Dungarvan Harbour Special Protection Area

(Site Code 4032)

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Conservation Objectives Supporting Document

VERSION 1

National Parks & Wildlife Service

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TABLE OF CONTENTS

SUMMARY

This document presents conservation objectives for the Special Conservation Interests of Dungarvan Harbour 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 Dungarvan Harbour Special Protection Area, as well as introducing the concept of conservation objectives and their formulation.

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

Part Four reviews the conservation condition of the site's Special Conservation Interest (SCI) species including analysis of 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 site Special Conservation Interest species.

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 Dungarvan Harbour 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 at the site which may interact with waterbirds during the non-breeding season and includes an assessment of those activities that were recorded to cause disturbance to non-breeding waterbirds at Dungarvan Harbour 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 Dungarvan Harbour Special Protection Area

Dungarvan Harbour SPA is located in the south-west of Co. Waterford. It is a large C-shaped harbour, extending east as far as Ballynacourty Point in the north and Helvick Head in the south. The harbour is almost entirely dissected by the linear north-south orientated Cunnigar Spit which provides shelter to the inner harbour.

The site includes three estuaries. The River Colligan, which runs south from the Comeragh Mountains, enters the north side of Dungarvan Bay at Dungarvan Town. The River Brickey enters the harbour in the west and the Glendine River enters in the northeast. As these three rivers are relatively small, freshwater input relative to the size of the site is low, resulting in a largely marine-influenced site.

The intertidal habitats are dominated by sandflats, including the extensive 'Whitehouse Bank' which is a relatively stable sand bank on the eastern side of the Cunnigar spit. The inner harbour (west of Cunnigar spit), being more sheltered, has mudflats fringed in places by saltmarsh habitat. Saltmarsh is also found within the River Brickey estuary and along the River Colligan estuary (McCorry & Ryle, 2009).

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

1.3 Introduction to Conservation Objectives

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve '*favourable conservation status'* and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 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 Dungarvan Harbour Special Protection Areas).

[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 Dungarvan Harbour Special Protection Area

Dungarvan Harbour SPA is selected as a Special Protection Area because it regularly supports over 20,000 waterbirds during the non-breeding season making this a site of international importance.

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

The Selection Species listed for Dungarvan Harbour SPA are as follows:-

1. During winter the site regularly supports 1% or more of the biogeographical population of Light-bellied Brent Goose (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 723 individuals.

2. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Golden Plover (*Pluvialis apricaria*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 4,980 individuals.

3. During winter the site regularly supports 1% or more of the all-Ireland population of Dunlin (*Calidris alpina*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 4,984 individuals.

4. 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 779 individuals.

5. During winter the site regularly supports 1% or more of the all-Ireland population of the Annex I species Bar-tailed Godwit (*Limosa lapponica*). The mean peak number within the SPA during the baseline period (1995/96 – 1999/00) was 1,068 individuals.

6. 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 731 individuals.

7. During winter the site regularly supports 1% or more of the all-Ireland population of Turnstone (*Arenaria interpres*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 177 individuals.

The following species are identified as additional Special Conservation Interests (SCIs) for Dungarvan Harbour SPA as they were recorded in numbers of all-Ireland importance during the baseline period (1995/96 – 1999/00) (Table 2.1):

[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.

Shelduck (*Tadorna tadorna*)
Red-breasted Merganser (*Mergus serrator*)
Great Crested Grebe (*Podiceps cristatus*)
Oystercatcher (*Haematopus ostralegus*)
Grey Plover (*Pluvialis squatarola*)
Lapwing (*Vanellus vanellus*)
Knot (*Calidris canutus*)
Curlew (*Numenius arquata*)

The wetland habitats contained within Dungarvan Harbour SPA are identified to be 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 Dungarvan Harbour 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		723	International Importance	8	2	1
	Golden Plover	Yes	4,980	All-Ireland Importance	11	2	1
	Dunlin		4,984	All-Ireland Importance	5	1	1
	Black-tailed Godwit		779	International Importance	8	3	2
	Bar-tailed Godwit	Yes	1,068	All-Ireland Importance	4	2	1
	Redshank		731	All-Ireland Importance	7	1	1
	Turnstone		177	All-Ireland Importance	7	1	1
Additional Special Conservation Interests	Shelduck		538	All-Ireland Importance	7	2	1
	Red-breasted Merganser		52	All-Ireland Importance	10	2	1
	Great Crested Grebe		53	All-Ireland Importance	9	2	1
	Oystercatcher		767	All-Ireland Importance	15	2	1
	Grey Plover		444	All-Ireland Importance	6	3	1
	Lapwing		3,233	All-Ireland Importance	19	6	2
	Knot		698	All-Ireland Importance	9	1	1
	Curlew		766	All-Ireland Importance	16	4	2
Other conservation designations associated with the site[b]		**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**	
			Yes	Yes			

[a] Baseline data from I-WeBS with the exception of Light-bellied Brent Goose (Robinson et al. 2004).
[b] Note that other designations associated with Dungarvan Harbour 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 Eastern region (includes the regional cross-border site Blackwater Estuary).
[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 Waterford (includes the county cross-border site Blackwater Estuary).

PART THREE - CONSERVATION OBJECTIVES FOR DUNGARVAN HARBOUR SPA

3.1 Conservation Objectives for the Special Conservation Interests of Dungarvan Harbour SPA

The overarching Conservation Objective for Dungarvan Harbour 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 the continuation of their long-term survival across their natural range.

Conservation Objectives for Dungarvan Harbour 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 Dungarvan Harbour 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 numbers or **range (distribution)** of areas used 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 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 introduced in Section 5.

Objective 2: *To maintain the favourable conservation condition of the wetland habitat at Dungarvan Harbour 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 2219 ha, other than that occurring from natural patterns of variation.

The boundary of Dungarvan Harbour SPA was defined to include the primary wetland habitats of the harbour. 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. Many waterbird species will use more than one of the habitat types for different reasons 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 Dungarvan Harbour SPA this broad category is estimated to be 847 ha. Subtidal areas are continuously available for benthic feeding ducks (e.g. Scaup and Common Scoter) and piscivorous/other waterbirds (e.g. Red-breasted Merganser, divers and grebes). 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 Dungarvan Harbour SPA this is estimated to be 1,256 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 benthic feeding ducks (e.g. Scaup and Common Scoter) and piscivorous/other waterbirds (e.g. Red-breasted Merganser, divers and grebes). 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 Dungarvan Harbour SPA this is estimated to be 115 ha. Supratidal areas are used by a range of waterbird species as a roosting resource as well as providing feeding opportunities for some species.

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

[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 non-breeding waterbird Special Conservation Interests of Dungarvan Harbour SPA.

Objective 1: *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Dungarvan Harbour 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 4 of this document.
Range	Distribution	Number and range of areas used by waterbirds as determined by regular low tide and other waterbird surveys.	There should be no significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation.	Waterbird distribution from the 2009/10 waterbird survey programme is reviewed in Part 5 of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at* Dungarvan Harbour *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 2,219 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 2,219 ha using OSI data and relevant orthophotographs.

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

4.1 Population data for non-breeding waterbird SCI species of Dungarvan Harbour SPA

Non-breeding waterbirds have been counted regularly at Dungarvan Harbour as part of the Irish Wetland Bird Survey (I-WeBS) since the survey commenced in 1994 (Crowe, 2005). The I-WeBS count area is approximately 2,841 ha.

Table 4.1 presents population[8] data for the non-breeding waterbird Special Conservation Interest (SCI) species of Dungarvan Harbour SPA. Data are from the I-WeBS database with the exception of Light-bellied Brent Goose which is the subject of a separate, species-specific survey (see Appendix 2). For the calculation of the individual species populations shown, total numbers are calculated from counts summed across all subsites counted in each month surveyed (I-WeBS months: Sept – March). The annual maxima is then identified and used to calculate the five-year mean peak. The baseline period is 1995/96 – 1999/00 and the most recent five-year average is for 2005/06 – 2009/10. To facilitate calculation of this recent average, the dataset comprises I-WeBS data for the period 2005/06 – 2008/09[9] and count data from the high tide survey of the 2009/10 waterbird survey programme.

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).

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

[9] Surveys undertaken on a rising or high tide.

Table 4.1 Population data for waterbird Special Conservation Interest Species of Dungarvan Harbour SPA

Site Special Conservation Interests (SCIs)	Baseline Period (1995/96 - 1999/00)	Recent Site Data (2005/06 – 2009/10)
Light-bellied Brent Goose*	723 (i)	1,424 (i)
Golden Plover*	4,980 (n)	3,454 (n)
Dunlin*	4,984 (n)	2,903 (n)
Black-tailed Godwit*	779 (i)	706 (i)
Bar-tailed Godwit*	1,068 (n)	913 (n)
Redshank*	731 (n)	941 (n)
Turnstone*	177 (n)	196 (n)
Shelduck	538 (n)	339 (n)
Red-breasted Merganser	52 (n)	31
Great Crested Grebe	53 (n)	36
Oystercatcher	767 (n)	898 (n)
Grey Plover	444 (n)	493 (n)
Lapwing	3,233 (n)	2,035
Knot	698 (n)	715 (n)
Curlew	766 (n)	452

* denotes site selection species.
(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance.
International thresholds used for the baseline period are given in Wetlands International (2002). Recent site data uses thresholds as per Wetlands International (2006). All-Ireland thresholds are shown within Crowe et al. (2008).

4.2 Waterbird population trends at Dungarvan Harbour SPA

The calculation and assessment of waterbird population trends for Dungarvan Harbour SPA follows the UK Wetland Bird Survey 'Alerts System' which provides a standardised technique for monitoring changes in the numbers of non-breeding waterbirds over a range of spatial scales and time periods (Appendix 3).

For Dungarvan Harbour, annual population indices were calculated for each 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).

Table 4.2 presents site population trends for the waterbird Special Conservation Interest species of Dungarvan Harbour SPA. Trends are given for the 'long-term' 12-year period (1995/96–2007/08) and the recent five-year period (2002/03 - 2007/08). 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 across the specified time period.

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.

