey programme

5.3.1 Introduction

The 2009/10 waterbird survey programme was designed to investigate how waterbirds are distributed across coastal wetland sites during the low tide period. The surveys ran alongside and are complementary to the Irish Wetland Bird Survey (I-WeBS) which is a nationwide survey undertaken primarily on a rising tide or at high tide.

At Bannow Bay SPA, a standard survey programme of four low tide counts (October, November & December 2009 and February 2010) and a high tide count (January 2010) were completed across the site.[14] Waterbirds were counted within a series of eight count sections (subsites) across the site (Appendix 6). Count subsites used were based on I-WeBS subsites (see Crowe, 2005) and are not exactly coincident with the SPA boundary.

The behaviour of waterbirds during counts was attributed to one of two categories (foraging or roosting/other) while the position of the birds was recorded as per one of four broad habitat types (intertidal, subtidal, supratidal and terrestrial). Note that the definitions of broad habitats (Table 5.3) were defined specifically for the survey programme and do not follow strict habitat-based definitions for these areas.

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. *Spartina* 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, an additional high tide roost survey was completed on 25/02/2010. During this survey, roost sites were located, species and numbers of waterbirds counted and the position of the roosts marked onto field maps. As a full species count was undertaken on this day, the data obtained were used as an additional high tide survey within analyses to complement the high tide data recorded on 23/01/10 which was compromised somewhat by poor weather conditions (see Cummins & Crowe, 2010 for details).

5.3.2 Waterbird data, analyses and presentation

The aim of data analyses was to understand how waterbirds are distributed across the site of Bannow Bay SPA 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.

[14] Low tide surveys: 08/10/09, 18/11/09, 16/12/09 & 12/02/10 plus a high tide survey on 23/01/10.

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).
- Intertidal foraging densities (low 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.

Subsite rank positions were converted to categories (see box below). The highest rank position for each subsite across any of the low tide count dates is presented for each SCI species in a subsite by species matrix. For high tide surveys and peak densities, simple rank numbers are presented.

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 then 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[15] 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. **Note however, that 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.**

In contrast to dot-density maps, roost maps produced from data obtained from the roost survey (25/02/10) show the mapped locations of waterbird roosts, but note the limitations in relation to field mapping discussed below.

[15] Birds within supratidal and terrestrial habitats are not shown on these maps.

Notes on data interpretation and methodological limitations

Subsite rankings and dot-density maps relate to the distribution of waterbirds at subsite level as recorded within the survey area during the 2009/10 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, others 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.

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 2009/10 survey programme at Bannow Bay SPA. Cummins and Crowe (2010) provide a summary of waterbird data collected. Of note were weather conditions recorded during the winter of 2009/10. December 2009 was the coldest for 28 years (Met Éireann (2009) and the cold spell persisted into the first half of January; January being the coldest on record for 25 years (Met Éireann (2010). Such weather events are likely to affect waterbird distribution patterns across Ireland and Europe, and results of the Waterbird Survey Programme should be interpreted with this regard. This is further discussed in relation to waterbird patterns across wetland sites covered by the Irish Wetland Bird Survey (I-WeBS) in Crowe et al. (2011).

All SCI species were recorded within all counts undertaken with the exception of Pintail, which was not recorded in any count (Pintail have been largely absent from I-WeBS counts conducted since 2000/01, please refer to Section 4.2).

Table 5.4 shows peak numbers (whole site) for SCI species recorded during the low tide (LT) and high tide (HT) surveys. In the case of the latter, the peak number is either from the HT survey on 23/01/10 or from the high tide roost survey undertaken on 25/02/10.

Average percentage occupancy, defined as the average proportion of subsites in which a species occurred during low tide counts, ranged from the moderate distribution of Golden Plover (average 31% of subsites) to Redshank that occurred in every subsite during all low tide surveys.

Average percentage area occupancy is defined as the average proportion of the total count area that a species occurred in during low tide counts (based on subsite areas). Although this is a broad calculation across all habitat types it gives some indication of the range of a species across the site as a whole. The most widespread species in terms of area occupied was Redshank, followed by Oystercatcher, Curlew and Light-bellied Brent Goose (Table 5.4). Overall, ten of the SCI species occurred, on average, within 50% or more of the total count area.

Table 5.4 Bannow Bay SPA 2009/2010 waterbird surveys – summary data

Site Special Conservation Interests (SCIs)	Peak number recorded - LT surveys[I]	Peak number recorded - HT survey[II]	Average subsite % occupancy [III]	Average % area occupancy [III]
Light-bellied Brent Goose*	2,158 (i)	1,354 (2) (i)	69 (13)	88 (7)
Dunlin*	1,238 (n)	2,438 (2) (n)	56 (7)	67 (6)
Black-tailed Godwit*	5,653 (i)	390 (2) (n)	56 (24)	51 (24)
Bar-tailed Godwit*	1,050 (n)	1,736 (2) (i)	53 (12)	72 (18)
Shelduck	393 (n)	354 (2) (n)	59 (33)	47 (33)
Pintail**	0	0	-	-
Oystercatcher	1,477 (n)	1,676 (2) (n)	94 (7)	99 (1)
Golden Plover	3,517 (n)	503 (2)	31 (7)	28 (11)
Grey Plover	118 (n)	232 (2) (n)	47 (12)	65 (15)
Lapwing	3,401 (n)	2,116 (1) (n)	78 (12)	85 (15)
Knot	329 (n)	826 (2) (n)	41 (6)	60 (7)
Curlew	824 (n)	1,043 (2) (n)	97 (6)	93 (13)
Redshank	905 (n)	307 (2)	100 (0)	100 (0)

* site selection species; ** Note that Pintail was not recorded during the survey programme.
(i) denotes numbers of International importance; (n) denotes numbers of all-Ireland importance (1% thresholds; 1999/00 – 2003/04 Crowe et al. 2008).
[I] 4 low-tide counts undertaken on 08/10/09 18/10/09, 16/12/09 & 12/02/10; [II] High-tide counts undertaken on 23/01/10 (1) and 25/02/10 (2) (the peak number shown); [III] Mean (± s.d.) calculated across 4 low tide counts.

Species richness (total number of species) across the whole site was consistent throughout the survey programme with a total of 33, 31, 31, and 34 species recorded during the four low tide counts respectively, and 34 and 32 species recorded during the two high tide surveys respectively.

Species richness at subsite level ranged from an average 12 species (0O487 and 0O489) to 25 species (0O413) during low tide surveys (Table 5.5). 0O411 supported the peak number (22 species) of species recorded during either of the two high tide surveys.

Table 5.5 Subsite species richness

Subsite	Subsite Name	Mean (±S.D) LT Survey	Peak (HT Surveys)	Peak Overall
0O410	Fethard Bay	14 (1.9)	11	16 (L)
0O411	St Kiernans to Saltmills to Big Burrow	22 (1.5)	22	23 (L)
0O413	Saint Kiernans to Newtown	25 (2.2)	17	27 (L)
0O416	Kiltra	21 (6)	20	26 (L)
0O417	Clonmines Castle	12 (4.2)	21	21 (H)
0O418	Bannow Island to Newquay	19 (3.6)	17	24 (L)
0O487	Tintern Abbey to Tintern Bridge	12 (4.3)	8	18 (L)
0O489	Pollfur	12 (1.3)	9	13 (L)

5.3.4 Waterbird distribution

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

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 behaviour 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 Bannow Bay SPA. Waterbird distribution dot-density maps are provided in Appendix 7. Summary roost data are presented in Appendix 8.

Table 5.6 (a) Bannow Bay SPA 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). (Note that Pintail were not recorded during any survey).

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB	H	V	V	V	M	V	L	M
DN		V	H	V	M	V	M	
BW		M	H	V	M	M	H	H
BA	L	H	V	V	M	M		M
SU	H	H	M	V	H	V	M	H
OC	H	H	V	V	M	V	L	L
GP		V	H	V	H	V		M
GV		V	V	M	M	V		M
L.	M	H	H	V	V	M	H	
KN		V	H	V		V		
CU	L	H	H	V	H	V	M	M
RK	M	V	H	H	M	V	L	M

Table 5.6 (b) Bannow Bay SPA Subsite assessment – ranked total numbers HT Survey (across all habitats) (peak rank attained across the two HT surveys)

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB	4	1	3	2		1		5
DN		3	4	1	2	1		
BW		3		1	1			
BA		4	3	1	2	2		
SU		2	4	5	3	1		2
OC	4	2	4	2	3	1		
GP		3	1	1	2	2		
GV			3	1	2	1		5
L.		3	5	2	1	4	2	
KN		4	3	2	1	1		
CU	6	3	4	1	3	2	1	5
RK	5	3	4	1	2	1	7	5

Table 5.6 (c) Bannow Bay SPA Subsite assessment – total numbers foraging intertidally[I] and subtidally[II] (LT surveys) Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods).

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB[I]	H	V	V			H		L
PB[II]	V		V	V		H	V	
DN[I]		V	H	V	M	V	M	
BW[I]		M	V	V	H	H	V	H
BA[I]	L	H	V	V	M	M		L
SU[1]		H	L	V	H	V	M	H
OC[I]	H	H	H	V	M	V	L	M
GP[I]								V
GV[I]		V	H	M	L	V		
L.[I]		V	H	V	V		H	
KN[I]		V	H	V		V		
CU[I]	M	H	H	V	M	V	M	M
RK[I]	L	V	H	H	M	V	M	M

Table 5.6 (d) Bannow Bay SPA Subsite assessment – ranked peak intertidal foraging density for selected species (LT surveys)

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB	1	3	4			2		5
DN		4	5	3	6	1	1	
BW		7	6	4	2	5	1	3
BA	7	6	4	1	3	2		5
SU		6	7	5	4	1	3	2
OC	2	7	6	3	4	1	8	5
GP								
GV		2	3	5	4	1		
L.								
KN		2	4	3		1		
CU	8	7	5	2	3	4	1	6
RK	8	7	6	4	5	1	2	3

Table 5.6 (e) Bannow Bay SPA Subsite assessment – total numbers (roosting/other behaviour) during LT surveys (Intertidal[I], Subtidal[II], Intertidal/Supratidal combined[III]); Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods).

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB[I]	V	V	H	V		H		
PB[II]	V	V	V					
DN[I]		M	V	V	H			
BW[I]			H	V	M		H	
BA[I]			V	V	H	V		
SU[I]	M	V	M	H		V		M
OC[I]	H	M	V	L	V	V		L
GP[I]		V	H	V	H	V		
GV[I]		V	V			V		
L.[I]	H	V	M	V	V	H	H	
KN[I]			V					
CU[I]	M	V	H	M	H	V		H
RK[III]				V		V		

Table 5.6 (f) Bannow Bay SPA Subsite assessment – ranked total numbers (roosting/other behaviour) during HT survey (Intertidal[I], Subtidal[II] and Intertidal/Supratidal combined[III]) (peak rank attained across the two HT surveys)

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB[I]		1						
PB[II]	2	1	3					
DN[1]		3	2	1	2			
BW[I]		2		1	1			
BA[I]		4	3	1	2	2		
SU[II]		2	4		3			1
OC[I]	4	2	4	1	3	1		
GP[I]				1	2			
GV[III]			1	3	2	1		3
L.[I]		1	4	3	1	5		
KN[I]		3	2	1				
CU[I]	5	2	5	1	4	5	1	5
RK[III]		2	3	1				1

Bannow Bay - Waterbird Survey Programme 2009/10

Waterbird distribution - discussion notes

Where mentioned, information on benthic communities or sediment is from sampling programmes commissioned by the National Parks & Wildlife Service and Marine Institute and reported in NPWS (2011b) and ASU (2010). 'I-WeBS' refers to count data recorded at Bannow Bay as part of the Irish Wetland Bird Survey (I-WeBS).

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
Brent Geese were recorded in all surveys undertaken. Numbers were above the threshold of international importance in all surveys and peaked during low tide surveys on 12/02/10 (2,158 individuals). High tide counts of 1,203 and 1,354 were recorded for 23/01/10 and 25/02/10 respectively. Across the survey period, Brent Geese were recorded within all eight count subsites and were present within five - seven subsites during individual low tide surveys. Different subsites held peak numbers on the four low tide survey dates: 0O413, 0O416, 0O411 and 0O418 respectively. The subsite peak count of 1,286 was recorded for 0O418 (Bannow Island to Newquay) on 12/02/10.
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). The geese may also feed upon algae species, saltmarsh plants and may move to terrestrial grazing, especially as the winter season progresses. At Bannow Bay, Brent Geese foraged intertidally within five subsites overall (0O410, 0O411, 0O413, 0O418 and 0O489). 0O413 supported peak numbers on 08/10/09 when 57% of all recorded individuals occurred there, with the remainder of individuals foraging individually within 0O411 (St Kiernans to Saltmills to Big Burrow). 0O411 supported peak numbers of Brent foraging intertidally on three survey occasions (18/11/09, 16/12/09 & 12/02/10) and the second highest number on another occasion; with up to 73% of the total number foraging across the site on one occasion. It is interesting to note that this subsite contains a *Zostera noltii*-dominated community that occurs in the upper and mid shore between Gorteens and Saltmills (NPWS, 2011b). The seagrass occurs as a patchy meadow intermixed with the filamentous green alga *Ulva* sp[16] and by its nature is difficult to map with accuracy (ASU, 2010). The fact that waterbird flock position maps do not show Brent Geese to only concentrate in this one area of *Zostera noltii*, is therefore not surprising; nevertheless an association between the seagrass species and this grazing waterbird was evident. The high tide survey on 25/02/10 recorded a relatively large flock (306) of Brent foraging intertidally within 0O418 (Bannow Island to Newquay), the single largest flock recorded foraging intertidally. This subsite also held the second largest number of intertidally foraging individuals on 18/11/09. 0O413 (Saint Kiernans to Newtown) supported peak numbers of Brent Geese on 08/10/09. Fethard Bay (0O410) supported good numbers on three survey occasions. The intertidal communities of all five subsites where Brent Geese were recorded foraging intertidally are dominated by fine sediments (fine sands to silt-clay sediments) with the highest proportion of silt-clay (mud) recorded in the estuarine areas at the head of the bay (e.g. 0O489), in the intertidal flats of Gorteens (within 0O411) and to the east of Bannow Island (southern, inner section of 0O418). Although *Zostera* was only recorded from 0O411, *Ulva* sp. was recorded as being most dominant within 0O411 and 0O418 (refer to ASU, 2010). Subtidal foraging was recorded within five subsites: 0O410, 0O413, 0O416, 0O418 and 0O487, usually just a couple of individuals, the exceptions being 24 individuals within 0O410 (Fethard Bay) on 16/12/09 and 32 individuals within 0O416 (Kiltra) on 08/10/09. Bannow Bay is surrounded by relatively undisturbed agricultural grassland, and terrestrial foraging within grassland was observed regularly adjacent to 0O416, 0O417, 0O418 and 0O489 (and outside of the SPA). Grassland off 0O418 (Bannow Island to Newquay) supported 1,000 and 1,280 Brent Geese respectively on 23/01/10 and 12/02/10 (HT and LT survey). The overall peak intertidal foraging density was recorded for 0O410 (Fethard Bay) and 0O418 (Bannow Island to Newquay) which both supported 1.8 Brent Geese ha^{-1} on 18/11/09. The whole site average intertidal foraging density was 0.40 Brent Geese ha^{-1}.
Roosting Distribution
Roosting/other behaviour (intertidal) was recorded within low tide surveys and most regularly (3 surveys) within 0O410, 0O411 and 0O413. By far the largest number recorded was 201 individuals within 0O411 (St Kiernans to Saltmills to Big Burrow) on 12/02/10, positioned along the south-western shore of this subsite as it narrows towards Polfur. Subtidal roosting/other behaviour was recorded within 0O410, 0O411 and 0O413, the former two subsites with most regularity. Brent Geese were recorded roosting/other during both high tide surveys*, with a low five birds on 23/01/10 and 728 individuals on 25/02/10. On this latter occasion 0O411 (St Kiernans to Saltmills to Big Burrow) supported the highest number of roosting individuals; 643 Brent Geese at seven different locations. The largest flock (350 individuals) were positioned in the southern extent of this subsite as the site narrows towards Polfur; these birds loafed subtidally and the count was most likely an underestimate because the birds were highly clumped and difficult to count. On 23/01/10, the majority of Brent recorded were feeding terrestrially during high tide (see above). Terrestrial foraging was again recorded during the HT count on 25/02/10 when some 850 individuals foraged within grassland on Bannow Island.

*the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

[16] formerly classified as *Enteromorpha* sp.

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 85^0 E (Delaney et al. 2009). This race migrates southwest to winter along the coasts of Western Europe, south to Iberia, western Mediterranean and beyond. *C. a. alpina* originating from the western part of their breeding range moult mainly in the Wadden Sea and begin 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

Low tide numbers of Dunlin peaked on 16/12/09 (1,238 individuals); a greater number (2,438) on 25/02/10 likely the result of the inclusion of some passage birds. Numbers of all-Ireland importance were recorded in two months (December 09 and February 2010).

Overall, Dunlins were recorded within six subsites, generally four or five subsites used during individual low tide surveys. 0O416 (Kiltra) supported peak numbers on two low tide occasions (08/10/09 & 12/02/10) and the peak number during the January 2010 high tide survey. 0O418 (Bannow Island to Newquay) supported peak numbers on 18/11/09 and 0O411 (St Kiernans to Saltmills to Big Burrow) on 16/12/09.

Three subsites supported Dunlin in all four low tide surveys: 0O411, 0O413 and 0O418. The subsite peak of 2,255 Dunlins was recorded for 0O418 (Bannow Island to Newquay) on 25/02/10 (HT survey) and represented 91% of all Dunlin recorded on that day.

Foraging Distribution

Intertidal foraging was recorded within six subsites: 0O411, 0O413, 0O416, 0O417, 0O418 and 0O487 but with regularity (four surveys or more) within only four: 0O411 (St Kiernans to Saltmills to Big Burrow), 0O413 (Saint Kiernans to Newtown), 0O416 (Kiltra) and 0O418 (Bannow Island to Newquay).

0O416 supported peak numbers on 08/10/09 and 12/02/10; 0O418 (Bannow Island to Newquay) on 18/11/09 and 0O411 (St Kiernans to Saltmills to Big Burrow) on 16/12/09. 0O411 was notable in supporting peak or second highest ranked numbers in all low tide surveys. Numbers recorded in 0O413 (Saint Kiernans to Newtown) were always ranked in the top three. A large 2,225 individuals were recorded foraging intertidally during the high tide survey on 25/02/10, all located within 0O418.

The intertidal communities of the subsites of Bannow Bay are dominated by fine sediments (fine sands to silt-clay sediments) with the highest proportion of silt-clay (mud) recorded in the inner estuarine areas (i.e. 0O417, 0O416, 0O487), across 0O411, and to the east of Bannow Island (the southern, inner section of 0O418) and described by the benthic community 'fine sand with *Pygospio elegans* and *Corophium volutator'* (NPWS, 2011b). Areas with a greater proportion of silt/clay sediment appear to have been favoured by foraging Dunlin, as evident from subsite use and field mapping of the most obvious flocks. This is consistent with previous studies that have shown Dunlin to prefer sediments with a degree of sand and mud (e.g. Hill et al. 1993; Moreira, 1993; Granadeiro et al. 2004), as opposed to sites that are dominated by one (muddy) or the other (sandy). Dunlin have a relatively wide prey range including smaller polychaete worms, small size-classes of bivalves, gastropod molluscs (e.g. *Hydrobia ulvae*) and crustaceans such as *Corophium volutator* and Gammarid amphipods.

On several occasions, Dunlin occurred as part of a larger dispersed flock of mixed foraging waders within a community dominated by the seagrass *Zostera noltii* (e.g. flocks of 131 + 193 individuals on 16/12/09 and flocks of 79 + 92 on 12/02/10). This area, occurring in the upper and mid shore between Gorteens and Saltmills (NPWS, 2011b), is distinguished by the presence of high abundances of the polychaete *Ampharete acutifrons* and the oligochaete *Tubificoides benedii. Hydrobia ulvae,* the polychaete *Pygospio elegans* and *Corophium volutator* were also recorded in moderate abundances, and all could form potential prey species of Dunlin.

The peak intertidal foraging density was recorded for 0O487 (Tintern Abbey to Tintern Bridge) which supported 4.9 Dunlin ha^{-1} on 18/11/09. The whole site average intertidal foraging density was 0.86 Dunlin ha^{-1}.

Roosting Distribution

Occasional records of roosting Dunlin were made, the maximum number being 200 on 08/10/09 within 0O413 (Saint Kiernans to Newtown).

During high tide counts the majority of individuals were recorded foraging. 80 Dunlin were recorded roosting/other during the high tide survey on 23/01/10 (431 were foraging).* The high tide/roost survey on 25/02/10 recorded 209 Dunlin roosting at three locations within three subsites (0O413, 0O416 and 0O417). Of these, 50% (105 individuals) roosted within 0O416 along the north-western shoreline of this subsite.

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

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

Black-tailed Godwits *Limosa limosa* have a widespread Palearctic breeding distribution. Four populations are recognised – three populations of the nominate *L. l. limosa* and one *L. l. islandica*, the latter of which breeds almost exclusively in Iceland and winters in Britain, Ireland, Spain, Portugal and Morocco (Delaney et al. 1999).

Numbers

Numbers of Black-tailed Godwits peaked early with 5,653 individuals recorded in October 2009; a large number (5 - 6,000) had also been observed during the site recce in September 2009. From November onwards numbers ranged from 62 (18/11/09) to 390 (25/02/10). These results suggest that the early high counts comprised a large proportion of passage birds. By way of comparison, the high count of 5,653 represents c 43% of the total number of over-wintering Black-tailed Godwits supported by the Republic of Ireland.

Black-tailed Godwits were recorded in seven subsites (not in 0O410). 0O416 (Kiltra) was the only subsite to record individuals in all surveys and recorded peak numbers during all low tide surveys, including 4,615 on 08/10/09.

Foraging Distribution

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

At Bannow Bay, Black-tailed Godwits were recorded foraging intertidally within seven subsites overall (not in 0O410). 0O416 (Kiltra) supported peak numbers of foraging individuals on two occasions (18/11/09 and 12/02/10). 0O413 (Saint Kiernans to Newtown) supported peak numbers foraging (76) on 08/10/09, but rarely recorded foraging individuals again during the survey programme. 0O487 (Tintern Abbey to Tintern Bridge) supported peak numbers of foraging birds (35) on 16/12/09.

The benthic community of 0O416 (Kiltra) and a good proportion of 0O413 (Saint Kiernans to Newtown) is classified as 'fine sand with *Pygospio elegans* and *Corophium volutator'* (NPWS, 2011b). The sediment comprises largely fine material, with fine sand in samples ranging from 8% to 82%, very fine sand from 1% to 51% and silt-clay from 0.1% to 58% (NPWS, 2011b). Characterising species of this community type that may form prey of Black-tailed Godwits include the bivalve *Scrobicularia plana,* and polychaetes *Hediste diversicolor* and *Arenicola marina.* In addition, the bivalve *Macoma balthica* was recorded at all five benthic sampling stations within 0O416 subsite and *Mya arenaria* at two stations (ASU, 2010), both considered to be favoured prey species of Black-tailed Godwits (e.g. Gill et al. 2001).

The overall peak intertidal foraging density was recorded for 0O487 (Tintern Abbey to Tintern Bridge) which supported 3 Black-tailed Godwits ha^{-1} on 16/12/09. This was closely followed by 0O417 (Clonmines Castle) which supported a peak density of 2.9 Black-tailed Godwits $ha.^{-1}$ The whole site average intertidal foraging density was 0.15 Black-tailed Godwits ha^{-1}.

Roosting Distribution

A greater number of Black-tailed Godwits were recorded roosting rather than foraging on two low tide survey occasions (08/10/09 and 16/12/09). On 08/10/09, an extremely large count of 5,494 comprised all roosting birds (as opposed to 159 that were foraging), although the roosting individuals had most likely foraged before the count started (and were perhaps roosting in order to digest consumed prey before resuming foraging). 0O416 (Kiltra) supported 4,615 roosting individuals on 08/1/09 and good numbers (200) on 16/12/09 also. 0O413 and 0O417 supported 675 and 204 respectively on 08/10/09.

220 Black-tailed Godwits were recorded roosting/other on 23/01/10*, all within 0O417 (Clonmines Castle). On 25/02/10, 246 Black-tailed Godwits were recorded roosting/other. A flock of 94 roosted supratidally within 0O417 (Clonmines Castle) but the majority roosted within 0O416 (Kiltra) (106 individuals) positioned along the north-western shoreline as part of a large mixed species roost alongside saltmarsh. Smaller numbers roosted intertidally and supratidally within 0O411 (St Kiernans to Saltmills to Big Burrow).

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

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

The Bar-tailed Godwit has a widespread breeding distribution across the subarctic 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. The Wadden Sea is used by *L. l. lapponica* and other populations as a staging and moulting area in autumn and spring.

Numbers

Numbers of all-Ireland importance were recorded in all surveys and peaked during low tide surveys in February 2010 (1,050 individuals). A greater number (1,736) recorded on 25/02/10 during the high tide roost survey represents numbers of international importance, and likely includes some passage birds.

Across the entire survey period, Bar-tailed Godwits were recorded in seven of the eight subsites (not in 0O489). 0O413 (Saint Kiernans to Newtown) supported peak numbers during the first three low tide surveys. 0O416 (Kiltra) supported peak numbers during the February 2010 low tide survey and during both high tide surveys.

The overall subsite peak number (860) was recorded within 0O416 (Kiltra) on 25/02/10.

Foraging Distribution

Bar-tailed Godwits are a wader species considered characteristic of coastal wetland sites dominated by sand (e.g. Hill et al. 1993). The birds forage by probing within intertidal sediment for invertebrate species, of which polychaete worms such as Lugworm *Arenicola marina* are the most favoured (e.g. Scheiffath, 2001).

Bar-tailed Godwits at Bannow Bay foraged most regularly (three or more low tide surveys) within three subsites: 0O411 (St Kiernans to Saltmills to Big Burrow), 0O413 (Saint Kiernans to Newtown) and 0O416 (Kiltra).

0O416 (Kiltra) supported peak numbers on 08/10/09, 18/11/09 and 12/02/10, with the birds generally located in the upper third of this subsite and as part of mixed species flocks comprising Black-tailed Godwits, Dunlin amongst others. 0O413 (Saint Kiernans to Newtown) supported peak numbers on 16/12/09. Good numbers foraged within 0O411 (St Kiernans to Saltmills to Big Burrow) and 0O418 (Bannow Island to Newquay).

The benthic community of 0O416 and a good proportion of 0O413, 0O418 and 0O411 is classified as 'fine sand with *Pygospio elegans* and *Corophium volutator*' (NPWS, 2011b). The sediment comprises largely fine material, with fine sand ranging from 8% to 82%, very fine sand from 1% to 51% and silt-clay from 0.1% to 58% (NPWS, 2011b). Characterising species of this community type that are likely to form prey of Bar-tailed Godwits include polychaetes *Hediste diversicolor* and *Arenicola marina.* 0O413 and 0O411 also have areas classified as 'intertidal sand dominated by polychaetes' (NPWS, 2011b) and these are distinguished by *Nepthys cirrosa* and *N. hombergi*, both potential prey of Bar-tailed Godwits.

The overall peak intertidal foraging density was recorded for 0O416 (Kiltra) which supported 3.8 Bar-tailed Godwits ha^{-1} on 12/02/10. The second highest peak density was 1.8 Bar-tailed Godwits ha^{-1} (0O418 Bannow Island to Newquay). The whole site average intertidal foraging density was 0.56 Bar-tailed Godwits ha^{-1}.

Roosting Distribution

Relatively little roosting behaviour was recorded during low tide surveys, an exception being 202 individuals within 0O413 (Saint Kiernans to Newtown) on 08/10/09.

During the high tide survey on 23/01/10, 343 Bar-tailed Godwits roosted intertidally and the majority (89%) were within 0O416 (Kiltra) with smaller numbers within 0O417 (Clonmines Castle)*.

During the high tide survey on 25/02/10, 1,581 Bar-tailed Godwits were recorded roosting/other within four subsites. A large flock of 860 roosted along the north-western shoreline of 0O416 (Kiltra) at the edge of saltmarsh, a large mixed-species roost site comprising Bar-tailed Godwits, Dunlin, Oystercatcher, Black-tailed Godwits and Knot. A flock of 575 roosted within 0O418 at the tip of Bannow island; as the tide rose and covered the mudflats, birds moved to emergent sandbanks off the western tip of the island (within 0O411). These sandbanks are most likely an important roost area within the site as they are inaccessible and undisturbed, but these factors also result in them being difficult to observe from any of the vantage points used and as such birds are likely under-recorded.

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

Shelduck *Tadorna tadorna* - Family (group): Anatidae (ducks)
Tadorna tadorna has five known populations which breed across temperate Eurasia. The northwest Europe population breeds and winters along coasts of Britain, Ireland, Scandinavia, the Baltic and continental Europe. Although a breeding species in Ireland, Shelducks undertake a moult migration each autumn. Large moult gatherings occur along traditionally used areas of the north German coast of the Wadden Sea although several sites in Britain have also become recognised as important moulting areas such as Bridgewater Bay (Severn Estuary), the Humber Estuary, the Wash, and the Firth of Forth. Following the moult, the ducks then migrate to wintering areas.
Numbers
Numbers of Shelduck rose from 36 individuals during October 2009 to a peak of 393 on 16/12/09. 225 and 354 Shelduck were counted during the high tide surveys on 23/01/10 and 25/02/10 respectively. Apart from the October 2009 survey, all other counts represented numbers of all-Ireland importance. Shelduck were recorded within all eight subsites across the survey programme. They were recorded with most regularity (four surveys or more) within 0O416, 0O417, 0O418 and 0O489. 0O418 (Bannow Island to Newquay) supported peak numbers within five of the six surveys with proportions of total numbers ranging from 50% to 96%. 0O416 (Kiltra) held peak numbers (34) on 08/10/09. 0O411 (St Kiernans to Saltmills to Big Burrow) held good numbers on three survey occasions (peak number 108 on 25/02/10) and 0O489 (Polfur) held smaller numbers on four survey occasions (max number 27).
Foraging Distribution
Shelducks can forage in a variety of ways from scything their bill through wet mud on exposed tidal flats, to dabbling and scything in shallow water and up-ending in deeper waters. They can therefore forage throughout the tidal cycle. Their diet consists mainly of small intertidal molluscs, worms and arthropods that are sifted from the top layer of the sediment and the Mud Snail *Hydrobia ulvae* is thought to make a significant proportion of the diet (e.g. Bryant & Leng, 1975, Murphy et al. 2006). At Bannow Bay, 0O418 (Bannow Island to Newquay) supported peak numbers foraging intertidally on three survey occasions: 18/11/09, 16/12/09 and 12/02/10. 0O416 (Kiltra) held peak numbers (34) foraging intertidally on 08/10/09. Thereafter, smaller numbers were observed irregularly within a further five subsites: 0O411, 0O413, 0O417, 0O487 and 0O489. Subtidal foraging was only recorded during high tide surveys. On both occasions 0O418 (Bannow Island to Newquay) supported over 90% of all recorded, with smaller numbers in 0O417 and 0O489. Examination of core sample data for Bannow Bay (ASU, 2010) reveals that the Mud Snail *Hydrobia ulvae* was common across the site but was found in greatest numbers in three samples taken from 0O418 and 0O411, with the highest total numbers (335 individuals from five core samples) within 0O418. The overall peak intertidal foraging density was recorded for 0O418 (Bannow Island to Newquay) which supported 3.4 Shelduck ha^{-1} on 12/02/10. The whole site average intertidal foraging density was 0.20 Shelduck ha^{-1}.
Roosting Distribution
Over 50 Shelduck roosted intertidally on two low tide survey dates within 0O411 (St Kiernans to Saltmills to Big Burrow). 0O418 (Bannow Island to Newquay) also recorded good numbers roosting intertidally on three survey occasions. The high tide survey on 23/01/10* only recorded a single roosting individual. On 25/02/10, 120 Shelduck roosted at four locations within three subsites (0O411, 0O416, 0O489). The largest single number (77) roosted supratidally just west of Oyster Point in 0O411, a mixed species roost also comprising Black-tailed Godwits, Oystercatcher and Redshank. A further 33 individuals roosted supratidally (9) and subtidally (24) within 0O489 (Polfur).

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

Pintail *Anas acuta* - Family (group): Anatidae (ducks)
The Pintail has a Holarctic distribution breeding widely over northern temperate and arctic zones. Although there is a small population breeding within Ireland, the main numbers that winter in Ireland come from breeding grounds from Iceland eastwards through Fennoscandia to western Russia (Wernham et al. 2002). Wintering Pintail primarily within inhabit estuaries or coastal brackish lagoons.
Numbers
Pintail were not recorded at Bannow Bay during the 2009/10 Waterbird Survey Programme. The I-WeBS database shows that this species was last recorded at the site during the winter of 2005/06.