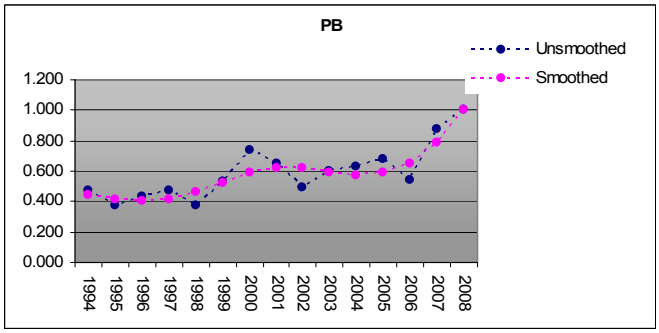
Table 4.2 Site Population Trends for waterbird Special Conservation Interest species of Dungarvan Harbour SPA

	Special Conservation Interests	Site Population Trend[1] 12 Yr	Site Population Trend[2] 5 Yr
Site Selection Species	Light-bellied Brent Goose	+ 91.1	+ 27.3
	Golden Plover	- 18.5	- 29.3
	Dunlin	- 38.4	- 16.6
	Black-tailed Godwit	+ 46.7	+ 2.6
	Bar-tailed Godwit	+ 6.7	- 14.5
	Redshank	+ 65.5	+ 16
	Turnstone	+ 31.2	+ 34.8
Additional Special Conservation Interests	Shelduck	- 21.9	- 13.4
	Red-breasted Merganser	- 15.4	- 9.4
	Great Crested Grebe	- 14.5	- 20
	Oystercatcher	+ 51.2	+ 25.2
	Grey Plover	- 11.2	- 2.8
	Lapwing	- 46.1	- 28.9
	Knot	+ 10	+ 29.5
	Curlew	- 19.6	- 12.7

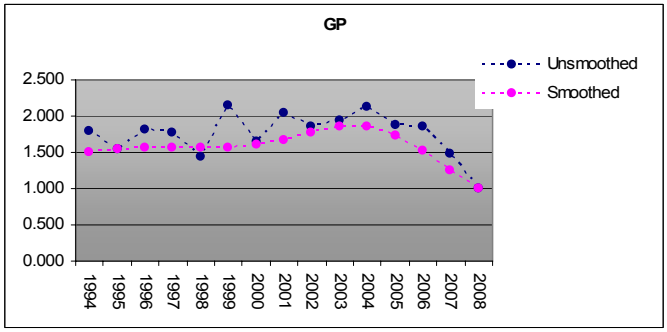
[1]Site population trend analysis: 12 yr = 1995/96 – 2007/08
[2]Site population trend analysis: 5 yr = 2002/03 – 2007/08.

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

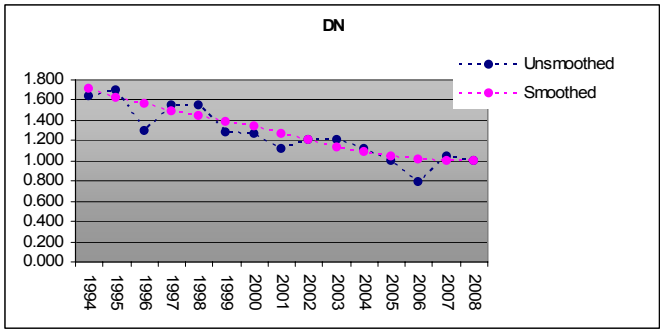
Light-bellied Brent Goose – has shown a trend for progressive increase at Dungarvan Harbour. This is consistent with the national trend (Crowe et al. 2008).



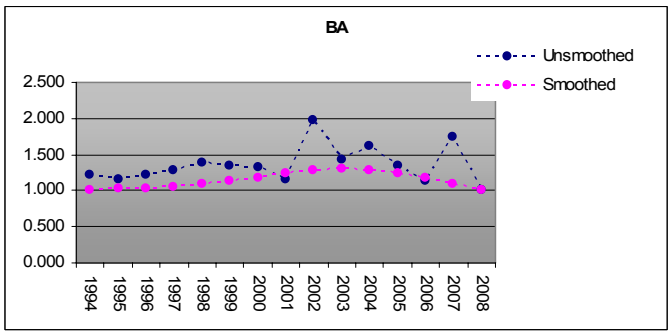
Golden Plover – despite wide variation in annual indices, the site trend was reasonably stable or slightly increasing up to 2004/05. However, since 2004 numbers have dropped sharply, hence the larger short-term trend for decline.



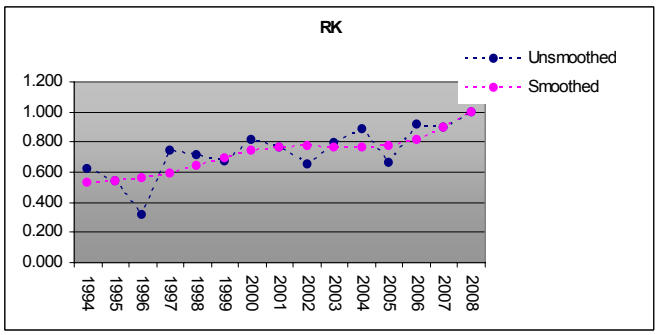
Dunlin – numbers have declined progressively at Dungarvan Harbour. This is in line with the national trend (Crowe et al. 2008) and that evident in Northern Ireland and Britain (Calbrade et al. 2010).



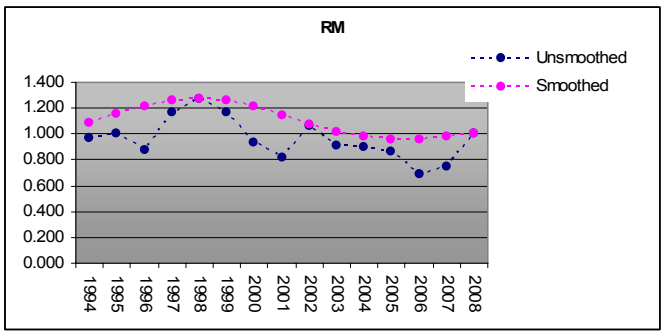
Bar-tailed Godwit – site numbers showed a slight increase up to 2004/05 but have since declined to former levels, hence the short-term trend for decline.



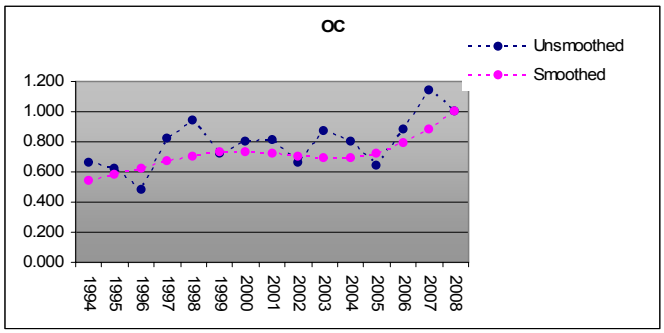
Redshank – although numbers fluctuated widely between some years, the smoothed trend highlights the relatively consistent increase in numbers across the data period.



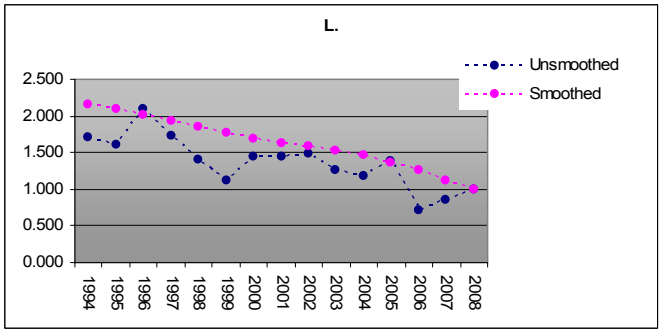
Red-breasted Merganser – numbers of this species have fluctuated widely between years. A period of higher numbers in the years 1997/98 to 1999/00 was followed by a decline. However the short-term trend suggests some recovery.



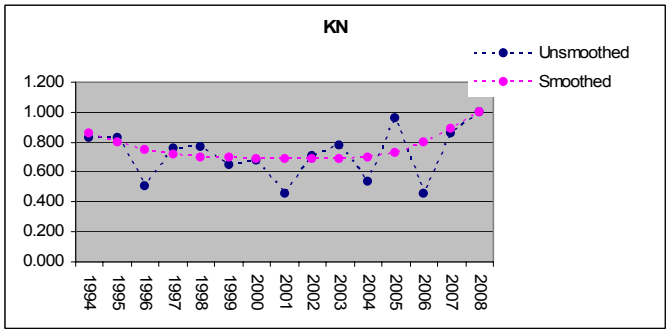
Oystercatcher – exhibits a trend for consistent increase in numbers across the data period. Numbers recorded in 2007/08 and 2008/09 were the highest since the data period began.



Lapwing – numbers have declined steadily which is consistent with the all-Ireland trend (Crowe et al. 2008).



Knot – numbers have fluctuated widely between years but the smoothed trend indicates a relatively stable site population across time with a recent increase; numbers recorded in 2007/08 and 2008/09 were the highest since the data period began.



4.3 Dungarvan Harbour SPA – site conservation condition of non-breeding waterbirds

Conservation condition of waterbird species is determined using the longer-term site population trend (Table 4.3). Conservation condition is assigned using the following criteria:

Favourable population = population is stable/increasing.

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

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

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

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

With regards the 15 non-breeding waterbird species of Special Conservation Interest for Dungarvan Harbour SPA, and based on the long-term population trend for the site, it has been determined that:-

1. 2 species are currently considered as **Unfavourable** (Dunlin and Lapwing);

2. 6 species is considered as **intermediate (unfavourable)** (Golden Plover, Great Crested Grebe, Shelduck, Red-breasted Merganser, Grey Plover and Curlew);

3. 7 species are currently considered as **Favourable** (Light-bellied Brent Goose, Black-tailed Godwit, Bar-tailed Godwit, Redshank, Turnstone, Oystercatcher and Knot);

Table 4.3 Non-breeding SCI species of Dungarvan Harbour SPA – Current Site Conservation Condition

	Special Conservation Interests	Site Population Trend[1]	Site Conservation Condition
Site Selection Species	Light-bellied Brent Goose	+ 91.1	Favourable
	Golden Plover	- 18.5	Intermediate (unfavourable)
	Dunlin	- 38.4	Unfavourable
	Black-tailed Godwit	+ 46.7	Favourable
	Bar-tailed Godwit	+ 6.7	Favourable
	Redshank	+ 65.5	Favourable
	Turnstone	+ 31.2	Favourable
Additional Special Conservation Interests	Shelduck	- 21.9	Intermediate (unfavourable)
	Red-breasted Merganser	- 15.4	Intermediate (unfavourable)
	Great Crested Grebe	- 14.5	Intermediate (unfavourable)
	Oystercatcher	+ 51.2	Favourable
	Grey Plover	- 11.2	Intermediate (unfavourable)
	Lapwing	- 46.1	Unfavourable
	Knot	+ 10	Favourable
	Curlew	- 19.6	Intermediate (unfavourable)

4.4 Conservation condition in light of national, all-Ireland and International trends

Site conservation condition and population trends for waterbird species of Special Conservation Interest at Dungarvan Harbour SPA have been reviewed in light of species' all-Ireland and international trends. This information review is presented in Table 4.4.