Oystercatcher *Haematopus ostralegus* - Family (group): Haematopodidae (wading birds)
Haematopus ostralegus is polytypic; four subspecies are recognised of which only two occur within western Europe and Africa (Delaney et al. 2009). The nominate race breeds in western and northern Europe as far as Iceland, Norway and Finland and includes those birds that breed within Ireland. Irish-breeding birds are partial migrants, some moving south during winter while others remain on the Irish coast. Wintering birds are supplemented by breeding birds from Iceland and the Faeroe Islands (Wernham et al. 2002).
Numbers
Whole site numbers peaked in October 2009 when 1,477 Oystercatchers were counted, representing numbers of all-Ireland importance. 561 individuals were recorded during the high tide survey on 23/01/10 and 1,676 during the high tide survey on 25/02/10. Given that the January high tide count was beset by poor visibility, and particularly in the outer sections of the bay where a lot of Oystercatchers roost, the February high tide count is considered a better reflection of numbers present. Oystercatchers were recorded in all eight subsites and seven subsites supported the species in all four low tide surveys. Different subsites held peak numbers during the four low tide surveys: 0O416, 0O418, 0O413 and 0O418 respectively. The subsite peak count of 688 was recorded for 0O418 (Bannow Island to Newquay) on 18/11/09, and represented numbers of all-Ireland importance.
Foraging Distribution
Oystercatchers are large wading birds that forage primarily on tidal flats although the species can be found foraging along non-estuarine coastline or terrestrially for earthworms. On tidal flats their food consists of Cockles (*Cerastoderma edule*), Blue Mussels (*Mytilus edulis*) and to a lesser degree other bivalve molluscs such as *Macoma balthica*, *Scrobicularia plana* and *Mya arenaria* as well as larger polychaetes such as *Arenicola marina* and *Hediste diversicolor.* Cockles and Mussels are favoured prey items and '*universally important during winter*' (Zwarts et al. 1996a) because these bivalves live in the upper sediment and are nearly always accessible, although it is now known that individual birds may be specialised by way of morphology with regards choosing one or the other of these prey items and their methods of handling them. Oystercatchers were recorded foraging within all eight subsites at Bannow Bay. 0O418 (Bannow Island to Newquay) held peak numbers foraging intertidally on three occasions (18/11/09, 16/12/09 & 12/02/10), field records suggesting the birds were scattered widely across this subsite. 0O416 (Kiltra) held peak numbers foraging intertidally on 08/10/09. Good numbers were also recorded within 0O410, 0O411, 0O413 and 0O417. 0O489 (Polfur) supported lower numbers during all four low tide surveys. The intertidal benthic community of Bannow Bay is dominated by a broad community classified as 'fine sand with *Pygospio elegans* and *Corophium volutator*' (NPWS, 2011b). Sandier parts are classified as 'intertidal sand dominated by polychaetes,' this occurring along the southern stretches of 0O413 and 0O411 and across the north of subsite 0O418. The bivalves *Scrobicularia plana* and *Tellina tenuis* are distinguishing species of the two broad habitat types respectively. Examination of core sample data for the site reveals that the Cockle *Cerastoderma edule* was abundant, particularly in muddy sand to the north and east of Bannow island (southern sections of 0O411 and 0O413) and northern section of 0O418 and assigned the biotope LS.LSa.MuSa.CerPo - *Cerastoderma edule* and polychaetes in littoral muddy sand[17] (ASU, 2010). Mussels (*Mytilus edulis*) were recorded to a lesser degree across the site although they are present in association with a seagrass *Zostera noltii* bed within 0O411. Terrestrial foraging was recorded adjacent to six subsites: 0O410, 0O413, 0O416, 0O417 & 0O418 (outside of SPA boundary) Terrestrial foraging was recorded most frequently during the high tide surveys although the numbers of individuals recorded were relatively low in relation to the total numbers (that were mostly roosting) recorded on those days. The overall peak intertidal foraging density was recorded for 0O418 (Bannow Island to Newquay) which supported 9 Oystercatchers ha^{-1} on 18/11/09. The second highest density recorded was 3.8 Oystercatchers ha^{-1} (0O410 Fethard Bay). The whole site average intertidal foraging density was 0.96 Oystercatchers ha^{-1}.
Roosting Distribution
Large numbers of Oystercatchers were at times observed roosting/other during low tide surveys, for example 235 Oystercatchers within 0O410 (Fethard Bay) on 25/02/10, and a further 310 on the same day within 0O418 (Bannow Island to Newquay). 0O413 (Saint Kiernans to Newtown) supported large numbers on two occasions: 156 on 08/10/09 and 300 on 16/12/09. 351 Oystercatchers roosted intertidally during the high tide survey of 23/01/10* and 0O416 (Kiltra) held peak numbers (112). On 25/02/10 1,510 Oystercatchers roosted at 12 different locations within five subsites (0O410, 0O411, 0O413, 0O416 and 0O418). The largest single roost was 885 Oystercatchers that roosted intertidally (along with Bar-tailed Godwits) at the tip of Bannow island; as the tide rose and covered the mudflats, birds moved to emergent sandbanks off the western tip of the island (within 0O411). These sandbanks are most likely an important roost area within the site as they are inaccessible and undisturbed, but these factors also result in them being difficult to observe from any of the vantage points used and as such birds are likely under-recorded. On the same day, 0O411 supported the second largest number of roosting individuals, 366 Oystercatchers across four separate roost sites. In addition, 147 Oystercatchers roosted along the north-western shoreline of 0O416, a large mixed species roost alongside the saltmarsh that also held Dunlin, Black-tailed Godwits, Bar-tailed Godwits, Curlew, Grey Plover and Redshank (total count of roosting birds: 1,909 birds).

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

[17] Marine Biotope Classification of Britain and Ireland (Connor *et al.,* 2004).

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

The Eurasian Golden Plover is a Palearctic species, occurring mainly at higher latitudes of Western Europe to north-central Siberia and wintering south in Europe, north Africa and parts of Asia. Two subspecies are currently described. *P. a. altifrons* is the 'northern' form and breeds at high latitudes in Western Eurasia from Iceland and the Faeroes across northern Scandinavia to 125^{0}E in the north Siberia lowlands south of Taymyr (Delaney et al. 2009). The nominate *P. a apricaria* breeds at more southerly latitudes including Ireland and Britain and migrates south for winter. Golden Plovers that winter in Ireland are thought to be mostly Icelandic-breeding birds *P. a. altifrons* (Wernham et al. 2002).

Numbers

Total numbers of Golden Plover varied greatly across the months which is not unusual given the species tendency to move between coastal wetland sites and agricultural grassland foraging areas. Very low numbers in January/February 2010 were likely related to the cold weather event as evidenced by I-WeBS data for this period (Crowe et al. 2011). The peak number of Golden Plover recorded was 3,517 on 16/12/09 surpassing the threshold for all-Ireland importance.

Golden Plovers were recorded in six subsites overall (0O411, 0O413, 0O416, 0O417, 0O418 & 0O489).

0O418 (Bannow Island to Newquay) supported peak numbers (3,250) on 08/10/09. 0O416 (Kiltra) supported peak numbers on 18/11/09 and 12/02/10; and 0O411 (St Kiernans to Saltmills to Big Burrow) supported peak numbers on 16/12/09.

The subsite peak count was 3,500 (0O418 (Bannow Island to Newquay on 16/12/09)).

Foraging Distribution

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

Apart from a single individual on two occasions (subsites 0O411 and 0O489), Golden Plovers were not recorded foraging intertidally during low tide surveys.

456 Golden Plover were recorded foraging terrestrially adjacent to 0O413 (Saint Kiernans to Newtown) during the high tide survey on 25/02/10 (outside of SPA boundary) which accounted for 90% of all individuals recorded on that date. This was the only record of terrestrial foraging made, although this is likely to be a regular activity around the site.

Roosting Distribution

Significant numbers of intertidally-roosting Golden Plovers were recorded on two occasions. 3,250 were recorded within 0O418 (Bannow Island to Newquay) on 08/10/09, and 3,500 were recorded within 0O411 (St Kiernans to Saltmills to Big Burrow) on 16/12/09.

0O416 (Kiltra) supported smaller numbers roosting intertidally on three low tide survey occasions, including 312 individuals on 18/11/09. Both 0O416 and 0O418 supported roosting Golden Plovers on three survey occasions.

During the high tide survey on 23/01/10,* 53 Golden Plovers were recorded roosting across three subsites and the majority (79%) were within 0O416 (Kiltra). No roosting individuals were recorded during the roost/HT survey on 25/02/10 but 503 were recorded foraging on this day within grassland fields off 0O418 (Bannow Island to Newquay).

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

Grey Plover *Pluvialis squatarola* - Family (group): Charadriidae (wading birds)
The Grey Plover is generally considered a monotypic species and has a holarctic breeding distribution across the tundra of Eurasia and North America (Delaney et al. 2009). The species migrates from breeding areas to a very wide wintering range extending to the coastlines of Africa, south and east Asia, Australasia and South America (BWPi, 2004). In Ireland, Grey Plovers occur as both passage and wintering birds and are thought to originate from Russian breeding populations (Wernham et al. 2002).
Numbers
Whole site numbers of Grey Plovers were variable but surpassed the threshold of all-Ireland importance on four survey occasions (08/10/09, 18/11/09, 12/02/10 and 25/02/10). The peak number during a low tide survey was 118 Grey Plovers on 08/10/09; the peak overall was 232 individuals on 25/02/10. Grey Plovers were recorded in a total six subsites throughout the entire survey programme. Only two subsites supported the species during all four low tide surveys: 0O413 (Saint Kiernans to Newtown) and 0O418 (Bannow Island to Newquay). These two subsites, plus 0O411 (St Kiernans to Saltmills to Big Burrow) supported peak numbers during low tide surveys. The low tide subsite peak was 83 individuals within 0O418 (Bannow Island to Newquay) on 18/11/09; this subsite also supporting the peak high tide number (221) on 25/02/10.
Foraging Distribution
During winter Grey Plovers forage mainly 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). Three subsites supported foraging Grey Plover with most regularity (four surveys or more) as follows: 0O413, 0O416 and 0O418. 0O418 (Bannow Island to Newquay) supported peak numbers on 08/10/09 and 18/11/09; 0O413 (Saint Kiernans to Newtown) on 16/12/09, and 0O411 (St Kiernans to Saltmills to Big Burrow) on 12/02/10. 0O416 (Kiltra) held smaller numbers on three LT survey occasions. Grey Plovers, that can be territorial when foraging, were generally scattered widely across subsites. The intertidal benthic community of Bannow Bay is dominated by a broad community classified as 'fine sand with *Pygospio elegans* and *Corophium volutator'* (NPWS, 2011b) which is assigned to all of 0O416, the southern, inner section of 0O418 and northern parts of 0O413. Sandier areas are classified as 'intertidal sand dominated by polychaetes,' this community occurring along the southern stretches of 0O413 and 0O411 and across the north of subsite 0O418. The overall peak intertidal foraging density was recorded for 0O418 (Bannow Island to Newquay) which supported 1 Grey Plover ha^{-1} on 18/11/09. The whole site average intertidal foraging density was 0.07 Grey Plovers ha^{-1}.
Roosting Distribution
During low tide surveys, relatively few Grey Plovers were recorded in roosting/other behaviour. Seven individuals roosted during the high tide survey on 23/01/10*. 232 Grey Plover roosted during the high tide survey on 25/02/10 when the majority (95%) were located along the southern shoreline of 0O0O418 (Bannow Island to Newquay). A further eight individuals roosted within 0O417 (Clonmines Castle) along its western shoreline while three individuals roosted as part of the large mixed-species roost along the northwest shoreline of 0O416 (Kiltra).

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

Lapwing *Vanellus vanellus* - Family (group): Charadriidae (wading birds)
The Lapwing is a monotypic species and has a wide Palearctic breeding distribution from Britain and Ireland in the west to Eastern and southern Siberia in the east with a southern limit extending into Spain (Delaney et al. 2009). Birds breeding in Britain and Ireland are partial migrants with some residing over winter and some migrating south. The wintering population is enhanced by Lapwings moving in from continental Europe and northern and western Britain (Wernham et al. 2002). Cold weather movements can result in a greater flux of birds to Ireland's estuaries.
Numbers
Whole site numbers of Lapwing peaked in December 2009 (3,401 individuals) representing numbers of all-Ireland importance; this threshold also surpassed in November 2009 and January 2010. Across the survey programme, Lapwings were recorded within seven of the eight subsites (not in 0O489). Five subsites recorded the species in all surveys undertaken: 0O411, 0O413, 0O416, 0O417 and 0O418. 0O417 (Clonmines Castle) supported peak numbers during three low tide surveys (08/10/09, 16/12/09 & 12/02/10) and during both high tide surveys. 0O416 (Kiltra) supported peak numbers on 18/11/09. The subsite peak count of 1,438 Lapwings was recorded for 0O417 (Clonmines Castle) on 16/12/09.
Foraging Distribution
Lapwings are traditionally 'inland' waders. During winter they can be observed across a wide variety of habitats, principally using lowland farmland and freshwater wetlands (e.g. turloughs and callows) but also coastal wetlands where they feed on a variety of soil and surface-living invertebrates. They are opportunistic and mobile birds and will readily exploit temporary food sources such as newly-ploughed fields. Estuaries are typically used as roosting areas where large flocks may be observed roosting upon the tidal flats but coastal areas will also be used to a greater degree during cold weather events when farmland and freshwater habitats freeze over. There is evidence in the UK that utilisation of coastal habitats has increased, coupled with an increase in intertidal feeding (Gillings et al. 2006). At Bannow Bay, relatively little intertidal feeding was observed up to January 2010, the maximum at any time being 122 Lapwing foraging within 0O417 (Clonmines Castle) on 08/10/09. In February 2010, and likely linked to the cold weather event which would lead to terrestrial foraging areas being frozen over, 533 Lapwings foraged intertidally across five subsites. The majority were located within 0O417 (Clonmines Castle) where 378 individuals represented 71% of the total number counted across the site. 238 Lapwings foraged supratidally within 0O417 (Clonmines Castle) during the high tide survey on 23/01/10. Terrestrial foraging was observed adjacent to 5 subsites: 0O411, 0O413, 0O416, 0O417 and 0O418 (outside of SPA boundary). This activity was most abundant during the high tide survey on 23/01/10 when 484 Lapwings foraged across land adjacent to three subsites (0O416, 0O417 and 0O418) (23% of the total number recorded during that survey).
Roosting Distribution
Large aggregations of Lapwings were recorded roosting across the site including 1,438 within 0O417 (Clonmines Castle) on 16/12/09, 1,350 within 0O416 (Kiltra) on 18/11/09 and 1,026 within 0O411 (St Kiernans to Saltmills to Big Burrow) on 16/12/09. Intertidal roosting was observed regularly (four or more surveys) within four subsites: 0O411, 0O413, 0O416 and 0O418. Peak numbers roosting intertidally were recorded for 0O416 (Kiltra), 0O416 (Kiltra), 0O417 (Clonmines Castle) and 0O411 (St Kiernans to Saltmills to Big Burrow), for the four low tide surveys respectively. The high tide survey on 23/01/10* recorded 1,033 Lapwings roosting within intertidal habitat. A further 242 were observed roosting terrestrially adjacent to 0O411 and 0O417. On 25/02/10, 483 Lapwings roosted at two locations within two subsites: 0O411 and 0O417. 90 Lapwings roosted intertidally within 0O411 with a further 393 roosting supratidally in 0O417 (0O417 (Clonmines Castle). In addition, 140 Lapwings roosted terrestrially, outside of the count area and SPA, but adjacent to 0O487 (Tintern Abbey to Tintern Bridge).

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

Knot *Calidris canutus* - Family (group): Scolopacidae (wading birds)

Knot are a high Arctic breeding species. Two populations are recognised in Western Eurasia and Africa - *C. c canutus* and *C. c. islandica*. The latter breeds in north and east Greenland and northern Canada and winters in north-west Europe. Ireland supports a relatively small proportion of the total population during winter (c5%). The Wadden Sea is an important staging ground for the species after a non-stop flight from the breeding grounds (Van der Kam, 2004).

Numbers

Whole-site numbers of Knot peaked during low tide surveys with 329 individuals on 12/02/10. The low number (3) recorded on the January 2010 high tide survey was possibly linked to the poor counting conditions (see Cummins & Crowe, 2010). The second high tide count on 25/02/10 recorded 866 individuals. Three surveys (December 2009 & January/February 2010 recorded numbers of all-Ireland importance.

Knot were recorded within five subsites overall: 0O411, 0O413, 0O416, 0O417 and 0O418. Peak numbers during low tide surveys were supported by 0O416 (Kiltra), 0O418 (Bannow Island to Newquay) (twice) and 0O411 (St Kiernans to Saltmills to Big Burrow).

The subsite peak number was 272 Knot recorded within 0O411 (St Kiernans to Saltmills to Big Burrow) on 12/02/10.

Foraging Distribution

Knots forage across mud and sandflats, pecking visible prey items off the surface or probing to the depth that their bill (3.5cm) allows. The preferred prey items are bivalve molluscs including *Scrobicularia plana, Macoma balthica* and *Mytilus edulis* of smaller size-classes that are able to be swallowed (shell length in the range 6 – 16mm depending on bivalve species and shape of shell) (Dekinga & Pierma, 1993). *Hydrobia ulvae* may also be an important prey at some sites (Moreira, 1994).

At Bannow Bay, Knots foraged with most regularity (four surveys, LT & HT combined) within 0O418 (Bannow Island to Newquay) and 0O411 (St Kiernans to Saltmills to Big Burrow). 0O418 (Bannow Island to Newquay) supported peak numbers on 18/11/09 and 16/12/09 (89 and 183 individuals respectively). 0O411 (St Kiernans to Saltmills to Big Burrow) supported peak numbers (272) on 12/02/10. 0O416 (Kiltra) supported peak numbers (106) on 08/10/09.

The intertidal benthic community of Bannow Bay is dominated by a broad community classified as 'fine sand with *Pygospio elegans* and *Corophium volutator'* (NPWS, 2011b) which is assigned to the southern, inner section of 0O418, parts of 0O411 and all of 0O416. The bivalve *Scrobicularia plana* occurs as a distinguishing species of this community. Sandier intertidal areas are classified as 'intertidal sand dominated by polychaetes,' this community occurring along the southern part of 0O411 and across the north of subsite 0O418. On more than one occasion, good numbers of Knot foraged within 0O411 within a *Zostera noltii* community that occurs along the upper and mid shore between Gorteens and Saltmills (NPWS, 2011b). This has a diverse associated fauna including high abundances of the polychaete *Ampharete acutifrons* and the oligochaete *Tubificoides* benedii, as well as the Mud Snail *Hydrobia ulvae, and* bivalves *Scrobicularia plana* and *Macoma balthica.*

The overall peak intertidal foraging density was recorded for 0O418 (Bannow Island to Newquay) which supported 2.4 Knot ha^{-1} on 16/12/09. The whole site average intertidal foraging density was 0.25 Knot ha^{-1}.

Roosting Distribution

Knot were recorded roosting intertidally within 0O413 (Saint Kiernans to Newtown) on two survey dates but only small numbers of individuals were involved (13 and one individual respectively).

During the high tide survey on 25/02/10, 131 Knot were recorded roosting within three subsites. 0O416 (Kiltra) supported the greatest proportion (50%), these birds part of the large mixed-species roost along the north-western shoreline of this subsite. A further 40 Knot roosted intertidally adjacent to saltmarsh in the north-west part of 0O413 (Saint Kiernans to Newtown). 26 Knot roosted intertidally (backed by saltmarsh) just west of St Kierans Quay in 0O411.

Curlew *Numenius arquata* - Family (group): Scolopacidae (wading birds)
The Curlew has a widespread breeding range across temperate latitudes of the Palearctic region, occurring across Europe and Asia from Ireland in the west to northern China in the east (Delaney et al. 2009). The nominate subspecies breeds across Europe and winters in Europe. Ireland supports a small and declining population of breeding Curlew. Irish breeding Curlew are thought to make only short migrations, many resident during winter. Wintering numbers are enhanced by birds moving in from breeding grounds in Fennoscandia, the Baltic and northwest Russia (Delaney et al. 2009).
Numbers
Numbers of Curlew during low tide surveys peaked on 08/10/09 (824 individuals). The high tide peak of 1,043 was recorded on 25/02/10. Both low and high tide peak counts surpassed the threshold of all-Ireland importance. Curlew had a widespread distribution across the site, occurring in all eight subsites. 0O416 (Kiltra) supported peak numbers during the first three low tide surveys, 0O418 (Bannow Island to Newquay) supported peak numbers on 12/02/10. 0O411 (St Kiernans to Saltmills to Big Burrow) supported good numbers in all surveys with numbers always ranked in the top three. A further four subsites supported Curlew in all low tide surveys undertaken: 0O413, 0O417, 0O487 and 0O489.
Foraging Distribution
Curlews are the largest intertidal wader to spend the non-breeding season within Ireland. Within intertidal areas they seek out larger prey items such as crabs, large worms and bivalves and their de-curved bill is ideally suited to extracting deep-living worms such as Lugworms (*Arenicola marina*). Curlews also feed amongst damp grasslands where they take terrestrial worms. At Bannow Bay, six subsites supported foraging Curlews during all low tide surveys: 0O411, 0O413, 0O416, 0O418, 0O487 and 0O489. However 0O416 (Kiltra) was clearly favoured – supporting peak numbers during the first three low tide surveys and the second highest during the final low tide survey. 0O418 (Bannow Island to Newquay) supported peak numbers foraging intertidally on 25/02/10. 0O411 (St Kiernans to Saltmills to Big Burrow) was notable in supporting good numbers of foraging individuals in all surveys with numbers always ranked in the top three. The intertidal benthic community of Bannow Bay is dominated by a broad community classified as 'fine sand with *Pygospio elegans* and *Corophium volutator'* (NPWS, 2011b) which is assigned to all of 0O416, the southern, inner section of 0O418, and parts of 0O411. Sandier intertidal areas are classified as 'intertidal sand dominated by polychaetes,' this community occurring along the southern part of 0O411 and across the north of subsite 0O418. Although Lugworms (*Arenicola marina*) were relatively rare within benthic core samples, signs of their presence (casts) were recorded relatively widely (11 sampling stations) across the middle of the site (0O416, 0O413, 0O411 and 0O418). The large polychaete *Nephtys hombergii* was also a dominant feature of the infauna, recorded at 12 sampling stations (ASU, 2010). Terrestrial foraging was observed adjacent to 5 subsites: 0O413, 0O416, 0O417, 0O418 and 0O487 (outside of SPA boundary). A maximum 190 Curlews were counted foraging terrestrially during the final high tide survey on 25/02/10. The overall peak intertidal foraging density was recorded for 0O487 (Tintern Abbey to Tintern Bridge) which supported 3.5 Curlews ha^{-1} on 12/02/10. The second highest density recorded was 1.5 Curlews ha^{-1} (0O416, Kiltra). The whole site average intertidal foraging density was 0.4 Curlews ha^{-1}.
Roosting Distribution
Curlews were recorded in roosting/other behaviour across all eight subsites. Peak numbers during low tide surveys were recorded for 0O411 (St Kiernans to Saltmills to Big Burrow) (08/10/09, 18/11/09, 16/12/09) and 0O418 (Bannow Island to Newquay) (12/02/10). During the January 2010* high tide survey, 253 Curlews roosted across four subsites (0O411, 0O416, 0O417 & 0O487) and 0O487 (Tintern Abbey to Tintern Bridge) supported the greatest number (110). On 25/02/10, 672 Curlew roosted at six positions within four subsites. The largest single roost was 562 Curlew which formed part of a large mixed-species roost positioned along the northwest shoreline of 0O416 (Kiltra). 100 Curlew roosted along the eastern edge of the island within 0O417 (Clonmines Castle). A few individuals roosted within 0O411 and 0O489.

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

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
Total numbers of Redshanks peaked early in October 2009 (908 individuals) and surpassed the threshold of all-Ireland importance. Numbers recorded on 18/11/09 and 12/02/10 were also of all-Ireland importance. Redshanks were widespread and recorded within all eight subsites during all low tide surveys. Low tide peak numbers were recorded for 0O418 (Bannow Island to Newquay) on three survey dates (08/10/09, 18/11/09 & 12/02/10) and 0O411 (St Kiernans to Saltmills to Big Burrow) on 16/12/09. The peak subsite count of 370 Redshanks was recorded within 0O418 (Bannow Island to Newquay) on 18/11/09.
Foraging Distribution
Redshanks forage mainly by pecking at the surface or probing within intertidal mudflats; favouring the muddier sections of sites (e.g. Rehfisch et al. 2000) where they prey upon species such as the Ragworm *Hediste diversicolor* or Mud Snail *Hydrobia ulvae.* A particularly favoured prey is the burrowing amphipod *Corophium volutator.* Redshanks were recorded foraging within all eight subsites across the survey programme. 0O418 (Bannow Island to Newquay) held peak numbers on 08/10/09 and 18/11/09 (308 and 370 Redshanks respectively) and on 12/02/10 (202 foraging individuals) plus the highest recorded intertidal foraging density (see last paragraph below). 0O411 (St Kiernans to Saltmills to Big Burrow) recorded peak numbers of foraging Redshanks on 16/12/09, closely followed by 0O418. Both 0O418 and 0O411 supported good numbers in other low tide surveys also. Also of note were 0O413 (Saint Kiernans to Newtown) and 0O416 (Kiltra) which always supported good numbers. The intertidal benthic community of Bannow Bay is dominated by a broad community classified as 'fine sand with *Pygospio elegans* and *Corophium volutator*' (NPWS, 2011b). The sediment is largely that of fine material, with fine sand in samples ranging from 8% to 82% and silt-clay from 0.1% to 58%. Muddier parts of the site (areas with the highest proportion of silt-clay particles) were recorded in the estuarine areas at the head of the bay (0O417) and in 0O487 and 0O489, across parts of 0O411 and to the east of Bannow Island (southern section of 0O418). This community complex is distinguished by the polychaete *Pygospio elegans* and the amphipod *Corophium volutator,* the latter a favoured prey of Redshank. Highest abundances of *Corophium* were found at sampling stations 1-5 in the head of Bannow Bay (0O417 (1) and 0O416 (2-5) so there is no clear association, based on the data collected, between higher abundances of *Corophium volutator* and greater numbers of Redshank. But *Corophium* was a relatively widespread species across the site, recorded at 54% of core sampling stations, and based on core data, Redshank at Bannow Bay would have a diversity of prey options including a variety of smaller polychaete worms and the Mud Snail *Hydrobia ulvae*. *H. ulvae* is highly sought when in abundance and occurred at 58% of core sampling stations across the site and in numbers of up to 14,800 m^2, considered superabundant on the marine SACFOR abundance scale[18]. The overall peak intertidal foraging density was recorded for 0O418 (Bannow Island to Newquay) which supported 4.9 Redshank ha^{-1} on 18/11/09. The second highest density recorded was 2.7 Redshank ha^{-1} (0O487: Tintern Abbey to Tintern Bridge). The whole site average intertidal foraging density was 0.67 Redshank ha^{-1}.
Roosting Distribution
Very few Redshanks were recorded roosting within low tide surveys, the exception being 50 individuals within 0O418 and 30 within 0O416 on 08/10/09. Only one single Redshank was recorded during the high tide survey on 23/01/10.* 111 Redshanks roosted across three subsites during the high tide survey on 25/02/10; 62 individuals within 0O416 and 49 Redshank within 0O411 (Kiltra). Those in 0O416 were part of the large mixed-species roost positioned along the northwest shoreline.

* the high tide survey on 23/01/10 was affected by fog; refer to Cummins & Crowe (2010)

[18] As adopted by the Marine Nature Conservation Review and used in relation to marine biotope mapping (Connor et al. 2004)

5.4 Bannow 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, 2010). 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 relates to not only 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 of the Conservation Advice Notes provides information on activities and events that occur in and around Bannow Bay SPA 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, Wexford County Development Plan (Wexford County Council, 2007), South Eastern River Basin District documents (e.g. SERBD, 2010a) and other available documents relevant to the ecology of the site.

Information on 'activities' and 'events' across the site was collected and categorised based on the standard EU list of pressures and threats as used in Article 17 reporting under the EU Habitats 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 saltmarsh plant species *Spartina anglica*.

In addition, information was collected during the 2009/10 waterbird survey programme (NPWS, 2010) 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 30+ hours of coordinated surveyor effort across the SPA site. All activities and events 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.

Data are presented in three ways:-

1. Activities and events identified to occur in and around Bannow Bay SPA (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 in and around Bannow Bay SPA

U known to occur but unknown spatial area hence all potential subsites are included (e.g. fisheries activities).
H historic, known to have occurred in the past.
P potential to occur in the future.

2. Of the activities and events identified to occur in and around Bannow Bay SPA, those that have the potential to cause disturbance to waterbirds (either directly or indirectly) are highlighted.

3. Data from the 2009/10 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 11.

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 Bannow Bay

Activities and events identified to occur across Bannow Bay SPA are shown in Appendix 9. Activities highlighted in grey have the potential to cause disturbance to waterbirds (see Section 5.4.4).

Bannow Bay is a relatively large, shallow and sheltered estuary, its narrow entrance bounded to the west by sand dunes and to the east by Bannow Island. Landuse surrounding the site is predominantly agricultural with livestock grazing and tillage dominating. The site is relatively isolated, the main settlements bordering the site are Wellingtonbridge, at the estuary head, and Saltmills to the south-west of the site, both relatively small villages with populations of

less than 250 (DoEHLG, 2009). Fethard-on-Sea lies at the south-eastern extremity of the site and is a small fishing village and holiday resort.

Two rivers, the Owenduff and Corock, discharge into the head of the bay, within smaller freshwater inputs from Tintern Stream in the west and several other small streams from the east.

Various fishing activities occur within and adjacent to the site (detail of spatial scale unknown). Static fishing gear activity in the area includes line fishing, tangle nets and the use of pots (DoEHLG, 2009). Mobile fishing (otter trawls) occurs to the south, beyond the SPA boundary.

Hand-gathering of edible molluscs (e.g. Periwinkles *Littorina littorea*) occurs and was recorded within subsites 0O410 and 0O411 during the 2009/10 surveys. Bait-digging also occurs and was recorded within three subsites (0O410, 0O411 and 0O418).

An area of 1.7km^2 of Bannow Bay is designated as a Shellfish Water under the EU Shellfish Waters Directive[19] (No. 11) (DoEHLG, 2009). The designated shellfish cultivation area is located within part of count subsites (0O411 and 0O413). The shellfish cultivated are Oysters (*Crassostrea gigas*) and Mussels (*Mytilus edulis*) (DoEHLG, 2009).

The Sea Fisheries Protection Authority is responsible for classifying shellfish production areas and the current classification of the Bannow Bay Bivalve Mollusc Production Area (an area enclosed by a line drawn between Ingard point and Clammer's Point) is Class B, as of 15th July 2011 (www.sfpa.ie). This means that shellfish may be placed on the market for human consumption only after treatment in a purification centre or after relaying, so as to meet the health standards for live bivalve molluscs laid down in EC Regulations on food safety[20].

The water quality of Bannow Bay is as yet unclassified according to the South Eastern River Basin District Transitional and Coastal Waters Action Plan (SERBD, 2010a). The main inflowing waters are classified as good (R. Owenduff), moderate (R. Corock) and poor (Tintern Stream); the latter based on a Q-value of 3 with a high degree of siltation (SERBD, 2010b).

Coastal and marine leisure activities at the site are largely concentrated around Bannow beach and Big Burrow dunes. General beach activities occur including walking and horse-riding. Leisure fishing occurs within the site and wider coastal area, with shore fishing either side of the narrow mouth to the bay (SRFB, 2008). A sea angling club based at Wellingtonbridge. The bay is navigable by small vessels only and with great care and local knowledge, because sandbanks across the tidal inlet are prone to shifting.

Saltmarsh habitat is present at various places around the site including extensive areas to the west of 0O417/0O416 (Clonmines Castle/Kiltra), inner 0O413 (St Kiernans to Newtown) and 0O418 (Bannow Island). McCorry & Ryle (2009) reported few damaging impacts upon saltmarsh habitats they monitored at Bannow Island but noted that the invasion of *Spartina anglica* was a major impact. *Spartina* was first recorded in Bannow Bay in the 1960's (Nairn, 1986) but there is no information to indicate whether it was planted or naturally colonised (McCorry & Ryle, 2009b). *Spartina* occurs in all except one of the count subsites surveyed for the 2009/10 waterbird survey programme.

[19] European Communities (Quality of Shellfish Waters) (Amendment) Regulation 2009 (SI 55 of 2009).

[20] Criteria for the classification of bivalve mollusc harvesting areas under Regulation (EC) No 854/2004, Regulation (EC) 853/2004 and Regulation (EC) 2073/2005.

Wildfowling was recorded irregularly at the site during the 2009/10 Waterbird Survey Programme. January 2010 was the coldest January for 25 years (Met Éireann (2010)) and in response to the freezing conditions, the Department of the Environment, Heritage and Local Government extended a temporary closure of the hunting season for wild birds (6th January 2010 to 20th January 2010).

5.4.4 Disturbance Assessment

Of the activities and events known to occur across Bannow Bay (Appendix 9), those that have the potential to cause disturbance to waterbirds are highlighted in grey.[21]

Based on this dataset, 0O411 (Fethard Bay) has the highest number of activities that have the potential to cause disturbance, related to human recreation (e.g. walking, horse riding, sailing), as well as coastal activities such as bait-digging and hand-gathering of molluscs. In terms of the potential impact that disturbance as a result of these activities may have, timing (seasonality) is an important factor because many of the activities identified will be more frequent during summer months and outside of the main period of waterbird presence at the site.

In general, relatively few occurrences of disturbance-causing activities were recorded during the 2009/10 Waterbird Survey Programme. Seven activities were identified and these were: walking (incl. dogs), motorised vehicles, horse riding, shooting, bait-digging, aircraft and activities associated with intertidal aquaculture. Summary data are shown in Table 5.8 and full results of the disturbance assessment are shown in Appendix 10. Individual activities/events are scored separately and there has been no attempt to produce cumulative scores for different activities occurring at the same time, although cumulative effects are likely.

Of the activities that were recorded causing disturbance, walking in intertidal areas (including dogs) was the most widespread, recorded within three subsites overall. Noise from aircraft flying over was recorded to cause disturbance to waterbirds within three subsites. The peak disturbance score attained was for 0O413 (Saint Kiernans to Newtown) and related to aquaculture activities (all combined). These being of an active nature (machinery, vehicles) and occurring regularly (in most surveys) resulted in an overall ‘high’ score being attained.

As a final review, Table 5.9 shows the peak disturbance scores overlaid on the subsite assessment table (total waterbird numbers, LT surveys).

[21] As identified through field survey records plus desk-top review and information gathering.