The calculation of all-Ireland trends (island of Ireland) for the long-term (12-year) data period has been facilitated by the provision of indices from the I-WeBS and the WeBS database (kindly provided by the I-WeBS Office and the British Trust for Ornithology). International trends follow Wetlands International (2006).

An additional assessment is carried out in Table 4.4 which examines 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:-

- Green – species whose populations are stable or increasing at both site level and all-Ireland level.
- Yellow - species whose populations are stable or increasing at site level but decreasing at 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.

Pink and red categories, which are not used in the current assessment for Dungarvan Harbour, highlight where populations are stable at national level, but where significant declines are seen at site level. In these cases it would be reasonable to suggest that site-based management issues may be responsible for the observed declining site population trends (Leech et al. 2002).

Table 4.4 Non-breeding waterbird populations of Dungarvan Harbour – additional population review, status and trends

Site Special Conservation Interests (SCIs)	BoCCI Category[a]	Site Conservation Condition	Current Site Trend 12 Yr[b]	Current all-Ireland Trend[c]	Current International Trend[d]
Light-bellied Brent Goose*	Amber	Favourable	+ 91.1	+ 58	Increase
Golden Plover*	Red	Intermediate (unfavourable)	- 18.5	- 2.2	Decline
Dunlin*	Amber	Unfavourable	- 38.4	- 46.5	Stable *(alpina)*
Black-tailed Godwit*		Favourable	+ 46.7	+ 70.2	Increase
Bar-tailed Godwit*	Amber	Favourable	+ 6.7	+ 1.5	Stable
Redshank*	Red	Favourable	+ 65.5	+ 22.7	Stable/Decline
Turnstone*	Green	Favourable	+ 31.2	+ 16.1	Decline
Shelduck	Amber	Intermediate (unfavourable)	- 21.9	+ 4.46	Stable
Red-breasted Merganser*	Green	Intermediate (unfavourable)	- 15.4	- 11	n/c
Great Crested Grebe	Amber	Intermediate (unfavourable)	- 14.5	- 18	Decline
Oystercatcher	Amber	Favourable	+ 51.2	+ 23.5	Decline
Grey Plover	Amber	Intermediate (unfavourable)	- 11.2	- 33.1	Decline
Lapwing	Red	Unfavourable	- 46.1	- 40.12	Decline
Knot	Red	Favourable	+ 10	- 2.91	Decline
Curlew	Red	Intermediate (unfavourable)	- 19.6	- 25.7	Decline

*Denotes site selection species; [a]See Lynas *et al.* (2007) for detailed listing criteria; [b]Site population trend analysis: see Section 4.2 for details. [c]all-Ireland trend calculated for period 1994/95 to 2008/09; [d]international trend after Wetland International (2006)

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 Dungarvan Harbour SPA.

The information provided in Part Five is intended to:-

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

Section 5.2 provides selected ecological summary information for the non-breeding waterbirds of Dungarvan Harbour SPA. This is intended to aid the interpretation of species distribution data provided within Section 5.3 of this report and related appendices. Finally, Section 5.4 provides summary information for activities and events that occur across Dungarvan Harbour SPA that may either act upon the habitats within the site, or may interact with waterbirds using the site.

Note that the information provided in this document does not provide a comprehensive assessment on which to assess plans and projects as required under the Habitats Directive, but rather should inform the scope of the assessments and help direct where further detailed examinations are required.

The information provided in Part Five is based on best-available information at time of report production (September 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 70 waterbird species that have been recorded at Dungarvan Harbour SPA during the period 1994/95 – 2008/09 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 listed species and for other waterbird species included in the total waterbird assemblage. These species may include those that utilise the site during passage, those that are present in months of the year outside of the non-breeding season[10] or species that use the site at certain times only (e.g. as a cold weather refuge).

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

During the period 1994/95 to 2008/09, 26 waterbird species were recorded on a regular basis during I-WeBS.[11] Out of these 26 species, 15 are listed as Special Conservation Interest species for the site and a further 11 are non-SCI species. These non-SCI waterbird species are shown in Table 5.1 together with population data taken from the I-WeBS database.

Table 5.1 Regularly-occurring non SCI waterbird species that occur at Dungarvan Harbour SPA during the non-breeding season

Species	Baseline Data Period (1995/96 – 1999/00)	Recent Site Average (2004/05 – 2008/09)
Wigeon (*Anas penelope*)	304	294
Teal (*Anas crecca*)	167	231
Mallard (*Anas platyrhynchos*)	38	53
Goldeneye (*Bucephala clangula*)	17	8
Great Northern Diver (*Gavia immer*)	3	7
Cormorant (*Phalacrocorax carbo*)	56	70
Grey Heron (*Ardea cinerea*)	17	19
Ringed Plover (*Charadrius hiaticula*)	64	14
Sanderling (*Calidris alba*)	45	68 (n)
Snipe (*Gallinago gallinago*)	103	65
Greenshank (*Tringa nebularia*)	19	30 (n)

(n) denotes numbers of all-Ireland importance (thresholds given in Crowe et al. 2008)

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

Table 5.2 provides selected ecological information for waterbird SCI species of Dungarvan Harbour SPA. Information is provided for Selection species (Table 5.2a) and for additional Conservation Interests (Table 5.2b). Information is provided for 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).

Information to aid understanding of categories and codes is provided in the table sub text.

[11] Regular is defined as a species that has occurred in 12 out of the 15-year data period.

Table 5.2a Waterbirds – Ecological characteristics, requirements & specialities – non-breeding 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	2	High
Golden Plover *Pluvialis apricaria*	Charadriidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate
Dunlin *Calidris alpina*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	3	Moderate
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
Redshank *Tringa totanus*	Scolopacidae (wading birds)	Widespread	4	Wide	Intertidal mud and sand flats	2	Moderate
Turnstone *Arenaria interpres*	Scolopacidae (wading birds)	Very widespread	4	Wide	Intertidal mud and sand flats	3	High

[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 Dungarvan Harbour 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. Note, a score of 1 for sea ducks and divers relates to propensity for within-season movements although the site is an important part of the species' wintering range.

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

Table 5.2b Waterbirds – Ecological characteristics, requirements & specialities – species of Additional Conservation Interest

	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 mudflats and shallow subtidal	3	High
Red-breasted Merganser *Mergus serrator*	Anatidae (sea ducks)	Intermediate	2	Highly specialised	Sheltered & shallow subtidal	1	Unknown
Great Crested Grebe *Podiceps cristatus*	Podicipedidae (grebes)	Widespread	2/3	Narrower	Sheltered & shallow subtidal	2	High
Oystercatcher *Haematopus ostralegus*	Haematopodidae (wading birds)	Intermediate	4	Narrower	Intertidal mud and sand flats	2	High
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

[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 Dungarvan Harbour 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. Note, a score of 1 for sea ducks and divers relates to propensity for within-season movements although the site is an important part of the species' wintering range.
[F] Site fidelity on non-breeding grounds: Unknown; Weak; Moderate; or High (based on published information).

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 Dungarvan Harbour SPA, a survey programme of four low tide counts (October, November & December 2009 and February 2010) and a high tide count (February 2010) were completed across the site.[12]

Waterbirds were counted within a series of 18 count sections (subsites) (Appendix 6). An additional subsite (0M428 Clonea Strand) was also counted during the high tide survey. This site, located c2km to the east of Dungarvan Harbour is outside of the SPA site and is not therefore included in data analyses although it is recognised that some interchange in bird numbers may occur between the two.

The behaviour of waterbirds during counts was attributed to one of two categories (foraging or roosting/other) while the position of birds was recorded in relation to one of four broad habitat types (intertidal, subtidal, supratidal and terrestrial). 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, a 'roost survey' was undertaken during the high tide period on 8th March 2010. During this survey, roost sites were located, species and numbers counted and the position of the roosts marked onto field maps.

5.3.2 Waterbird data, analyses and presentation

The aim of data analyses was to understand how waterbirds are distributed across Dungarvan Harbour SPA during the autumn and winter months. By assessing patterns of waterbird

[12] Low tide surveys: 07/10/09, 17/11/09, 17/12/09 & 11/02/10 plus a high tide survey on 27/01/10.

distribution at low and high tide, together with examination of data on sediment and invertebrate distribution and abundance, we aimed to identify areas (subsites) within the site that are the most important for foraging and roosting on a species by species basis.

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

- Total numbers (low tide surveys);
- Total numbers (high tide survey);
- Total numbers of foraging birds (low tide surveys);
- Total numbers of roosting birds (low tide and high tide surveys);
- Foraging density (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 the subsites surveyed. Rank positions were then converted to categories (see below) with the exception of assessments relating to the single high tide survey or average foraging density that are presented simply as rank numbers. The highest rank position/category for each subsite across any of the low tide count dates is presented in a subsite by species matrix.

Subsite Rank Position - Categories

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

Waterbird count data for low tide surveys are also presented as species distribution maps ('dot density maps'). Dot-density maps show foraging or roosting/other distribution within intertidal, subtidal or supratidal habitats. The 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.**

Summary data from the roost survey are presented together with a roost map that shows the mapped locations of waterbird roosts.

For selected waterbird species intertidal foraging density (birds/ha) was calculated for subsites and for the whole site by taking the mean number of each species during low tide counts, and dividing by the intertidal area surveyed (subsite or whole site as appropriate). These data, together with detailed information on species/flock positioning, are presented as separate discussion notes for each SCI species.

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 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

Note that hereafter the name 'Dungarvan Harbour refers to the count area used during the 2009/10 waterbird survey programme. There are some differences between the extent of the count area and the total area designated as Dungarvan Harbour SPA[13] (Appendix 6). Standard waterbird codes are often used in figures, tables and data files; these codes are listed in Appendix 4.

A total of 40 waterbird species were recorded during the 2009/10 survey programme at Dungarvan Harbour SPA. Cummins and Crowe (2010) provide a summary of waterbird data collected. With the exception of Red-breasted Merganser (not recorded on 07/10/09), all SCI species were recorded within all counts undertaken. Table 5.4 shows peak numbers (whole site) for SCI species recorded during the low tide (LT) and high tide (HT) surveys.

Average % occupancy, defined as the average percentage of subsites in which a species occurred during low tide counts varied greatly. The least widespread-occurring species were Golden Plover (11%) and Great Crested Grebe (12.5%). The most widespread-occurring species were Redshank and Curlew (% occupancy > 80%) (Table 5.4).

Average % 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 least widespread-occurring species was Golden Plover (19%). The majority of species (ten out of the total 15) ranged across 20% - 50% of the total count area. Only four species ranged on average, across an area greater than 50% of the total area surveyed (Light-bellied Brent Geese, Redshank, Oystercatcher and Curlew).

[13] The relationship between the count area and the designated sites shown in a map in Appendix 6

Table 5.4 Dungarvan Harbour 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*	1,305 (i)	1,867 (i)	43.1 (13.9)	57.0 (20.7)
Golden Plover*	8,990 (n)	421	11.1 (6.4)	19.4 (15.5)
Dunlin*	3,150 (n)	1,889 (n)	34.7 (8.3)	47.2 (5.1)
Black-tailed Godwit*	1,458 (i)	494 (i)	48.6 (16.6)	38.4 (14.6)
Bar-tailed Godwit*	1,023 (n)	954 (n)	27.8 (13.6)	37.4 (15.1)
Redshank*	1,023 (n)	408 (n)	87.5 (2.9)	90.9 (16.4)
Turnstone*	78	149 (n)	23.6 (8.3)	37.9 (16.9)
Shelduck	269 (n)	251 (n)	25.0 (14.0)	21.9 (10.2)
Red-breasted Merganser	30	32	14.8 (3.2)	38.6 (16.9)
Great Crested Grebe	12	7	12.5 (5.3)	46.5 (10.9)
Oystercatcher	827 (n)	687 (n)	76.4 (9.5)	98.5 (0.6)
Grey Plover	184 (n)	410 (n)	20.8 (12.3)	32.7 (22)
Lapwing	1,201	1,768	40.2 (13.4)	24.6 (6)
Knot	729 (n)	541 (n)	19.4 (9.6)	32.1 (14.1)
Curlew	659 (n)	396	83.3 (4.5)	90.8 (16.7)

* site selection species. n/c = not assessed. (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 07/10/09, 17/11/09, 17/12/09 & 11/02/10; [II] 1high-tide count undertaken on 11/02/10;
[III] Mean (± s.d) averaged across low tide surveys.

Species richness (total number of species) across the whole site was relatively consistent throughout the survey programme. A total of 33, 30, 34 and 32 species was recorded during the four low tide counts respectively. 35 species were recorded during the high tide count on 27th January 2010.

Species richness at subsite level varied considerably (Table 5.5). 0M419 (Cunnigar west) supported the greatest diversity of species during both low and high tide surveys.

Table 5.5 Subsite species richness

Subsite	Subsite Name	Mean (±S.D) LT Survey	HT Survey	Peak Overall
0M411	Ballyneety Bridge	6 (0.5)	3	6 (L)
0M412	Shandon Island	14 (4)	13	17 (L)
0M413	Monang	10 (2)	7	11 (L)
0M414	Dungarvan Town	10 (3)	10	13 (L)
0M415	Inner Dungarvan Town	6 (1)	3	7 (L)
0M416	Brickey Upper	3 (2)	8	8 (H)
0M417	Brickey Lower	14 (1)	12	16 (L)
0M418	Reencrehy	13 (3)	15	16 (L)
0M419	Cunnigar West	23 (3)	21	25 (L)
0M420	Whitehouse Bank	17 (2)	10	18 (L)
0M421	Ballynacourty North	14 (0.5)	16	16 (H)
0M422	Helvick Pier - Ballynacourty Pt	10 (3)	12	13 (L)
0M423	Duck's Pool	11 (4)	10	16 (L)
0M424	Old Railway	9 (3)	13	13 (H)
0M425	Ballyrandle	20 (2)	12	23 (L)
0M426	Clashnaloohan	1 (1)	1	3 (L)
0M427	Cunnigar South	20 (2)	16	23 (L)
0M428	Bridge	5 (2)	1	7 (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 surveys. Selected results from these 'subsite assessments' are shown in Tables 5.6 (a–e). 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.

Ranked assessments relate to the broad habitat that birds were observed in. In some cases, data for different broad habitats have been combined such as intertidal and supratidal habitats (roosting birds) or intertidal/subtidal, the latter for some wading birds in order to include those individuals that were roosting or foraging with their feet in water and hence recorded as subtidal (see superscripts and their description for each table).

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

Tables 5.6 (a–e) are followed by species discussion notes (Page 30 onwards) which provide additional information on the distribution of each SCI species, drawing upon the full extent of the data collected and analysed for Dungarvan Harbour SPA. Waterbird distribution dot-density maps are provided in Appendix 7. Finally, summary roost data are presented in Appendix 8.

Table 5.6 (a) Dungarvan Harbour 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).

Species ► Subsites ▼	PB	GP	DN	BW	BA	RK	TT	SU	RM	GG	OC	GV	L.	KN	CU
0M411						L	L						M		
0M412	V	H	M	V	L	H		L			M		V		H
0M413				L		M		L			M		H		M
0M414	L	V	L	H		M		M			M		M		M
0M415	L			L	L	L					L				L
0M416						L							V		L
0M417	M		H	V		H		H			H		V		H
0M418	V		H	V	H	V	M	M			H	L	V	H	H
0M419	V		H	L	M	H	V	H	V	V	H	H	L	L	H
0M420	H	V	M		H	M	M		M	M	H	H		H	H
0M421	H			L	M	M					H	H		L	V
0M422	L					M	M		H	V	M				L
0M423	H		M	M	M	H	V				M		L	M	L
0M424	M		L	H		M					L		M		M
0M425	H	M	H	H	V	H	V		V	M	H	M	L	H	H
0M426				L		L					L				
0M427	L	H	V	V	H	V		V			V	V	M	V	V
0M428					M	L					M				L

Table 5.6 (b) Dungarvan Harbour SPA Subsite assessment – total numbers foraging intertidally,[I] subtidally[II] and intertidal/subtidal combined [III](LT surveys).
Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods).

Species ► Subsites ▼	PB[I]	PB[II]	GP[I]	DN[I]	BW[III]	BA[III]	RK[III]	TT[I]	SU[I]	RM[II]	GG[II]	OC[I]	GV[I]	L.[I]	KN[I]	CU[I]
0M411							L	M								L
0M412				M	V	L	H		L			M		H		H
0M413					M		M		L			M		M		M
0M414	L			L	M		M		M			M		V		M
0M415		H			L	L	L					M				L
0M416							L									L
0M417	M			H	V		H		H			M		V		M
0M418	M			H	H	H	V	M	H			H			H	H
0M419	H	V		H	H	M	H	V	H	V	V	V	H		L	H
0M420	V			M		H	M	L		M	M	H	H		H	H
0M421	V	V			M	M	M					H	H		L	M
0M422	L	L					M	M		H	V	M		H		L
0M423	H	H		M	M	M	M	V				M		V	M	H
0M424	M	V		L	H		M					M				M
0M425	H	M	V	H	V	V	H	V		V	M	H	H		H	H
0M426					L		L					M				
0M427	M			V	V	H	V	M	V			V	V		V	V
0M428						L	L					M				L

Table 5.6 (c) Dungarvan Harbour SPA Subsite assessment – total numbers (roosting/other behaviour) within LT surveys (Intertidal[I], Subtidal[II], intertidal/subtidal combined [III]); Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods). RM and GG not recorded roosting.

Species ► Subsites ▼	PB[I]	PB[II]	GP[III]	DN[I]	BW[III]	BA[III]	RK[III]	TT[I]	SU[I]	SU[II]	OC[I]	GV[I]	L.[III]	KN[III]	CU[III]
0M411							L	V					M		L
0M412	V	V			V		M		H		H		V		V
0M413					H		H			V	H		H		M
0M414			H		V				H		L		M		M
0M415		M													
0M416			V				H						M		
0M417					H		V			V	V		H		H
0M418				V	V		V			V	V	V	V		H
0M419	V				L	V			V		H		L		H
0M420	H		V	V				V			H				M
0M421	H	V			L						M				V
0M422							V				L				
0M423					M		H				M		L		H
0M424	M	H					H						M		L
0M425	M	V	M		M	V	H				M		L	V	H
0M426															
0M427	H	M	H		M		H		V		V		M		V
0M428															L

Table 5.6 (d) Dungarvan Harbour SPA Subsite assessment – rank average intertidal foraging density: top six subsites for selected species (LT surveys)

Species ► Subsites ▼	PB	DN	BW	BA	RK	SU	OC	GV	KN	CU	TOTAL WATERBIRDS (foraging intertidally)
0M411											
0M412			4		2					2	
0M413			5		5	6					
0M414						5				6	
0M415				5							
0M416											
0M417	5	3	2			3					5
0M418		2	6	6	1	2	3		2	3	3
0M419	3	5				4	4	2	6		
0M420	5							4	5		
0M421	4							3			
0M422							5				
0M423	1	6	3	4	3				3	5	4
0M424	2		1								2
0M425		4		1			6	5	4		
0M426											
0M427		1		3	6	1	2	1	1	4	1
0M428				2	4		1			1	6

Table 5.6 (e) Dungarvan Harbour SPA Subsite assessment – ranked total numbers (HT survey & across all habitats).

Species ► Subsites ▼	PB	GP	DN	BW	BA	RK	TT	SU	RM	GG	OC	GV	L.	KN	CU
0M411											7		7		
0M412	1					7	8				11		4		9
0M413				5		7									10
0M414		1		3		3		5					3		7
0M415															
0M416		2	7	4		13							1		8
0M417	9				6	1		3	2		12				4
0M418	4		4	2	4	11	9	1			2		6	3	3
0M419	7		6			4		4	5	2	6	3		4	2
0M420	10						3		1	1	8				
0M421			1		2	12	6				3	1		1	
0M422	11					14	7		3		4		8		
0M423	12			1	5	6	5								
0M424	5	3	2		1	4	9				8	5	5		6
0M425	8					10	1		3	3	10				10
0M426	6														
0M427	2		3		3	2	4	2			1	2	2	2	1
0M428											12				

Table 5.6 (f) Dungarvan Harbour SPA Subsite assessment – total numbers (roosting/other behaviour) within HT surveys (Intertidal^{I}, Subtidal^{II}, Intertidal/Subtidal^{III} combined).

Species ► Subsites ▼	PB^{I}	PB^{II}	GP^{I}	DN^{I}	BW^{I}	BA^{III}	RK^{I}	TT^{I}	SU^{I}	SU^{II}	OC^{I}	GV^{I}	L.^{I}	KN^{III}	CU^{III}
0M411													4		
0M412		1					4						3		4
0M413															
0M414			1		1		5						5		3
0M415		6											1		
0M416			2												
0M417															
0M418	2	3								1					
0M419	1			3			2	1	1		3	3		3	1
0M420		4									6				
0M421		6		1		1					2	1		1	
0M422											4		7		
0M423						3									
0M424		2	3	4			3	2			5	4	6		
0M425		5									7				
0M426															
0M427		6		2		2	1			2	1	2	2	2	2
0M428															

Dungarvan Harbour SPA (4032) - Waterbird Survey Programme 2009/10

Waterbird distribution - discussion notes

Where mentioned, information on benthic communities or sediment is from the intertidal and subtidal sampling programme commissioned by the National Parks & Wildlife Service (NPWS) and Marine Institute and reported in NPWS (2011b) and ASU (2009).