Table 5.8 Disturbance Assessment – Summary Table
Number of activities recorded to cause disturbance to waterbirds during field surveys of the 2009/10 Waterbird Survey Programme plus the calculated peak disturbance score (see text for explanation). Scores 0 – 3 = Low Scores 4 – 6 = Moderate Scores 7 – 9 = High. Grey shading = no activity recorded to cause disturbance during field surveys

Subsite Code	Subsite Name	Number Activities causing disturbance	Peak Disturbance Score	Activity Responsible
0O410	Fethard Bay	2	6	• Walking (incl. dogs)
0O411	St Kiernans to Saltmills to Big Burrow	3	5	• Walking (incl. dogs)
0O413	Saint Kiernans to Newtown	4	7	• Aquaculture activities
0O416	Kiltra	1	5	• Aircraft
0O417	Clonmines Castle	1	6	• Shooting
0O418	Bannow Island to Newquay	2	5	• Motorised vehicles
0O487	Tintern Abbey to Tintern Bridge	0	0	
0O489	Pollfur	0	0	

Table 5.9 Bannow Bay - subsite rankings based on total numbers (LT surveys) x peak disturbance score attained during surveys of the 2009/10 waterbird survey programme

Subsites ► / Species ▼	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
PB	H	V	V	V	M	V	L	M
DN		V	H	V	M	V	M	
BW		M	H	V	M	M	H	H
BA	L	H	V	V	M	M		M
SU	H	H	M	V	H	V	M	H
OC	H	H	V	V	M	V	L	L
GP		V	H	V	H	V		M
GV		V	V	M	M	V		M
L.	M	H	H	V	V	M	H	
KN		V	H	V		V		
CU	L	H	H	V	H	V	M	M
RK	M	V	H	H	M	V	L	M

5.4.5 Discussion

This review has highlighted that many 'activities and events' occur across the site, while the disturbance assessment represents a 'snap-shot' record of the level of disturbance-causing activities that can occur during the non-breeding season.

Many of the 'activities' identified may act so as to modify wetland habitats of the site. While physical loss might be considered more historic in nature (e.g. the construction of piers,

slipways etc.), it may also occur due to changes in natural processes (e.g. sedimentation or erosion rates) as a result of former physical events such as the development of coastal defences, bridge building etc. Physical damage to wetland habitats may occur from trampling or compaction (e.g. horse-riding, humans walking, motorised vehicles). The grazing of salt marsh areas can modify waterbird roosting areas. Bait-digging and the hand-gathering of molluscs may cause some physical damage while at the same time removing waterbird prey resources. Fisheries and aquaculture interact with waterbirds in a variety of ways including the direct removal of waterbird prey (e.g. fish species, bivalves), habitat loss/modification (e.g. due to the physical presence of oyster trestles within intertidal habitat), habitat damage (e.g. from machinery, vehicles) and indirect effects upon invertebrate distribution and abundance.

Activities that cause 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[22] (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. (NB there may be a lack of time for waterbirds during the staging period);
- Age - for example when feeding, immature (1st winter birds) may be marginalised by older more dominant flocks so that their access to the optimal prey resources is limited. These individuals may already therefore be under pressure to gain their required daily energy intake before the effects of any disturbance event are taken into account;
- Timing/seasonality - birds may be more vulnerable at certain times e.g. pre- and post-migration, at the end of the winter when food resources are lower;
- Weather - birds are more vulnerable during periods of severe cold weather or strong winds;
- Site fidelity – some species are highly site faithful at site or within-site level and will therefore be affected to a greater degree than species that range more widely;
- Predation and competition – a knock-on effect of disturbance is that waterbirds may move into areas where they are subject to increased competition for prey resources, or

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

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: BANNOW BAY SPA

SITE CODE: 004033

Bannow Bay is a large, very sheltered, estuarine system with a narrow outlet to the sea, situated on the south coast of Co. Wexford. It is up to 14 km long along its north-east/south-west axis and has an average width of about 2 km. A number of small- to medium-sized rivers flow into the site, the principal being the Owenduff and the Corock which enter at the top end of the estuary. Very extensive intertidal mud and sand flats are exposed at low tide. The sediments have a rich macroinvertebrate fauna, with such species as Peppery Furrow-shell (*Scrobicularia plana*), Ragworm (*Hediste diversicolor*) and Lugworm (*Arenicola arenaria*) occurring frequently. Mats of green algae (*Ulva* spp.) are present on the intertidal flats and shorelines. Salt marshes are well-developed in the sheltered areas of the site and are characterised by species such as Common Saltmarsh-grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Saltmarsh Rush (*Juncus gerardi*) and Sea Rush (*Juncus maritimus*). Swards of Glasswort (*Salicornia* spp.) occur on the lower zones of the salt marshes and extend onto the intertidal flats.

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, Shelduck, Pintail, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew 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.

Bannow Bay supports an excellent diversity of wintering waterfowl and is one of the most important sites in the south-east. Of particular note is an internationally important population of Light-bellied Brent Goose (561) and Black-tailed Godwit (546) - all figures are mean peaks for the 5 winters 1995/96-1999/2000. The site also supports nationally important numbers of a further eleven species: Shelduck (500), Pintail (52), Oystercatcher (711), Golden Plover (1,955), Grey Plover (142), Lapwing (2,950), Knot (508), Dunlin (3,038), Bar-tailed Godwit (471), Curlew (891) and Redshank (377). The populations of Shelduck and Bar-tailed Godwit are of particular note as they comprise 3.4% and 3.0% of the respective all-Ireland totals. Other species which occur in numbers of regional importance include Wigeon (412), Teal (256), Ringed Plover (38) and Turnstone (50). The intertidal sand and mud flats provide excellent feeding for the waterfowl species, while suitable high tide roosts are provided by the salt marshes and other shoreline habitats. Part of the site is a Wildfowl Sanctuary.

Bannow Bay SPA is an excellent example of an enclosed estuarine system. It supports internationally important populations of Light-bellied Brent Goose and Black-tailed Godwit as well as nationally important populations of a further eleven species. Two of the species that occur, i.e. Golden Plover and Bar-tailed Godwit, are listed on Annex I of the E.U. Birds Directive.


CO. CARLOW
Kilkenny
CO. KILKENNY
CO. WEXFORD
Clongeen
Wexford
Waterford
Hilltown
Saltmills
SPA 004033
Bannow Bay
Cuan Bhanú
Bannow Island
Saltmills
Muileann an tSáile
Fethard
Fiodh Ard
Ramstown
Legend
SPA 004033
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY
SPA 004033
SITE CODE:
SPA 004033 Version 1.01
0 0.5 1 km
N
Map Version 1
Date: Feb 2012

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).

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 and organised in the Republic of 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).

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

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

APPENDIX 5

Waterbird foraging guilds (after Weller, 1999)

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

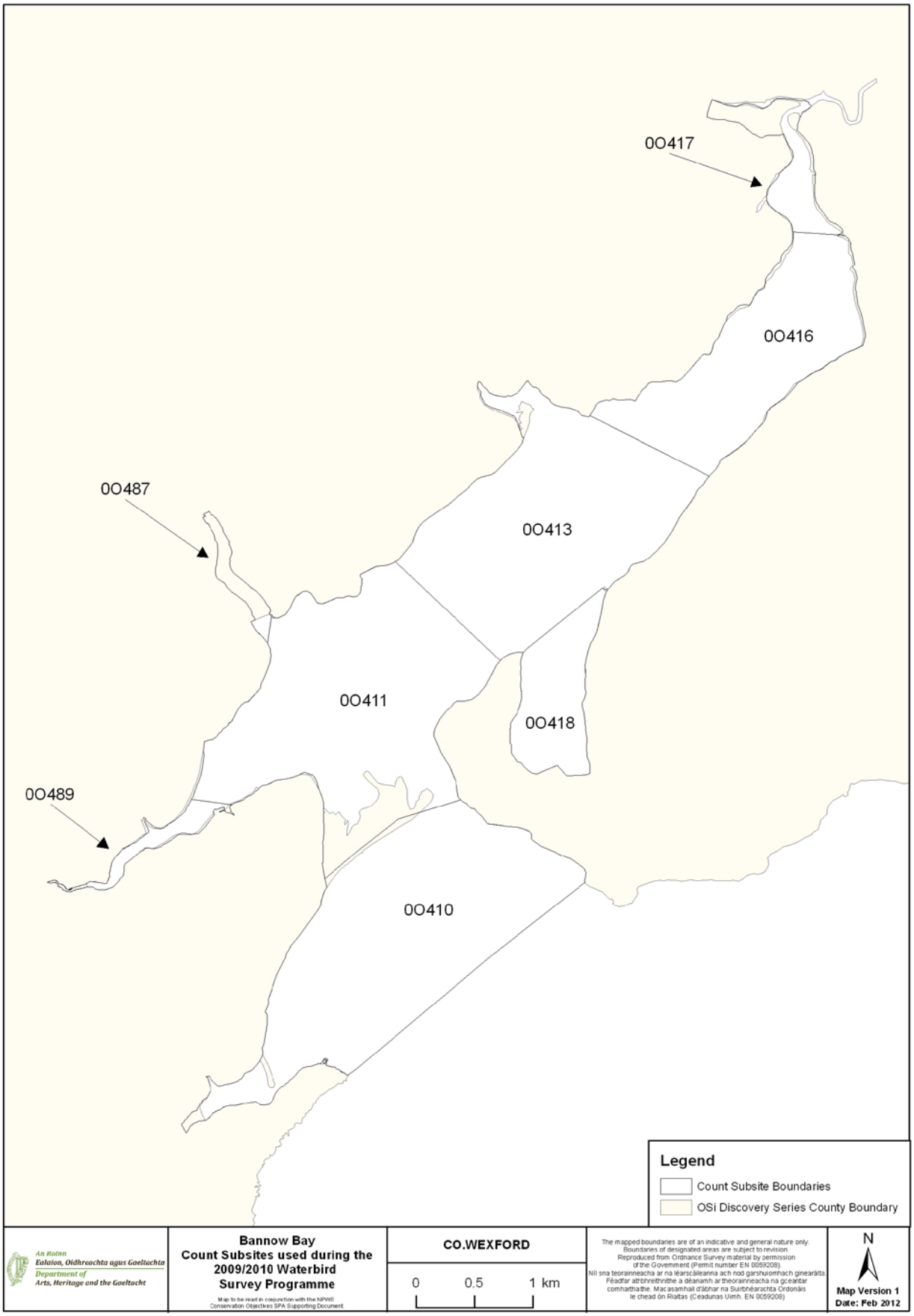
[a] dives <3m.

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

APPENDIX 6

Bannow Bay – Waterbird Survey Programme 2009/10 – Count Subsites

Subsite	Subsite Name	Subsite Area (ha)
0O410	Fethard Bay	366.5
0O411	St Kiernans to Saltmills to Big Burrow	360.2
0O413	Saint Kiernans to Newtown	318.8
0O416	Kiltra	199.1
0O417	Clonmines Castle	44.5
0O418	Bannow Island to Newquay	77.7
0O487	Tintern Abbey to Tintern Bridge	14.7
0O489	Pollfur	19.2

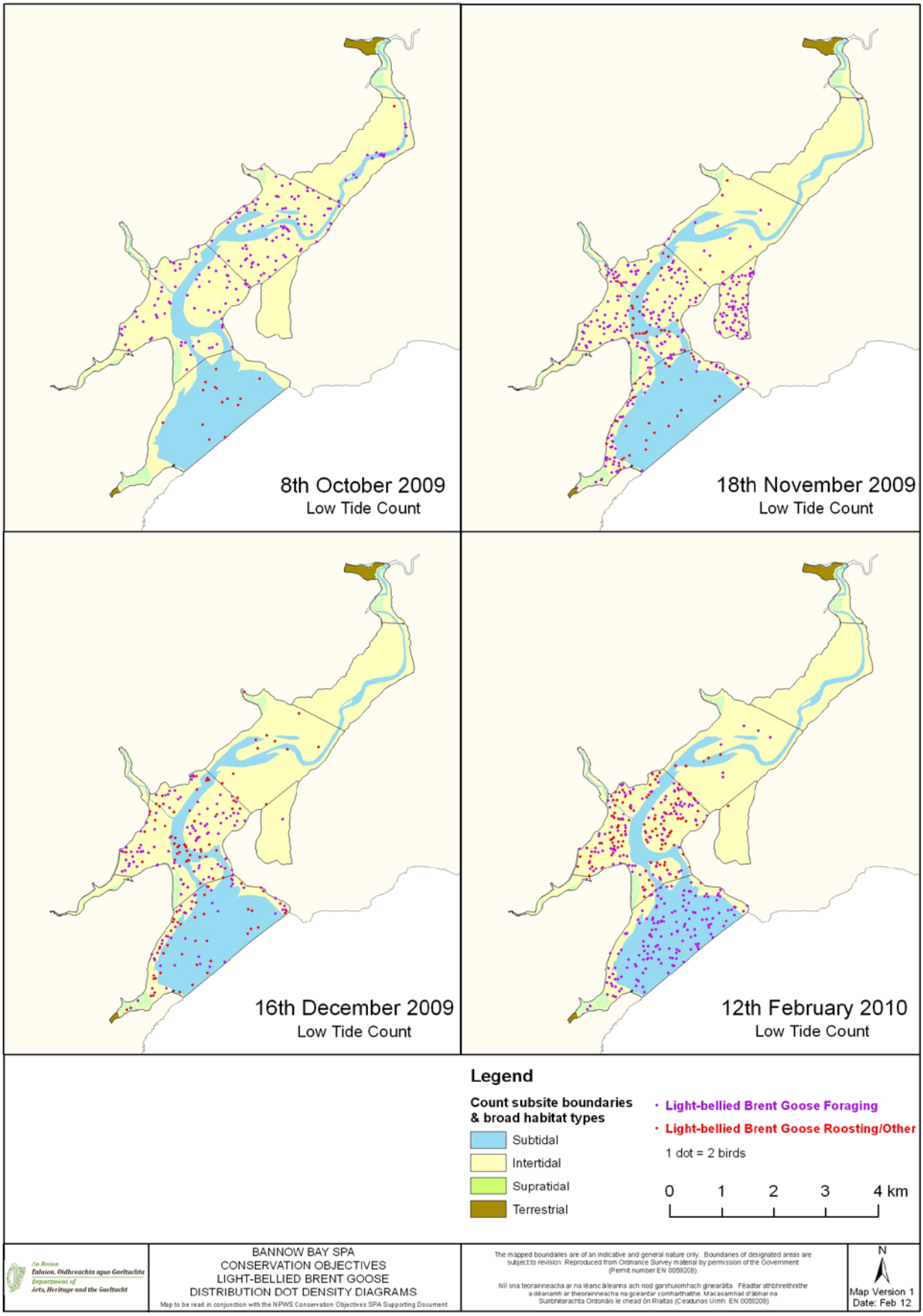

0O417
0O416
0O487
0O413
0O411
0O418
0O489
0O410
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundary
An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht
Bannow Bay
Count Subsites used during the
2009/2010 Waterbird
Survey Programme
Map to be read in conjunction with the NPWS
Conservation Objectives SPA Supporting Document
CO.WEXFORD
0 0.5 1 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 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta.
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le cead ón Rialtas (Ceadunas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 2012