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

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

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

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

Numbers

Internationally-important numbers of Brent Geese were recorded in all surveys undertaken between November 2009 and February 2010. Numbers were lower in October and November 2009 (615 and 639 respectively) then rose to 1,205 on 17/12/09. The peak low tide count of 1,305 was recorded during the final low tide survey (11/02/10) but the peak count overall was recorded during the high tide survey (1,867 Brent) (27/01/10).

Across Dungarvan Harbour, Brent Geese was a relatively widespread species, recorded within 14 subsites overall. Four subsites supported this species during all four low-tide surveys: 0M419 (Cunnigar West), 0M421 (Ballynacourty North), 0M425 (Ballyrandle) and 0M427 (Cunnigar South).

0M419 (Cunnigar West) supported peak numbers on 07/10/09 and 0M418 (Reencrehy) on 17/11/09. Thereafter 0M412 (Shandon Island) supported peak numbers in all surveys with numbers >600 representing numbers of International importance. The subsite peak count of 662 Brent was recorded within 0M412 on 17/12/09.

Foraging Distribution

Brent Geese are grazers and are known for their preference for foraging in intertidal areas with the Eelgrass *Zostera* sp. (Robinson et al. 2004). Where this food source is absent the birds feed upon algae species, saltmarsh plants and may also undertake terrestrial grazing. At Dungarvan, Zostera sp. is known from sandflats to the east and west of the Cunnigar spit. The intertidal benthic survey of 2009 (ASU, 2009) noted that the green alga *Ulva* sp. occurred across the site and was particularly notable on the lower shore of 0M425 (Ballyrandle).

Intertidal foraging was recorded regularly (three surveys or more) for six subsites: 0M418 (Reencrehy), 0M419 (Cunnigar West), 0M421 (Ballynacourty North), 0M424 (Old Railway), 0M425 (Ballyrandle) and 0M427 (Cunnigar south). During low tide surveys, two subsites supported peak proportions of foraging Brent (foraging intertidally): 0M421 (Ballynacourty North) in October and November 2009, and 0M420 (Whitehouse Bank) on 17/12/09 and 11/02/10. The latter supported 75% and 65% of the total numbers foraging intertidally on the respective dates. The geese were often, although not always, located close to the tide edge. 0M420 and 0M421 are both located to the east of Cunnigar spit and both therefore have an extensive intertidal area at low tide and a long tide edge. Aquaculture trestles are widespread on the lower shore.

0M419 (Cunnigar West) supported good numbers foraging intertidally during most low tide surveys (peak number 119 on 07/10/09), as did 0M425 (Ballyrandle) with fewer numbers recorded in 0M427 (Cunnigar south).

Subtidal foraging was recorded less frequently, most subsite records of a single occasion. Notable numbers recorded include 210 within 0M419 (Cunnigar West) on 17/12/09 and 81 within 0M421 (Ballynacourty North) on 11/02/10.

Terrestrial foraging within agricultural grassland (outside of the SPA boundary) was recorded within 0M412 (Shandon Island) during the December 2009 low tide survey, and within the small terrestrial subsite 0M426 (Clashnaloohan) during the high tide survey. Terrestrial foraging is likely to occur regularly within these and other suitable grassland areas that are outside the SPA boundary.

The greatest intertidal foraging density within a single subsite was 6 Brent Geese ha^{-1} (0M423 Duck's Pool, 17/11/09). Average subsite foraging density was also highest for 0M423 (1.5 individuals ha^{-1}). The whole site mean feeding density (intertidal habitat) was 0.27 Brent Geese ha^{-1}.

Roosting Distribution

During the first three low tide surveys relatively low proportions of the total number of Brent Geese were recorded within roosting/other behaviour (max 35%). However, during the high tide survey (27/01/10) and the final low tide survey (11/02/10), 51% and 55% respectively of Brent Geese were involved in roosting/other behaviour across intertidal and subtidal habitats.

During low tide surveys no single, or selection of subsites stand out in supporting roosting/other individuals on regular occasions. 0M412 (Shandon Island) supported good numbers on two occasions (298 and 611 on 17/12/09 and 11/02/10 respectively). 0M419 (Cunnigar West) also held good numbers on two occasions (137 on 07/10/09, and 72 during the high tide survey 27/01/10). 0M420 (Whitehouse Bank) recorded 82 individuals on 11/02/10, this subsite also supporting peak numbers of foraging individuals on that date.

963 Brent Geese were recorded roosting/other within nine subsites during the high tide survey (11/02/10). The majority (66%) were located within subtidal habitat. 0M412 (Shandon Island) supported the greatest number (600 individuals), all within subtidal habitat. 0M418 (Reencrehy) supported 142 individuals; 56% within subtidal habitat, and 0M424 (Old Railway) recorded 100 individuals. Intertidal roosting was recorded within only two subsites: 0M418 and 0M419; 135 individuals in total. There is known to be some interchange of species between Dungarvan Harbour and Clonea Strand, located to the NE of Dungarvan harbour (Pat Smiddy, pers. comm.). This area was therefore counted also during the high tide survey and it is notable that 300 Brent Geese were recorded there (subtidal roosting/other).

During the roost survey (08/03/10), 285 Brent Geese were recorded roosting across seven subsites (other individuals were observed foraging but numbers were well down on previous site numbers). 0M418 (Reencrehy) supported the most numbers (103), these geese loafing subtidally at two locations. 0M427 (Cunnigar south) supported 68 individuals, the majority of which were roosting intertidally at three different

areas of shoreline. 60 Brent Geese were roosting within 0M425 (Ballyrandle), the majority of which (54) at one intertidal location (point of Skehacrine) along with two Oystercatchers and one Redshank. Thereafter 0M415, 0M417, 0M419 and 0M421 supported fewer individuals.

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. The Golden Plovers that winter in Ireland are thought to be mostly Icelandic-breeding birds *P. a. altifrons* (Wernham et al. 2002).

Numbers

Numbers of Golden Plover peaked early in the survey programme, a whole site count of 8,990 recorded on 17/11/09, surpassing the threshold of all-Ireland importance and close to the threshold (9,300) for international importance. In the new year, numbers dropped considerably with only 421 recorded during the high tide survey (27/01/10) and 12 individuals on 11/02/10.

Golden Plovers were recorded in seven subsites overall (0M412, 0M414, 0M416, 0M420, 0M424, 0M425 and 0M427). 0M420 (Whitehouse Bank) held peak numbers during the first three surveys, and 100% of the total on 17/11/09. 0M414 (Dungarvan Town) supported peak numbers during the latter two surveys (27/01/10 and 11/02/10).

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).

At Dungarvan Harbour, almost no records were made of Golden Plovers foraging intertidally. The only exception was one individuals within 0M425 (Ballyrandle) on 07/10/09 and 13 individuals within the same subsite on 17/12/09.

No terrestrial foraging was recorded but this is likely to occur in suitable fields around the site that are not included within the SPA.

Roosting Distribution

Golden Plovers were recorded roosting intertidally in all low tide surveys although very low numbers (12 individuals in 0M414) occurred during the final February 2010 low tide count. The largest single number of roosting individuals was 8,990 recorded within 0M420 (Whitehouse Bank) on 17/11/09. This subsite also held good numbers on 17/12/09 (6,150 GP) and during the October 2009 low tide survey (1,440). 0M412 (Shandon island) recorded 389 Golden plovers roosting intertidally on 17/12/09 and 0M425 and 0M427 held 152 and 190 respectively on 07/10/09.

Golden Plovers were not recorded roosting during the roost survey (08/03/10).

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

The Dunlin is a Holarctic and highly migratory wader, breeding widely in Arctic zones across Europe, Asia and North America. The nominate form *alpina* breeds from northern Scandinavia eastwards across European Russia and western Siberia to 85^0 E (Delaney et al. 2009). This race migrates southwest to winter along the coasts of Western Europe, south to Iberia, western Mediterranean and beyond.

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

Numbers

Dunlin were recorded in numbers of all-Ireland importance in all months except the October low tide survey. The site peak of 3,150 individuals was recorded on 11/02/10 and 1,889 were recorded during the high tide survey.

Overall, Dunlin were recorded within 12 subsites, but subsite usage in individual surveys varied from five (07/10/09 and 17/12/09) to eight subsites (17/11/09). 0M427 (Cunnigar south) supported peak numbers in all four low tide surveys. 0M421 (Ballynacourty North) held peak numbers during the high tide survey (1,280 individuals), representing numbers of all-Ireland importance.

The subsite peak count of 2,667 Dunlin were recorded for 0M427 (Cunnigar south) on 11/02/10, and represents numbers of all-Ireland importance. Four subsites recorded Dunlin in all four low tide surveys: 0M419, 0M420, 0M425 and 0M427.

Foraging Distribution

Dunlin favour open and wide intertidal areas as opposed to narrow, enclosed estuaries. The expansive tidal flats of Dungarvan and especially 0M427 (Cunnigar south) and 0M425 (Ballyrandle) fit this pattern. But the Dunlin is also a wader species considered to prefer muddier estuaries (e.g. Hill et al. 1993; Summers et al. 2002). Thus the inner, sheltered subsites to the west of Cunnigar spit (0M418, 0M419, 0M427 and 0M417) appear more favoured than those to the east (0M420 and 0M421).

The majority of Dunlin foraged during low tide surveys. 0M427 (Cunnigar south) held peak numbers of foraging Dunlin in all four low tide surveys. The subsite peak count of 2,667 Dunlin recorded within 0M427 (Cunnigar south) on 11/02/10 were of all intertidally foraging birds. On 07/10/29, 284 Dunlin foraged as a widely scattered, roaming but generally cohesive flock together with Grey Plover and Knot across the middle section of the subsite which provides a network of mudflats and channels. A similar pattern of behaviour and species association remained for the rest of the survey programme; the flocks sometimes rather mobile but occurring generally within the mid-section of the subsite. In terms of benthic invertebrates, 0M427 (Cunnigar south) comprises two broad community types: 'estuarine sandy mud and mud' and 'fine sand with *Angulus tenuis* and *Scoloplos armiger* (NPWS, 2011b). The estuarine mud and sandy mud community is present in the west of the subsite and influenced by the River Brickey, has a typical estuarine infauna with species such as Ragworm *Hediste diversicolor,* oligochaete worms and bivalve *Scrobicularia plana*. The Mud Snail *Hydrobia ulvae* was found to be abundant within samples (ASU, 2009). The community defined as 'fine sand with *Angulus tenuis* and *Scoloplos armiger*' occurs to the immediate west of Cunnigar Spit and also recorded the polychaetes *Spio martinensis, Pygospio elegans* and *Nephtys hombergi.* This community is also present within 0M425 (Ballyrandle) which held good numbers of foraging Dunlins in all low tide surveys, ranked in the top four in each case.