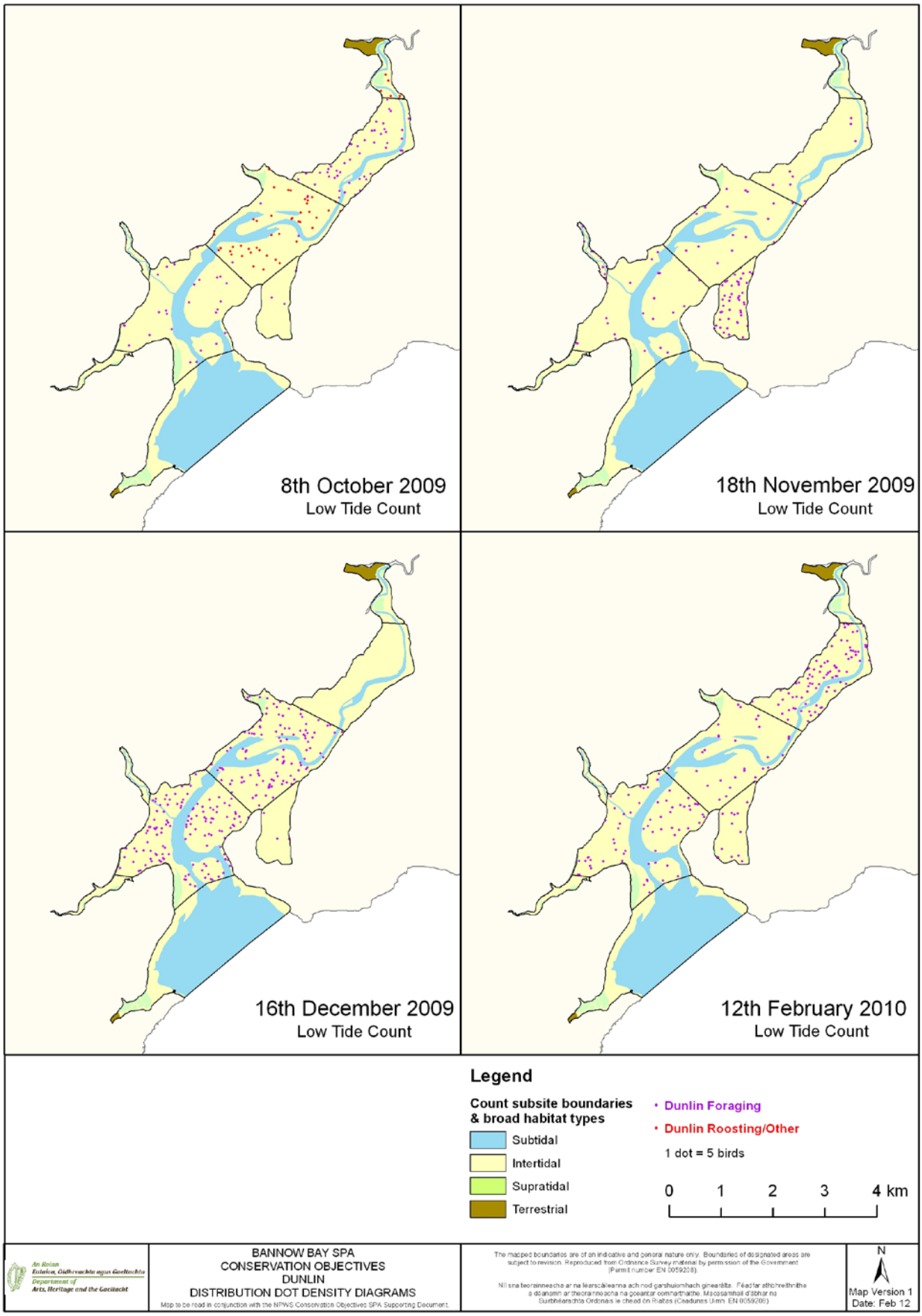
APPENDIX 7

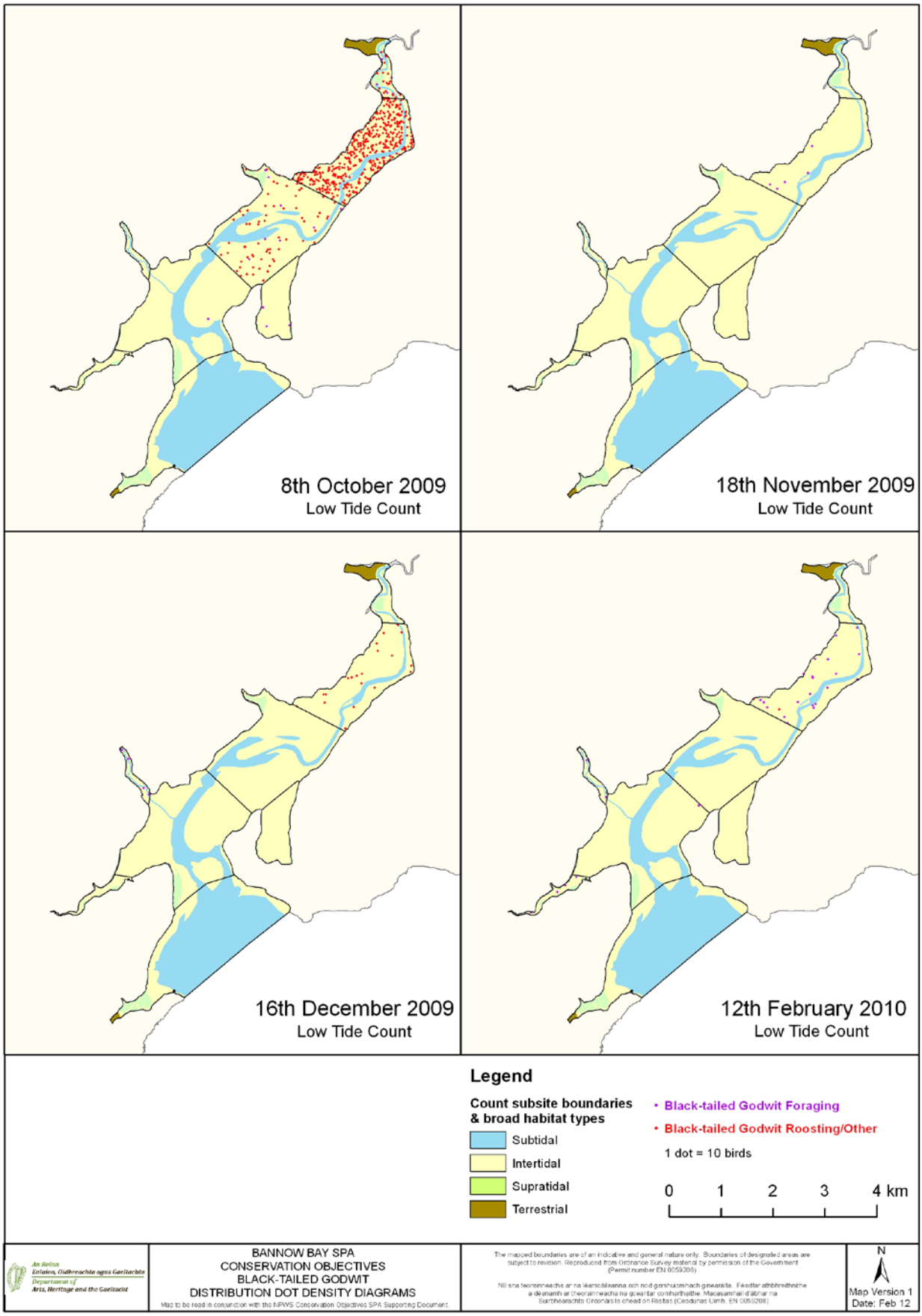
Bannow Bay

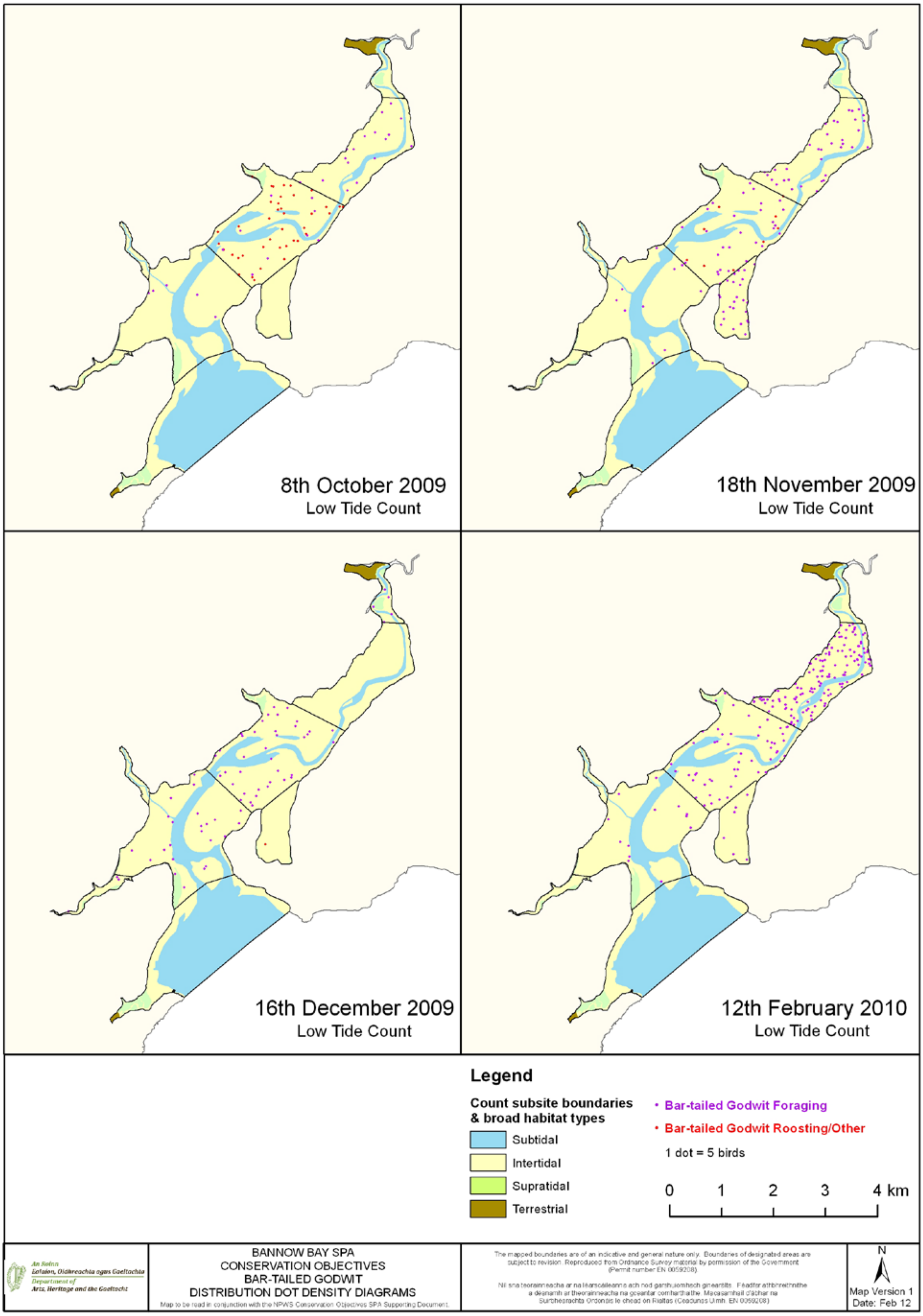
Waterbird distribution (dot-density diagrams) recorded during the low tide surveys (October 2009 – February 2010)

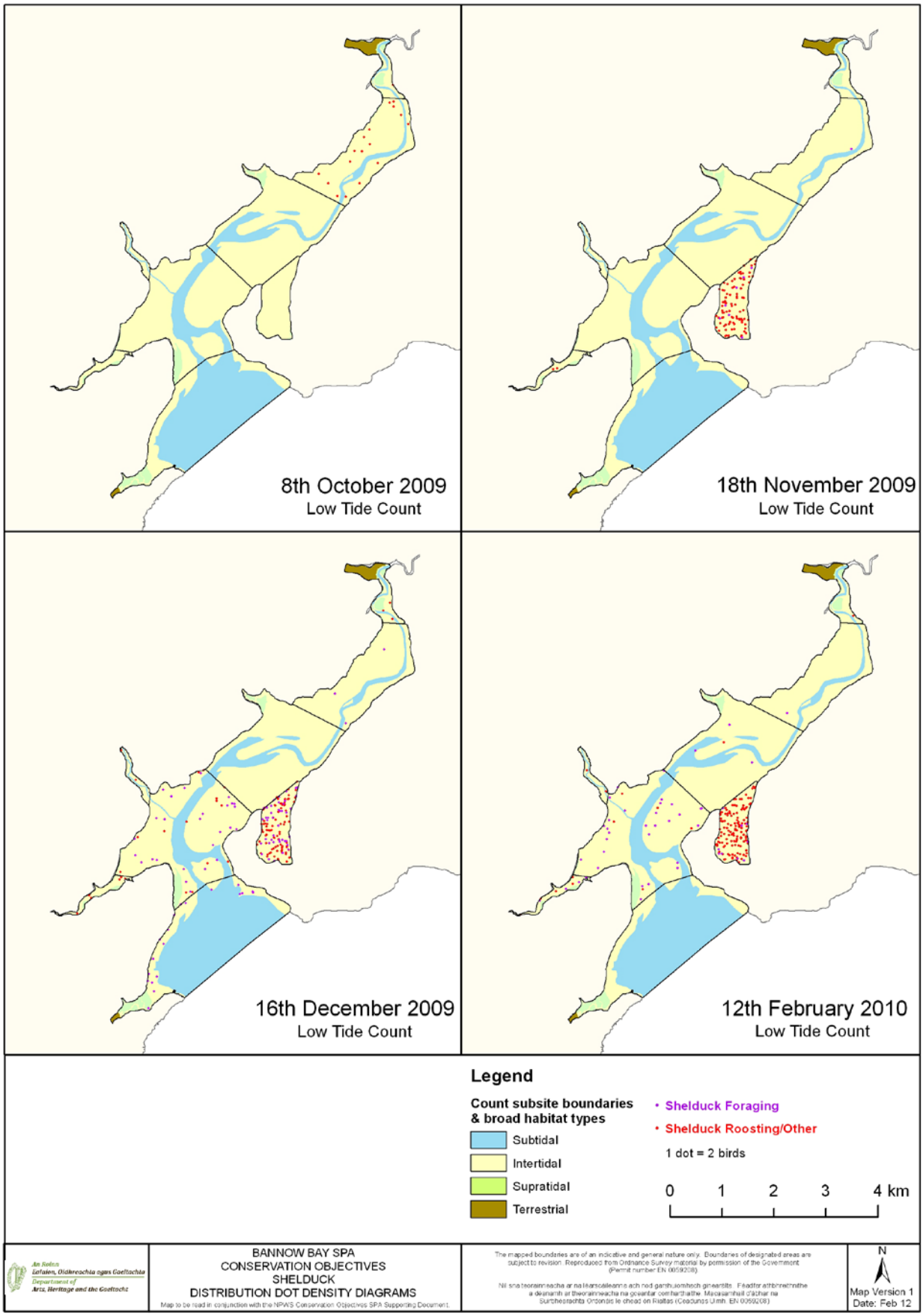
(note that data are shown for birds occurring within intertidal and subtidal habitat only)

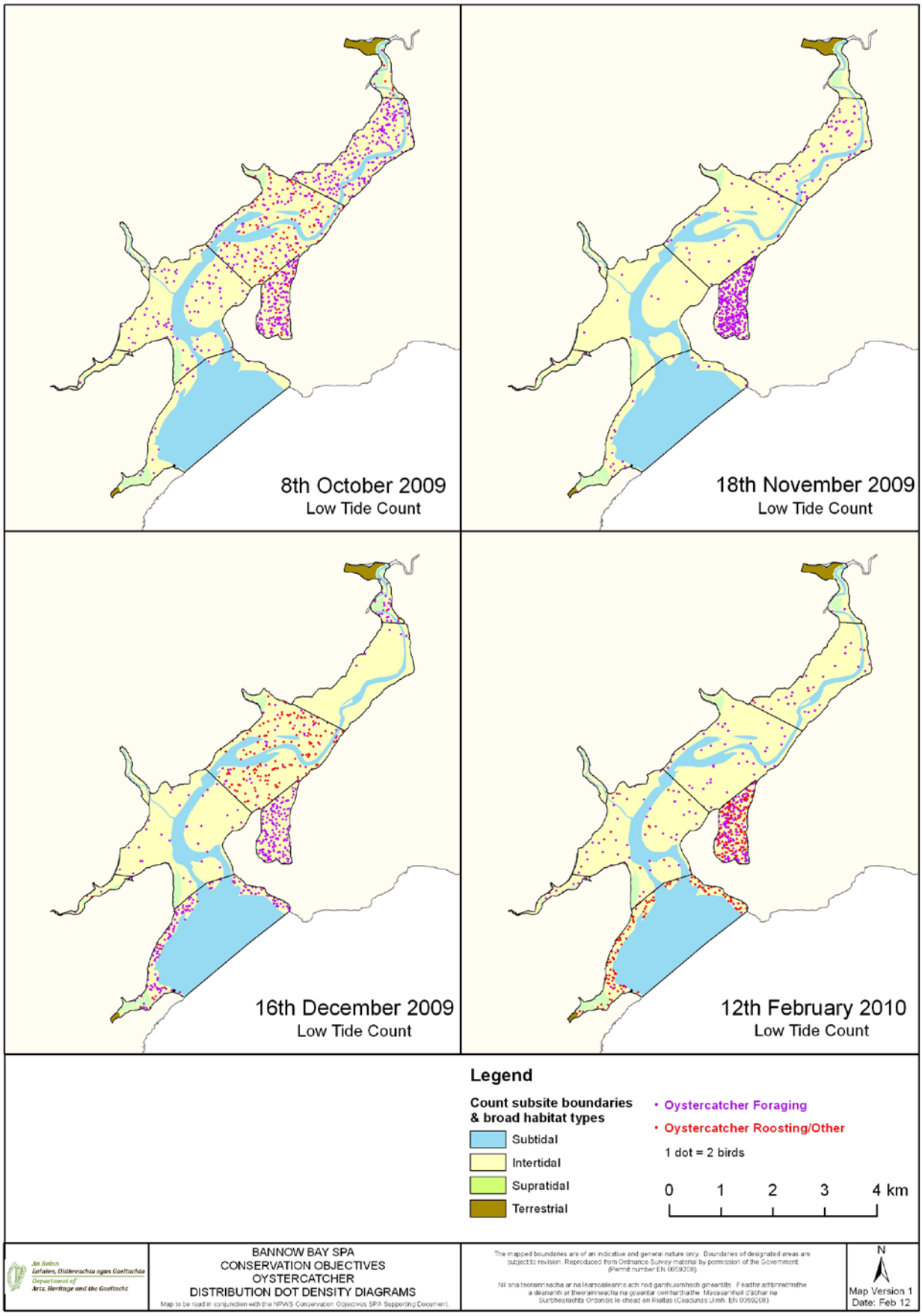

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Light-bellied Brent Goose Foraging
Light-bellied Brent Goose Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
LIGHT-BELLIED BRENT GOOSE
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadtar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'íobhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12