0M417, 0M418 and 0M419 all held the second highest number of foraging individuals on one occasion; the peak number recorded within these subsites being 164, 71 and 133 respectively.

The greatest intertidal foraging density within a single subsite was 17 Dunlin ha^{-1} (0M427 Cunnigar south on 11/02/10). Average subsite foraging density was also highest for 0M427 (9.5 individuals ha^{-1}). The whole site mean feeding density (intertidal habitat) was 1.7 Dunlin ha^{-1}.

Roosting Distribution

Relatively few Dunlin were recorded roosting within low tide surveys, one exception being 57 individuals that roosted within 0M418 (Reencrehy) on 17/11/09.

1,806 Dunlin were recorded roosting during the high tide survey (27/01/10). The greatest number (1,280) were located within 0M421 (Ballynacourty north) as part of one large mixed-species flock. 252 Dunlin roosted supratidally within the small subsite 0M424 (Old Railway) in saltmarsh. A further 235 Dunlin roosted within 0M427 (Cunnigar south). Smaller numbers roosted within 0M418 and 0M419. There is known to be some interchange of species between Dungarvan Harbour and Clonea Strand, located to the NE of Dungarvan harbour (Pat Smiddy, pers. comm.). This area was therefore counted also during the high tide survey and it is notable that 50 Dunlin were recorded roosting intertidally there.

1153 Dunlin were recorded roosting during the roost survey (08/03/10); the majority (890 individuals) in one flock within 0M421 (Ballynacourty north). Smaller numbers were recorded roosting within 0M418 (Reencrehy), 0M424 (Old Railway) and 0M427 (Cunnigar south).

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

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

Numbers

Numbers of Black-tailed Godwits peaked early with 1,458 recorded during the October survey (07/10/09). Thereafter numbers were variable, only 230 recorded on 17/11/09 but increasing to 859 during the December low tide survey (17/12/09). 494 Black-tailed Godwits were recorded during the high tide survey.

Black-tailed Godwits were relatively widespread in their distribution and recorded within 14 subsites overall (0M412, 0M413, 0M414, 0M415, 0M416, 0M417, 0M418, 0M419, 0M421, 0M423, 0M424, 0M425, 0M426, and 0M427). Only one subsite supported the species in all five surveys: 0M418 (Reencrehy). Eight subsites supported the species in three or more low tide surveys: 0M412, 0M414, 0M417, 0M418, 0M419, 0M423, 0M425 and 0M427. The peak subsite count of 551 individuals (representing numbers of all-Ireland importance) was recorded for 0M417 (Brickey Lower) on 07/10/09.

Foraging Distribution

Black-tailed Godwits are 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 Dungarvan Harbour, different subsites held peak numbers of foraging individuals during low tide surveys: 0M417, 0M427, 0M425 and 0M412 for the four dates respectively. 0M417 (Brickey Lower) supported 505 individuals on 07/10/09 representing 43% of the total foraging individuals counted. In November 2009, 0M427 (Cunnigar south) supported 94% of all foraging on that day; 136 individuals positioned as one flock along the western shore. On 17/12/09, the species was recorded foraging within eight subsites and the peak number (189) represented less than 30% of the total number.

As a species, the foraging distribution of Black-tailed Godwits is generally related to 'muddier' sediments and an estuarine mud and sandy mud community at Dungarvan harbour is present in the inner reaches of the site (NPWS, 2011b) including 0M417 (Brickey Lower), 0M427 (Cunnigar south) and 0M412 (Shandon Island) where Black-tailed Godwits are likely to feed upon invertebrate species *Scrobicularia plana* and *Hediste diversicolor*. Although not recorded in the Colligan Estuary, the bivalve *Macoma balthica* was recorded in the Brickey Estuary (0M417) and within 0M427 (Cunnigar South) (ASU, 2009). In contrast, 0M425 (Ballyrandle) is a sandier subsite, classified as 'fine sand' and characterised by the bivalve *Angulus tenuis* and the polychaete worm *Scoloplos armiger* (NPWS, 2011b) and a diverse polychaete community is present (ASU, 2009).

As the numbers of Black-tailed Godwits recorded during surveys were relatively low compared to numbers generally recorded during I-WeBS, it is reasonable to expect that a proportion of the birds using the site were not recorded because they were foraging terrestrially. No terrestrial foraging was recorded but this is likely to occur in suitable fields around the site that are not included within the SPA boundary.

The greatest intertidal foraging density recorded for a single subsite was 14 Black-tailed Godwits ha^{-1} (0M424 Old Railway on 17/12/09). Average subsite foraging density was also highest for 0M424 (6.7 individuals ha^{-1}). The whole site mean feeding density (intertidal habitat) was 0.6 Black-tailed Godwits ha^{-1}.

Roosting Distribution

Black-tailed Godwits were often recorded roosting intertidally during low tide surveys; the maximum number was 641 individuals on 11/02/10, representing six times the number recorded foraging on that date. Over 100 were recorded in each of three subsites (0M414, 0M417 and 0M418) with smaller numbers in a further four subsites. 297 Black-tailed Godwits roosted within six subsites on 07/10/09; the greatest number (156) within 0M414 (Dungarvan Town). 0M412 (Shandon Island) was notable for supporting roosting individuals in three low tide surveys, these birds in relatively similar positions in each survey and close to the river channel. Intertidal roosting was recorded within 0M413 (Monag), 0M419 (Cunnigar west), 0M421 (Ballynacourty north), 0M423 (Duck's Pool), 0M425 (Ballyrandle) and 0M427 (Cunnigar South).

Only 167 Black-tailed Godwits were recorded roosting during the high tide survey (08/03/10). The majority (141) were located at two positions within the south of 0M417 (Brickey Lower). Smaller numbers (20 and six respectively) were recorded within 0M412 and 0M418.

Bar-tailed Godwit *Limosa lapponica* - Family (group): Scolopacidae (wading birds)
The Bar-tailed Godwit has a widespread breeding distribution across the sub-arctic and low Arctic zones of the Palearctic and extending into western Alaska (Delaney et al. 2009). The taxonomy of the species is complex but five subspecies are generally recognised. The nominate subspecies *L. l. lapponica* breeds across the higher latitudes of Northern Europe, Russia and Siberia and west and winters mainly in Western Europe, including Ireland. The Wadden Sea is used by *L. l. lapponica* and other populations as a staging and moulting area in autumn and spring.
Numbers
Numbers of Bar-tailed Godwits rose progressively through the survey programme from 267 and 218 recorded on 07/10/09 and 17/11/09 to 954 individuals during the high tide survey and a site peak count of 1,023 during the final low tide survey (11/02/10). All site counts surpassed the threshold of all-Ireland importance. Bar-tailed Godwits were recorded in 12 subsites overall, although subsite occurrence during individual low tide surveys ranged from two to eight subsites. The species was recorded during all four low tide surveys within only one subsite 0M425 (Ballyrandle), and this subsite held peak numbers in all low tide surveys. The peak subsite count was 860 Bar-tailed Godwits on 11/02/10.
Foraging Distribution
Bar-tailed godwits are a wader species considered characteristic of coastal wetland sites dominated by sand. The birds forage by probing within intertidal sediment for invertebrate species, predominantly large polychaete worms such as *Arenicola marina* and *Nepthys* sp. The species is characteristic of sites with sandy substrates (e.g. Hill et al. 1993). Bar-tailed Godwits were recorded foraging within 11 subsites across the survey programme but regularly (within three LT surveys or more) within only two: 0M420 (Whitehouse Bank) and 0M425 (Ballyrandle). The latter held peak numbers foraging intertidally during all low tide surveys. 0M427 (Cunnigar south) supported the second highest numbers foraging on two survey occasions. 0M418 (Reencrehy) and 0M420 (Whitehouse bank) also supported second highest numbers on one occasion each. 0M425 (Ballyrandle) supported in excess of 70% of foraging individuals during all low tide surveys, clearly the favoured subsite. In terms of its benthic community, this subsite is classified as fine sand with *Angulus tenuis* and *Scoloplos armiger*,' the aforementioned bivalve and polychaete worm species being the most prevalent species of this complex (NPWS, 2011b). The polychaetes *Spio martinensis, Pygospio elegans* and *Nephtys hombergii* and the Common Cockle *Cerastoderma edule* are also common while the polychaete *Lanice conchilega* is found on the lower shore (NPWS, 2011b). *Scoloplos armiger* and *Nephtys hombergi* are known prey species of Bar-tailed Godwits while *Lanice conchilega*, although not forming a major part of the diet, may be important at certain times (Scheiffarth, 2001). A similar invertebrate community is found in 0M420 (Whitehouse Bank) and 0M427 (Cunnigar south) although the latter grades into estuarine muds in the west, towards the Brickey Estuary. The highest intertidal foraging density recorded for a single subsite was 3 Bar-tailed Godwits ha^{-1} (0M425 Ballyrandle on 11/02/10). Average subsite foraging density was also highest for 0M425 (1.6 individuals ha^{-1}). The whole site mean feeding density (intertidal habitat) was 0.4 Bar-tailed Godwits ha^{-1}.
Roosting Distribution
During low tide surveys, Bar-tailed Godwits were rarely recorded roosting intertidally, the exceptions being 103 individuals within 0M425 (Ballyrandle) on 07/10/09 and two individuals within 0M419 (Cunnigar West) on 11/02/10. During the high tide survey, 866 Bar-tailed Godwits were recorded roosting, the majority (650) within saltmarsh habitat of 0M424 (Old Railway). A further 108 roosted intertidally within 0M421 (Ballynacourty North). Thereafter 108 individuals roosted across two subsites: 0M423 and 0M427. 409 Bar-tailed Godwits were recorded roosting during the high tide survey (08/03/10). The majority were again recorded within saltmarsh of 0M424 (Old Railway) (240 individuals) and a further 145 roosted intertidally within 0M421 (Ballynacourty North). 24 roosted intertidally within 0M427.

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

Whole site numbers peaked early in October 2009 when a site count of 1,023 Redshanks was recorded. Thereafter numbers during low tide surveys ranged between 644 (11/02/10) and 795 (17/12/09). 408 Redshanks were recorded during the high tide survey (27/01/10).

Redshanks were widespread and recorded within all 18 subsites. Eleven subsites supported the species in all four low tide surveys: 0M411, 0M412, 0M413, 0M414, 0M417, 0M418, 0M419, 0M420, 0M421, 0M425 & 0M427. 0M418 (Reencrehy) supported peak numbers (276) on 07/10/09, this number was also the peak subsite count recorded. 0M427 (Cunnigar south) supported peak numbers in the remaining three low tide surveys. 0M425 (Ballyrandle) was notable for supporting the second highest numbers during three surveys.