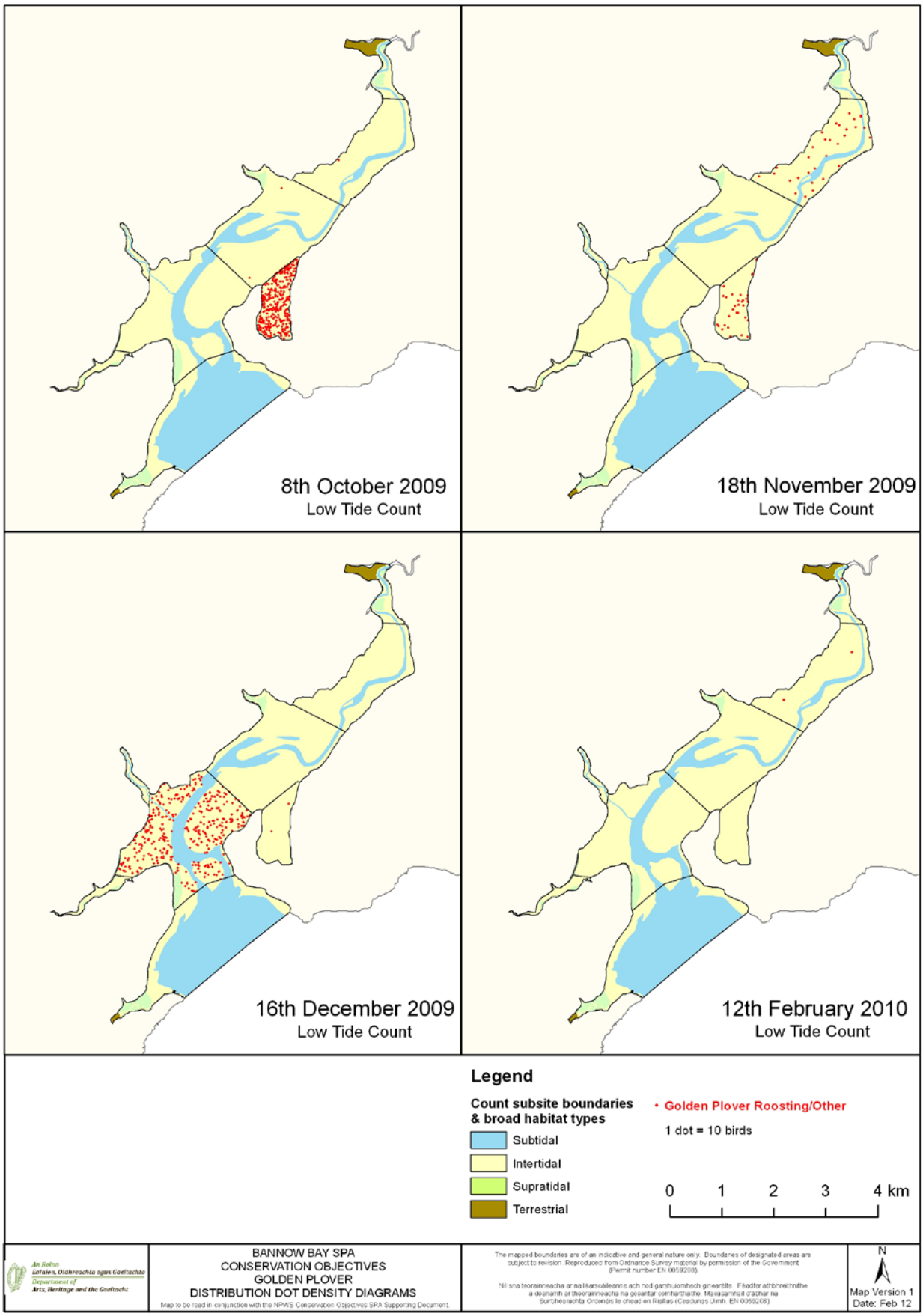

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Dunlin Foraging
Dunlin Roosting/Other
1 dot = 5 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
DUNLIN
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athchreithithe a dhéanamh ar theorainneacha na gceantar comhartha dhe. Macasamhail d'obair na Suirbhéireachta Ordonais le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12

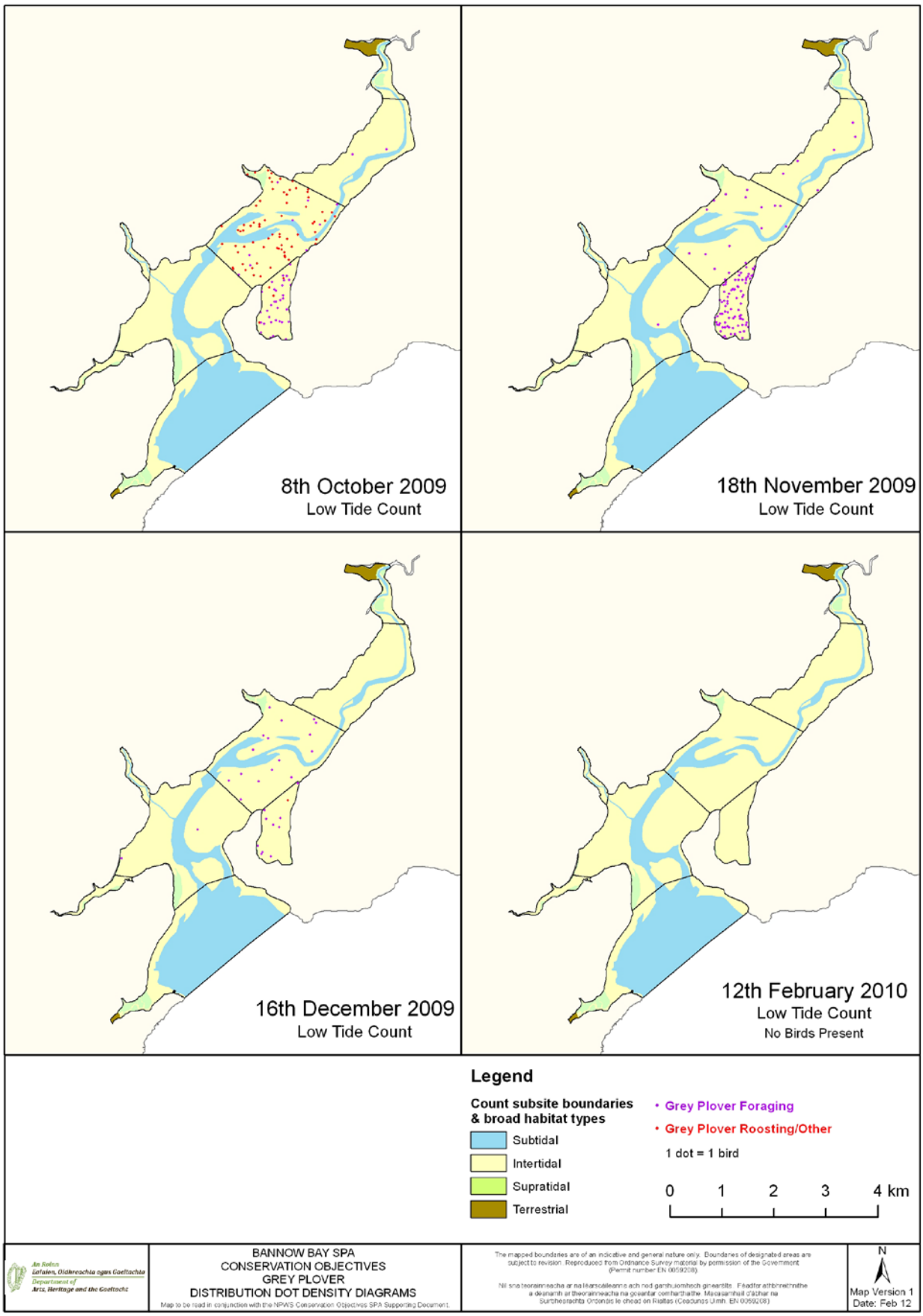

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Black-tailed Godwit Foraging
Black-tailed Godwit Roosting/Other
1 dot = 10 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
BLACK-TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Feadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comhardhaithe. Macasamhail dábhar na Suirbhéireachta Ordanáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12

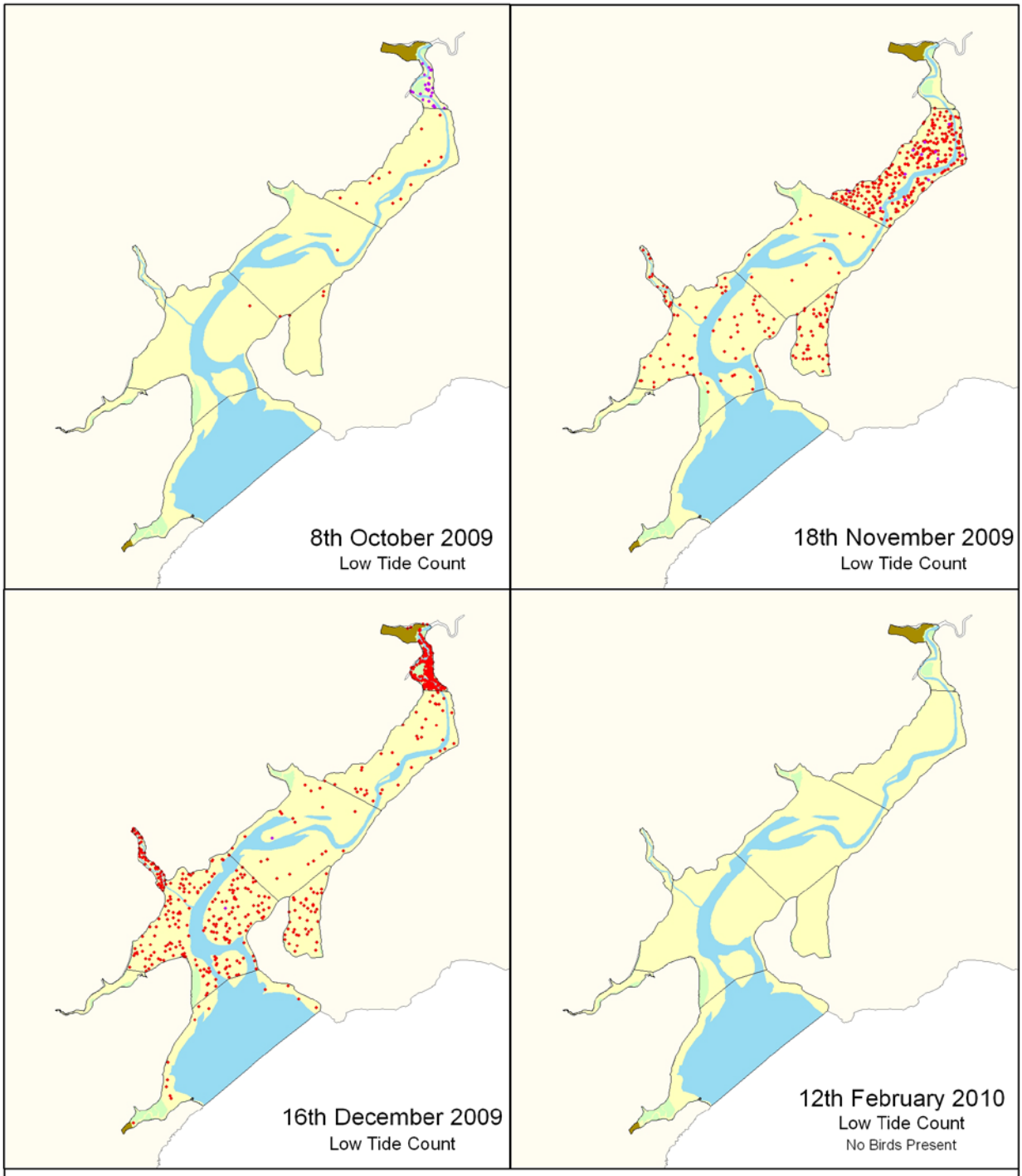

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Bar-tailed Godwit Foraging
Bar-tailed Godwit Roosting/Other
1 dot = 5 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
BAR-TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
N
Map Version 1
Date: Feb 12

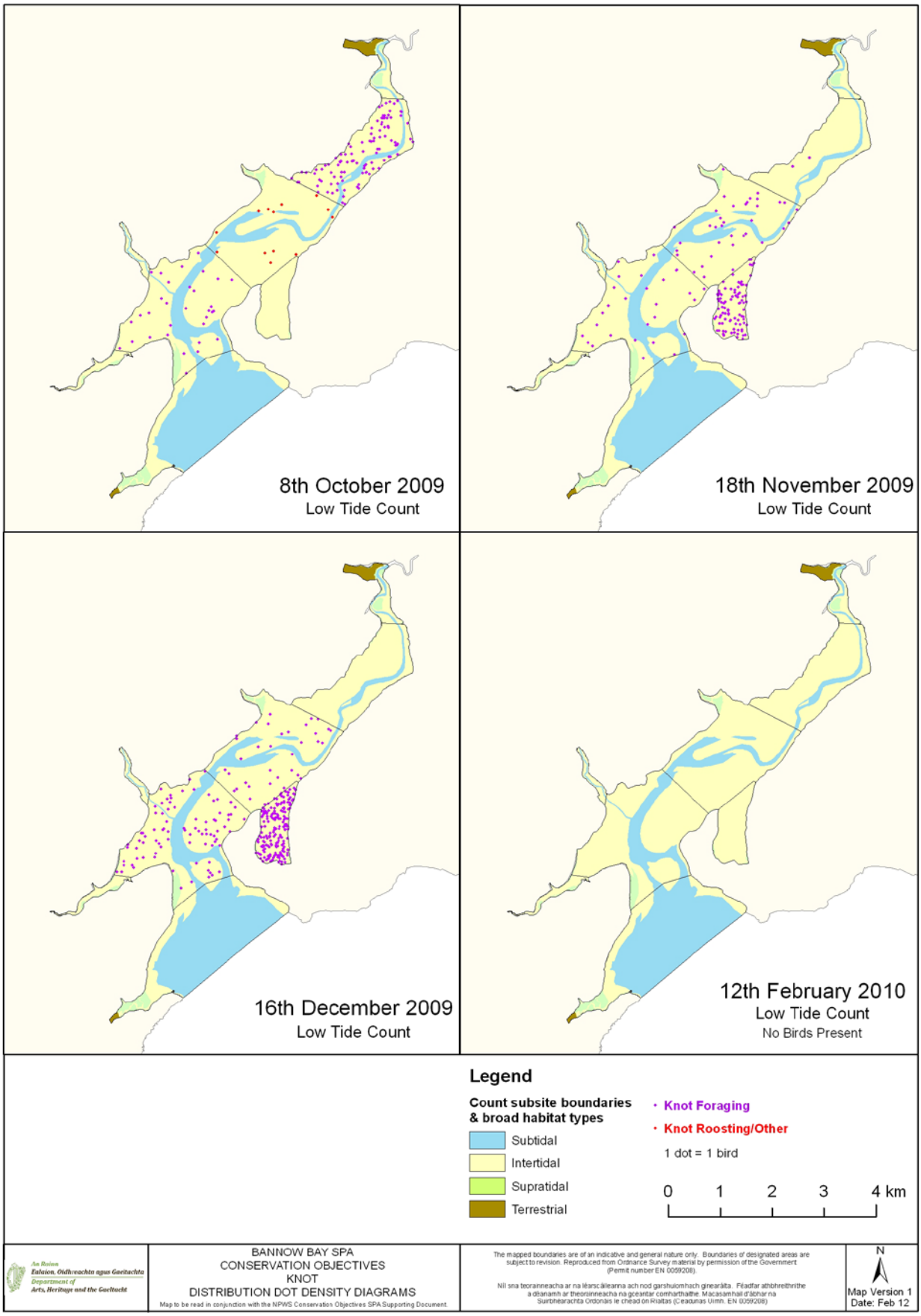

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Shelduck Foraging
Shelduck Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
SHELDUCK
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
N
Map Version 1
Date: Feb 12

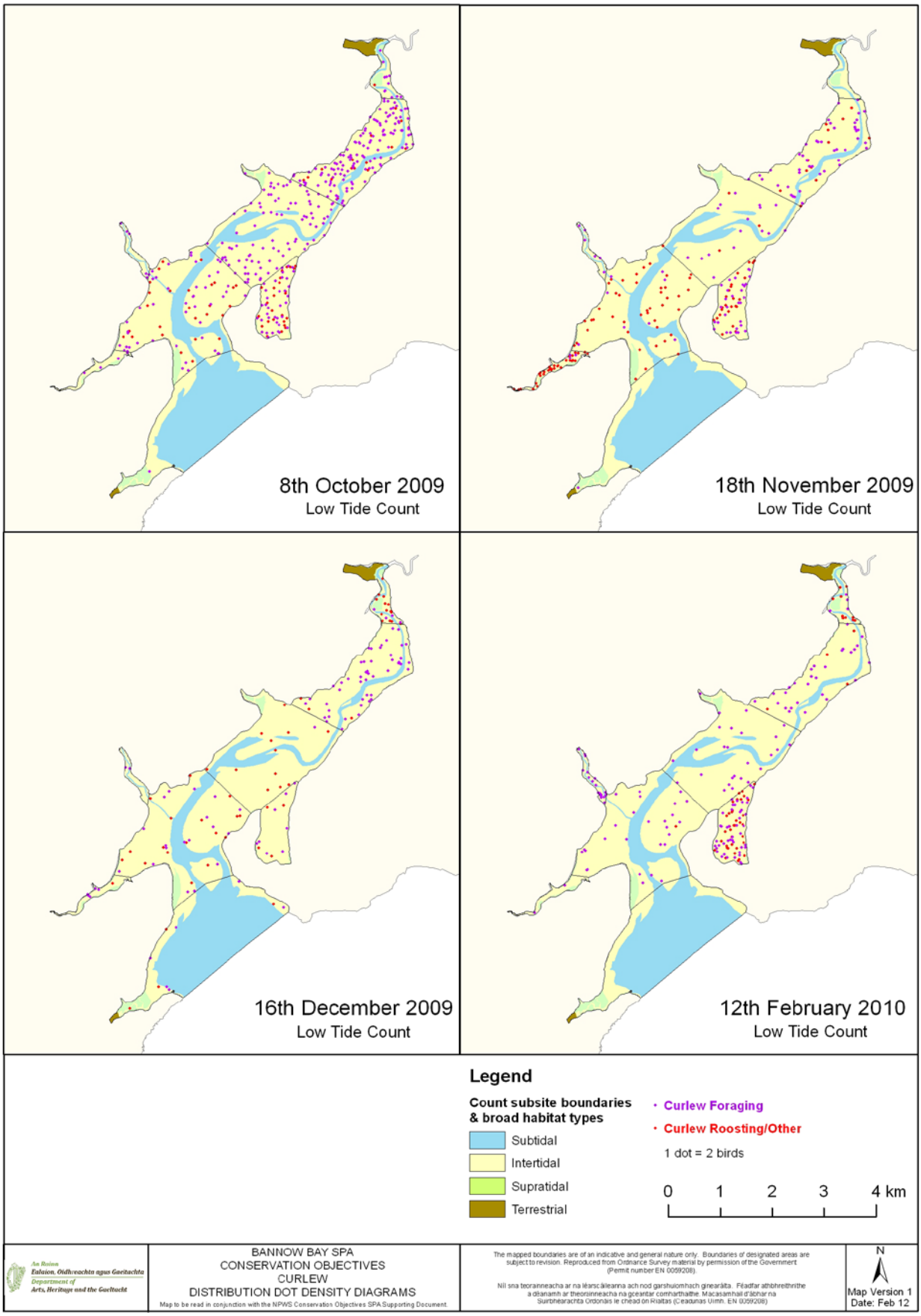

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Oystercatcher Foraging
Oystercatcher Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
OYSTERCATCHER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
N
Map Version 1
Date: Feb 12

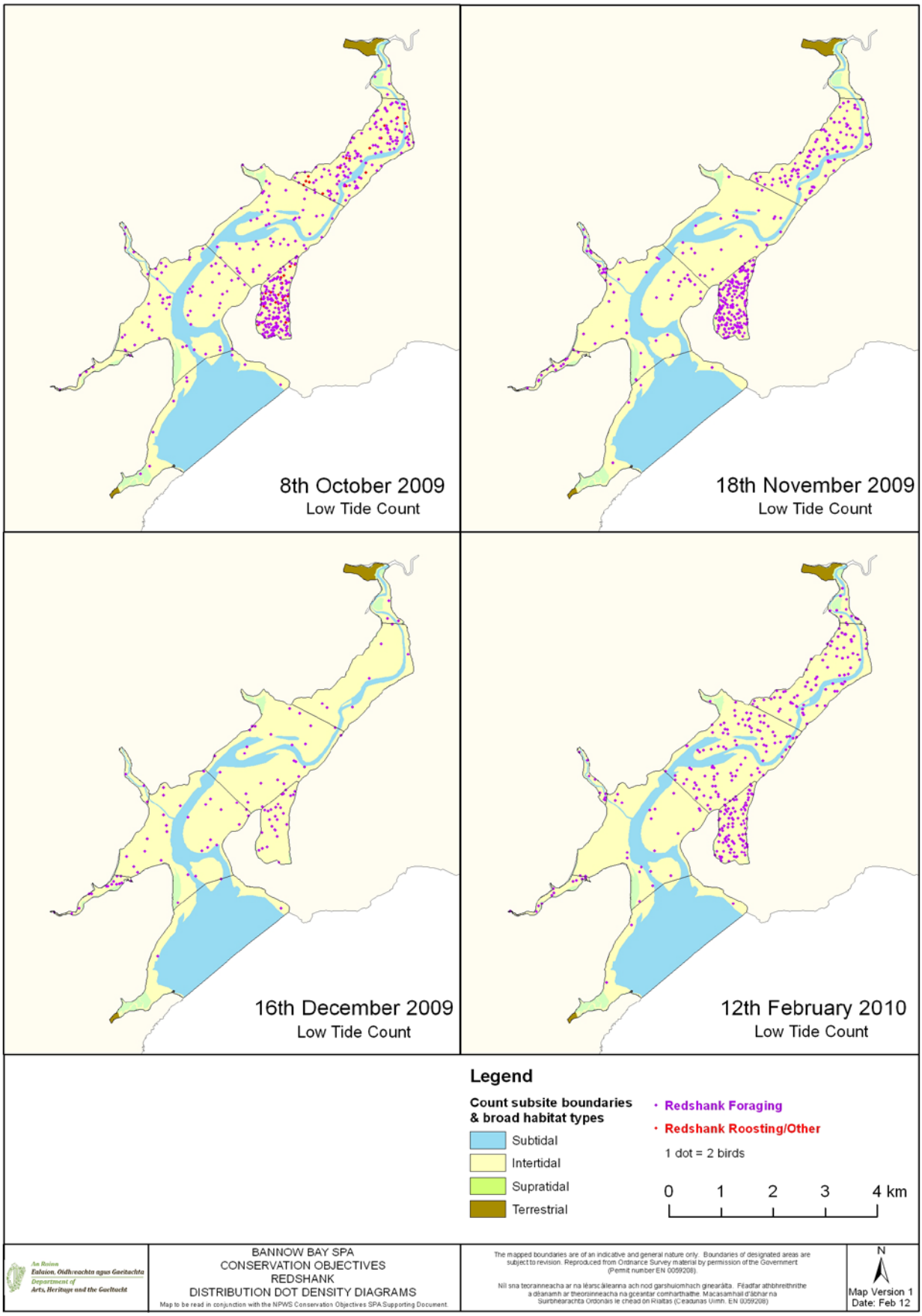

8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Golden Plover Roosting/Other
1 dot = 10 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
GOLDEN PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208)
Ní sna teorainneacha ar na léarscáileanna ach nod garthujomhach ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comhdhaingthe. Macasamhail d'áthar na Suirbhéireachta Ordanáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12


8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
No Birds Present
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Grey Plover Foraging
Grey Plover Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
GREY PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208)
Ní sna teorainneacha ar na léarscáileanna ach nod garsheomhach ginearálta. Féadfar athbhreithniú a dhéanamh ar theorainneacha na gceantar comhdhaingthe. Macasamhail d'áthar na Suirbhéireachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12


8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
No Birds Present
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Lapwing Foraging
Lapwing Roosting/Other
1 dot = 5 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
LAPWING
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithrithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'Ábhar na Suirbhearachta Ordonáis le cead on Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12


8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
No Birds Present
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Knot Foraging
Knot Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
KNOT
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithrithe a dhéanamh ar theorainneacha na gceantar comhartha thé. Macasamhail d'ábhar na Suirbhéireachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12


8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Curlew Foraging
Curlew Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
CURLEW
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comhartha thé. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12


8th October 2009
Low Tide Count
18th November 2009
Low Tide Count
16th December 2009
Low Tide Count
12th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Redshank Foraging
Redshank Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
BANNOW BAY SPA
CONSERVATION OBJECTIVES
REDSHANK
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 12

APPENDIX 8

Bannow Bay

Summary data and roost location maps from the roost survey (25/02/10)

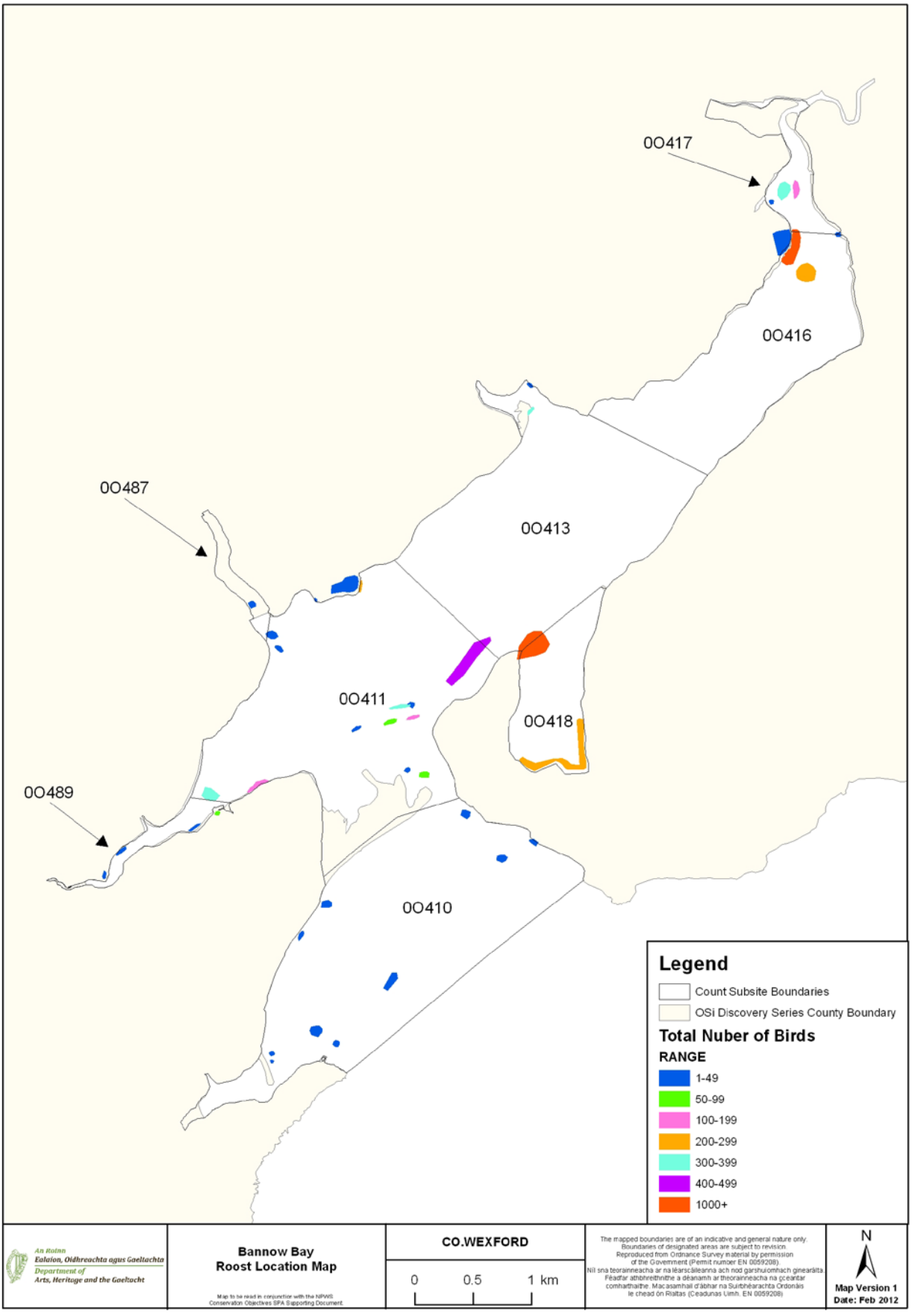
The tables and accompanying map summarises data collected from a roost survey undertaken on 25th February 2010. (Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations).

Bannow Bay - Roost Summary Table

Subsite Code	Subsite Name	Number individual roost locations	No. Species	Total No. birds	Species (alphabetical order)
0O410	Fethard Bay	10	6	55	CA, CM, GB, OC, PB, RM
0O411	St Kiernans to Saltmills to Big Burrow	15	17	1463	BA, BW, CA, CM, CU, GB, GK, HG, KN, L., OC, PB, RK, SA, SN, TT, WN
0O413	Saint Kiernans to Newtown	2	4	311	BA, DN, KN, OC.
0O416	Kiltra	4	11	2191	BA, BH, BW, CU, DN, GV, KN, OC, RK, SU, TT
0O417	Clonmines Castle	3	4	596	BW, CU, L. WN
0O418	Bannow Island to Newquay	2	7	1714	BA, BH, ET, GK, GV, OC, T
0O487	Tintern Abbey to Tintern Bridge	1	2	23	T., WN
0O489	Pollfur	4	6	117	CU, GB, MA, SU, T., WN

Bannow Bay SPA (4033) - SCI species and recorded roosts: the number given is the number of roosting individuals and in brackets, the number of roost locations within the subsite.

SCI SPECIES	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0A489
PB	19 (2)	643 (7)						
DN			40 (1)	105 (1)				
BW		47 (2)		105 (1)	94 (1)			
BA		1 (1)	145 (1)	860 (1)		575 (1)		
SU		77 (1)		10 (1)				33 (2)
OC	26 (4)	366 (4)	86 (2)	147 (1)		885 (1)		
GP	-	-	-	-	-	-	-	-
GV				3 (1)		221 (1)		
L.		90 (1)			393 (1)			
KN		26 (1)	40 (1)	65 91)				
CU		9 (3)		562 (1)	100 (1)			1 (1)
RK		49 (5)		62 (1)				


0O417
0O416
0O487
0O413
0O411
0O418
0O489
0O410
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundary
Total Nuber of Birds
RANGE
1-49
50-99
100-199
200-299
300-399
400-499
1000+
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Bannow Bay
Roost Location Map
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
CO.WEXFORD
0 0.5 1 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 0059208). Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadunas Uimh. EN 0059208)
N
Map Version 1
Date: Feb 2012

APPENDIX 9

Bannow Bay SPA (4033) - Activities & Events

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

Legend:	
O	observed or known to occur in and around Bannow Bay SPA
U	known to occur but unknown area (subsites)/spatial extent; 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.
	Grey highlighting refers to activities that have the potential, either directly or indirectly, to cause disturbance to waterbirds.

	OO410	OO411	OO413	OO416	OO417	OO418	OO487	OO489
1. Coastal protection, sea defences & stabilisation								
1.1 Linear defences		O	O	O				
1.4 *Spartina anglica* (presence)	O	O	O	O	O	O		O
2. Barrage schemes/drainage								
2.2 Altered drainage/river channel					O			
4. Industrial, port & related development								
4.2 Fishing harbour	O							
4.3 Slipway	O			O	O			
4.4 Pier	O	O	O			O		
6. Pollution								
6.1 Domestic & urban waste water	O				O/P		H	
6.4 Agricultural & forestry effluents			O			O		
6.7 Solid waste incl. fly-tipping		O		O				
7. Sediment extraction (marine & terrestial)								
7.4 Removal of beach materials	H/O							
8. Transport & communications								
8.2 Flight path		O	O	O				
8.3 Bridges & aqueducts		O			O	O	O	
8.5 Road		O	O	O				O
8.6 Car parks		O		O	O		O	
9. Urbanisation								
9.1 Urbanised areas, housing	O				O			
9.2 Commercial & industrial areas					O			
11. Education & scientific research								
11.3 Interpretative centre							O	

Continued……..

	OO410	OO411	OO413	OO416	OO417	OO418	OO487	OO489
12. Tourism & recreation								
12.2 Non-marina moorings	O	O	O			O		
12.6 Power boating & water-skiing	P							
12.8 Sailing	O							
12.9 Sailboarding & wind-surfing	O							
12.13 Rowing	H							
12.15 Angling	O	O	O	O		O		
12.17 Bathing & general beach recreation	O							
12.18 Walking, incl. dog walking	O	O	O	O		O		
12.19 Birdwatching		O	O	O	O	O	O	O
12.21 4WD, trial & quad bikes	O			O		O		
12.22 Motorised vehicles			O			O		
12.23 Horse-riding	O		O					
13. Wildfowl & hunting								
13.1 Wildfowling	H				O	O	H	H
13.2 Other hunting-related activities					O			
14. Bait-collecting								
14.1 Digging for lugworms/ragworms	O	O				O		
15. Fisheries & Aquaculture								
15.1 Professional passive fishing (e.g. longlining)	U	U	U	U				
15.2 Professional active fishing	U							
15.4 Fish traps & other fixed devices & nets	U	U	U	U				
15.5 Leisure fishing	O							
15.6 Molluscs - hand-gathering	O	O						
15.9 Intertidal aquaculture e.g trestles		O	O					
16. Agriculture & forestry								
16.1 Saltmarsh grazing/harvesting					O			
16.2 Grazing: intensive (terrestrial)	O	O	O	O	O	O	O	O
16.3 Grazing: non-intensive (terrestrial)		O			O			
16.6 Crop production: intensive	O	O			O	O		O
16.9 Removal of hedges, scrub	H	O			O		H	H
16.10 Mowing/grassland cutting	O	O			O		O	O
16.14 In-filling of ditches, ponds, pools, marshes						H		
16.20 Others				O				
19. Natural events								
19.1 Storms, floods and storm surges			O	O		O		
19.2 Severe cold weather	O	O	O	O	O	O	O	O

APPENDIX 10

Disturbance Assessment

Scoring system - definitions & rationale

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

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

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

Scoring system – worked example

Disturbance event – humans walking along a beach; the beach is a popular recreational area and this activity was recorded frequently during surveys.

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

Results - based on records from the 2009/10 Waterbird Survey Programme

	0O410	0O411	0O413	0O416	0O417	0O418	0O487	0O489
8. Transport & communications								
8.2 Flight path		3	5	5				
12. Tourism & recreation								
12.18 Walking, incl. dog walking	6	5	6					
12.22 Motorised vehicles						5		
12.23 Horse-riding	4		4					
13. Wildfowl & hunting								
13.2 Other hunting-related activities					6			
14. Bait-collecting								
14.1 Digging for lugworms/ragworms		4				4		
15. Fisheries & Aquaculture								
15.9 Intertidal aquaculture (all associated activities)			7					