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* and Mud Snail *Hydrobia ulvae.* A particularly favoured prey is the burrowing amphipod *Corophium volutator.*

Redshanks foraged within all 18 subsites. Peak numbers foraged intertidally within 0M418 (Reencrehy) on 07/10/09 (276 individuals); this subsite also held good numbers in all other surveys. Peak numbers of Redshank foraged intertidally within 0M427 (Cunnigar south) during the latter three low tide surveys. 0M425 (Ballyrandle) held the second highest numbers of foraging individuals on three survey occasions. 0M419 (Cunnigar West) recorded numbers ranked in the top four during all surveys.

0M418 (Reencrehy) and the western sections of 0M427 (Cunnigar south) and 0M419 (Cunnigar West) are classified as muddier, estuarine sediment communities following benthic sampling carried out in 2009 (NPWS, 2011b, ASU, 2009). It was not surprising therefore that within 0M427 the fieldworker noted a greater number of Redshanks in the western section (west of channel) than in the sandier eastern section. Two of the distinguishing invertebrate species of the estuarine mud benthic community, *Hydrobia ulvae* and *Corophium volutator*, are important prey items of Redshanks. Core samples taken within 0M418 (Reencrehy) recorded some of the greatest numbers of *Hydrobia ulvae* across the entire site. Although 0M425 (Ballyrandle) is a sandier subsite it hosts a diverse polychaete worm community many species of which could form prey items for Redshanks.

Surprisingly, although the amphipod *Corophium volutator* was found to be most abundant in the inner reaches of the Brickley and Glendine (0M417 and 0M423) these subsites did not hold particularly high numbers of Redshank or the highest densities (see below).

The highest intertidal foraging density recorded for a single subsite was 6 Redshank ha^{-1} (0M418 Reencrehy on 07/10/09). Average subsite foraging density was also highest for 0M418 (3.4 individuals ha^{-1}). 0M412 (Shandon Island) recorded an average 2 Redshank ha^{-1}, the second highest subsite density. The whole site average feeding density (intertidal habitat) was 0.6 Redshank ha^{-1}.

Roosting Distribution

Relatively small numbers of Redshanks were recorded undertaking roosting/other behaviour during low tide surveys. Ten individuals roosted along with 39 Oystercatchers along the NE shore of 0M419 (Cunnigar west) on 07/10/09. 12 Redshanks roosted intertidally within 0M417 Brickey Lower) on 17/12/09; thereafter observations were of small numbers (generally <5 birds).

A total of 164 Redshanks were recorded roosting during the high tide survey (27/01/10). 42 roosted intertidally and within saltmarsh of 0M424 (Old Railway), 29 intertidally within 0M427 (Cunnigar south) and 26 intertidally within Cunnigar west (0M419). 20 Redshanks roosted on saltmarsh of 0M423 (Duck's Pool). Thereafter, smaller numbers roosted within a further three subsites (0M412, 0M414 and 0M418).

There is known to be some interchange of species between Dungarvan Harbour and Clonea Strand, located to the NE of Dungarvan harbour (Pat Smiddy, pers. comm.). This area was therefore counted also during the high tide survey and it is notable that 20 Redshank were recorded roosting intertidally there.

134 Redshanks were recorded roosting during the roost survey (08/03/10). 0M423 (Duck's Pool) supported the greatest number (69), almost equally divided between intertidal and saltmarsh habitat. 0M427 (Cunnigar south) held 31 and 0M417 (Brickey Lower) held 27 roosting Redshanks. 0M418 and 0M425 recorded a few individuals.

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

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

Numbers

Numbers of Turnstone rose from just three individuals on 07/10/09 to a site peak of 149 Turnstones during the high tide survey (27/01/10), the latter representing numbers of all-Ireland importance.

Turnstones were recorded in 11 count subsites overall. Subsite use during individual low tide surveys ranged from two to five subsites but the species was more widely recorded during the high tide survey (ten subsites). The species was recorded with regularity (three surveys or more) within four subsites: 0M418, 0M419, 0M423 and 0M425. The latter (Ballyrandle, 0M425) was notable for supporting peak numbers during three surveys including the peak subsite count of 44 individuals on 27/01/10.

Foraging Distribution

Turnstones are associated with shorelines with rocky substratum, particularly those with algal wrack zones within which the birds forage for prey species such as amphipod crustaceans, insects and small molluscs. A mixed substrata/sediment upper shoreline and a strandline wrack zone is found in many locations around the site, therefore a widespread distribution is to be expected and it is difficult to link this species' distribution to any specific factors.

Across the entire survey programme, Turnstones were recorded foraging intertidally within ten subsites. 0M419 (Cunnigar West) and 0M425 (Ballyrandle) were notable for supporting foraging individuals during all low tide surveys. 0M419 (Cunnigar West) held peak numbers on 07/10/09 but this was only two individuals. 0M423 (Duck's Pool) was noted for supporting peak numbers (29) on 17/11/09 and good numbers during the high tide survey. 0M425 (Ballyrandle) held peak numbers during the high tide survey and the remaining two low tide surveys.

Roosting Distribution

Very few Turnstones were recorded roosting/other during low tide surveys. During the high tide survey (27/01/10) a total of 22 Turnstones were recorded roosting; 21 within 0M419 (Cunnigar west) and a single individual within 0M424 (Old Railway). Only eight Turnstones were recorded roosting during the roost survey (08/03/10). Five individuals were within 0M425 (Ballyrandle) and three within 0M423 (Duck's Pool).

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 to the Helgoland Bight area of the Wadden Sea (Prater, 1981). Following the moult, the ducks then migrate to wintering areas.

Numbers

Numbers of Shelduck rose from 56 individuals on 07/10/09 to a site peak of 269 on 11/02/10. 251 Shelduck were recorded during the high tide survey.

Shelduck were recorded within seven subsites overall but with regularity (three surveys or more) within only five subsites: 0M414, 0M417, 0M418, 0M419, and 0M427. Only 0M427 (Cunnigar South) held the species during all four low tide surveys and this subsite recorded peak numbers in all, recording a peak subsite count of 193 Shelduck on 17/12/09, representing numbers of all-Ireland importance.

Foraging Distribution

Foraging distribution of Shelduck has previously been shown to be linked to the distribution of their favoured prey the Mud Snail *Hydrobia ulvae* (Bryant & Leng; Murphy et al. 2006) which can be preyed upon by a variety of feeding methods depending on whether the tidal flats are exposed (e.g. scything) or covered with shallow water (head dipping) or deeper water (upending).

0M427 (Cunnigar South) held peak numbers of foraging Shelduck in all surveys, including the high tide survey on 27/01/10. In terms of benthic invertebrates, 0M427 (Cunnigar south) comprises two broad community types: 'estuarine sandy mud and mud' and 'fine sand with *Angulus tenuis* and *Scoloplos armiger* (NPWS, 2011b). The estuarine mud and sandy mud community is present in the west of the subsite and, influenced by the River Brickey, has a typical estuarine infauna comprising species such as Ragworm *Hediste diversicolor* and bivalve *Scrobicularia plana*. The community defined as 'fine sand with *Angulus tenuis* and *Scoloplos armiger*' occurs to the immediate west of Cunnigar Spit. The Mud Snail *Hydrobia ulvae* was found to be abundant within samples from 0M427 and particularly from stations along the western shore and the southern section (stations 10, 11: ASU, 2009). It is interesting to find that Shelduck distribution within this subsite in all months was relatively similar, the birds located along the southern shore, close to a freshwater inflow and relatively close to sampling stations found to have a high abundance of their favoured prey.

0M417, 0M418 and 0M419 were notable for all supporting numbers ranked in the top four or above during surveys (ranked 'high in subsite assessment tables). All of these subsites are characterised by estuarine mud communities and presence of *Hydrobia ulvae*.

Roosting Distribution

Apart from within 0M427 (Cunnigar south) few individuals were recorded roosting/other during low tide surveys. 0M427 held 21 and 17 roosting intertidally respectively within the low tide counts of 17/11/09 and 17/12/09. During the high tide survey (27/01/10) 115 Shelduck roosted subtidally within 0M418 (Reencrehy), 27 roosted subtidally within 0M427 (Cunnigar south) and 13 roosted intertidally within 0M419 (Cunnigar west). 202 Shelducks were recorded roosting during the roost survey (08/03/10). 160 were located within 0M427 (Cunnigar south) (77 subtidal + 83 intertidal) with smaller numbers within 0M417, 0M418 and 0M419.

Red-breasted Merganser *Mergus serrator* - Family (group): Anatidae (sea ducks)
Red-breasted Mergansers have a wide breeding range which spans northern Europe, Russia, Siberia and North America. The Irish breeding population is thought to be sedentary. Large flocks of moulting birds congregate at several sites in Ireland and numbers remain relatively stable throughout the wintering season apart from some peaks possibly reflecting passage populations or cold weather movements (Crowe, 2005). The wintering population is thought to be increased to some extent by the addition of birds from central Europe, eastern Greenland (Robinson, 1999) and Iceland (Scott & Rose, 1996).
Numbers
The species was not recorded on 07/10/09 and nine individuals were recorded on 17/11/09. The whole-site peak number of Red-breasted Mergansers occurred during the high tide survey (32 individuals) and 30 were recorded during the final low tide survey (11/02/10). Red-breasted Mergansers were recorded in five subsites overall (0M417, 0M419, 0M420, 0M425 and 0M425) but with regularity (three surveys or more) within only two - 0M419 (Cunnigar west) and 0M425 (Ballyrandle).
Foraging Distribution
Red-breasted Mergansers are sea ducks that feed on fish, obtained by frequent dives from the surface. They prefer shallow waters (range 3 – 6m) (BWPi, 2004). During low tide surveys Red-breasted Mergansers were recorded within two or three subsites but this increased to five during the high tide survey. 0M419 (Cunnigar west) and 0M425 (Ballyrandle) were the most regularly used subsites during low tide surveys and 0M420 (Whitehouse bank) held peak numbers (13) during the high tide survey.
Roosting Distribution
Red-breasted Mergansers were not recorded roosting/other during the survey programme.

Great Crested Grebe *Podiceps cristatus* - Family (group): Podicipedidae (grebes)
Great Crested Grebes are a widespread breeding species; one population of the nominate subspecies breeds and winters in north and west Europe (Wetlands International, 2006). It is thought likely that the majority that breed within Ireland are resident, with some immigration due to cold weather movements (Crowe, 2005). Breeding at inland wetlands (lakes), many move to coastal sites for the winter period (Wernham et al. 2002).
Numbers
Numbers remained relatively stable throughout the survey programme with 9–12 individuals recorded during low tide surveys and seven recorded during the high tide survey (27/01/10). Great Crested Grebes were recorded within four subsites overall (0M419, 0M420, 0M422 and 0M425). The large subtidal subsite 0M422 (Helvick Pier - Ballynacourty Pt) supported peak numbers during three surveys. 0M419 (Cunnigar west) supported peak numbers on two survey occasions. The subsite peak count recorded was 11 individuals within 0M422 (Helvick Pier - Ballynacourty Pt) on 07/10/09.
Foraging Distribution
Great Crested Grebes are largely piscivorous and make short dives for their prey in the depth range of 2-4m. Almost all records of Great Crested Grebes were of foraging individuals. The large subtidal subsite 0M422 (Helvick Pier - Ballynacourty Pt) supported peak numbers during three surveys (07/10/09, 17/12/09 & 11/02/10). 0M419 (Cunnigar west) supported peak numbers foraging on 17/11/09 (six individuals) and joint peak numbers on 17/12/09.
Roosting Distribution
Only one individual was recorded in roosting/other behaviour within 0M425 (Ballyrandle) on 27/01/10.

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 827 Oystercatchers represented numbers of all-Ireland importance at Dungarvan Harbour. Thereafter numbers during low tide surveys ranged from 638 (17/11/09) to 776 (17/12/09) and 687 Oystercatchers were counted during the high tide survey.

Oystercatchers were widespread and recorded in all subsites except 0M416 (Brickey Upper). Twelve subsites held the species during all four low tide surveys (0M412, 0M414, 0M417, 0M418, 0M419, 0M420, 0M421, 0M422, 0M423, 0M425, 0M427, 0M428). 0M427 (Cunnigar south) supported peak numbers in all surveys.

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*), 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. 1996) 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 means of handling them.

At Dungarvan, Oystercatchers were recorded foraging intertidally and terrestrially. Ten subsites recorded foraging Oystercatchers (intertidal habitat) during all four low tide surveys. 0M427 (Cunnigar south) held peak numbers on 17/11/09, 17/12/09 and 11/02/10 and the subsite peak count of 217 foraging Oystercatchers on 17/11/09, which represented 43% of all foraging individuals at the site on that date. Peak numbers recorded on 07/10/09 were foraging within 0M419 (Cunnigar west), this subsite holding the second highest numbers on two other survey dates. 0M425 (Ballyrandle), 0M421 (Ballynacourty North), 0M420 (Whitehouse Bank), 0M418 (Reencrehy) all supported good numbers during the survey programme.

0M427 (Cunnigar south) and 0M419 (Cunnigar west) comprise two broad benthic community types: 'estuarine sandy mud and mud' and 'fine sand with *Angulus tenuis* and *Scoloplos armiger* (NPWS, 2011b). The estuarine sandy mud and muds occur mainly along the western margins while the 'fine sand with *Angulus tenuis* and *Scoloplos armiger'* is present along the western margins of Cunnigar spit (i.e. the eastern margins of both 0M419 (Cunnigar west) and 0M427 (Cunnigar south). One of the distinguishing species of this latter benthic community is the Common Cockle *Cerastoderma edule*, and this bivalve occurred widely in sampling stations throughout both eastern and western sections of 0M419 and 0M427 (ASU, 2009). It is not surprising therefore that the Oystercatcher distribution was recorded by the fieldworker as 'well scattered' or 'widely distributed' across these subsites.

Terrestrial foraging was recorded irregularly but Oystercatchers are likely to forage within suitable fields around the site that are not included within the SPA.

The highest intertidal foraging density recorded for a single subsite was 5 Oystercatchers ha^{-1} (0M428 Bridge on 17/11/09). Average subsite foraging density was also highest for 0M428 (2.8 individuals ha^{-1}) followed by 0M427 (Cunnigar south) 1.2 Oystercatchers ha^{-1}. The whole site average feeding density (intertidal habitat) was 0.44 Oystercatchers ha^{-1}.

Roosting Distribution

Oystercatchers were often recorded roosting intertidally during low tide surveys; the maximum number was 246 individuals on 11/02/10. Peak numbers roosting intertidally were recorded for 0M427, 0M417, 0M418 and 0M427 for the four low tide survey dates respectively (80, 77, 72 and 145 individuals). Good numbers were also recorded within 0M419 (Cunnigar west) on two occasions (65 and 42 individuals on 07/10/09 & 11/02/10).

479 Oystercatchers roosted intertidally during the high tide survey (27/01/10), the peak number (246) within 0M427 (Cunnigar south) where 220 were located on a small area of mixed sediment shore along the western margins of Cunnigar spit. 0M421 (Ballynacourty North) supported 88 individuals and 0M419 (Cunnigar west) a further 57. 83 Oystercatchers roosted supratidally within 0M4418 (Reencrehy).

418 Oystercatchers were recorded roosting during the roost survey (08/03/10) at 19 different positions around the site. 40% (165) were located within 0M427 (Cunnigar south) on the same area of mixed substrata shore as noted above. A further 86 individuals were within 0M421 (Ballynacourty North) at three different locations. 0M418 and 0M412 supported 46 and 44 roosting individuals respectively. A further six subsites held fewer numbers (0M417, 0M419, 0M420, 0M423, 0M424 & 0M425).

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

The Grey Plover is 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 rose from 128 individuals during October 2009 to a peak of 410 individuals during the high tide survey (21/01/10). All whole site counts passed the threshold of all-Ireland importance (65). The pattern of a gradual rise in numbers to a January peak was recorded at other sites in the winter 2009/10 (e.g. Dundalk Bay, Wexford Harbour) and is consistent with the pattern shown by I-WeBS data in general (Crowe, 2005).

Grey Plovers were recorded in a total seven subsites throughout the entire survey programme but subsite use during individual surveys ranged from one subsite (07/10/09) to six subsites on 11/02/10. 0M427 (Cunnigar south) recorded peak numbers in all four low tide surveys. 0M421 (Ballynacourty North) supported peak numbers during the high tide survey (27/01/10) (375 Grey Plovers) which also represented the subsite peak count.

Foraging Distribution

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

At Dungarvan, 0M427 (Cunnigar south) held peak numbers of foraging Grey Plovers in all four low tide surveys; the maximum counted was 134 on 17/12/09. The species foraged more widely on 11/02/10 when 183 were distributed across five subsites; 0M427 held the most (72) but 0M420 (Whitehouse Bank) and 0M421 (Ballynacourty North) both held >40 individuals each. No foraging individuals were recorded during the high tide survey on 27/01/10.

Within 0M427 (Cunnigar south), the foraging distribution of Grey Plovers was similar to that of Dunlin and Knot and in most low tide surveys the species foraged as a widely scattered and constantly moving loose group positioned relatively centrally within the subsite. 0M427 (Cunnigar south) comprises two broad benthic community types: 'estuarine sandy mud and mud' and 'fine sand with *Angulus tenuis* and *Scoloplos armiger* (NPWS, 2011b). The estuarine sandy mud and muds occur mainly along the western margin of the subsite and exhibits such distinguishing species as Ragworm *Hediste diversicolor,* amphipod *Corophium volutator,* Mud Snail *Hydrobia ulvae* and *Scrobicularia plana.* The fine sand community with *Angulus tenuis* and *Scoloplos armiger* is present along the western margins of Cunnigar spit (i.e. the eastern margins of 0M427 (Cunnigar south)) and is equally diverse with high abundances of polychaete worms in places.

Across the entire site, Grey Plovers occurred within subsites comprising a greater proportion of sandy sediments and the species did not occur within any of the true estuarine sections (e.g. 0M423, 0M417 or the Colligan estuary subsites).

The highest intertidal foraging density recorded for a single subsite was 0.9 Grey Plovers ha^{-1} (0M427 Cunnigar south on 17/12/09). Average subsite foraging density was also highest for 0M427 (0.8 individuals ha^{-1}). The whole site average feeding density (intertidal habitat) was 0.15 Grey Plovers ha^{-1}.

Roosting Distribution

Almost all Grey Plovers were recorded foraging with only one individual recorded in roosting/other behaviour (0M418, 11/02/10). During the high tide survey (27/01/10), 410 Grey Plovers roosted within five subsites (0M418, 0M419, 0M421, 0M424 & 0M427). 375 of these roosted as part of a large mixed-species flock on Whitehouse Bank within 0M421 (Ballynacourty north). 285 individuals roosted in a similar position during the roost survey on 8th March 2010. This roosting area appears to be used when tides allow; on higher tides birds settle here for a time before moving elsewhere as the tide encroaches. Smaller numbers of Grey Plovers were recorded roosting within 0M420 and 0M427 (roost survey) and 0M419, 0M424 and 0M427 (high tide survey).

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 see a greater flux of birds to Ireland's estuaries.

Numbers

Whole site numbers of Lapwing rose from 101 individuals on 07/10/09 to a peak during the high tide survey (1,768).

Across the whole survey programme, Lapwings were recorded within 13 subsites. Subsite use during individual surveys varied from four subsites (07/10/09) to ten subsites (11/02/10).

0M412 (Shandon island), 0M417 (Brickey Lower) and 0M427 (Cunnigar south) recorded the species during all four low tide surveys.

Peak numbers during the four low tide surveys were recorded within 0M416 (Brickey upper), 0M417 (Brickey Lower), 0M412 (Shandon island) and 0M418 (Reencrehy) for the four dates respectively. The subsite peak count of 575 Lapwings was recorded within 0M416 (Brickey upper) during the high tide survey (27/01/10).

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 Dungarvan, Lapwings foraged intertidally within six subsites overall (0M412, 0M413, 0M414, 0M417, 0M423 and 0M424). All of these subsites represent the inner, estuarine sections of the overall site.

The greatest number recorded was on 17/11/09 when 306 Lapwings foraged within four subsites; 0M417 (Brickey Lower) held the most, 282 representing 92% of the total. Other records were of much lower numbers, generally less than 30 individuals, the exception being 47 within 0M424 (Old Railway) on 17/12/09.

Only one observation of terrestrial foraging was made (3 individuals in 0M424 on 27/01/10) but this activity is likely to be widespread around the site in undesignated areas.

Roosting Distribution

Records of Lapwings roosting intertidally were widespread across the site during low tide surveys with regular observations (three or more LT surveys) within 0M412, 0M413, 0M414, 0M417, 0M424 and 0M427. 0M412 (Shandon Island) held peak numbers during the first three low tide surveys (14, 223 and 327 birds respectively) while 542 roosted within 0M418 (Reencrehy) on 11/02/10. 0M417 (Brickey lower) held good numbers on three occasions (maximum number 270 on 17/12/09 and did 0M413 (Monag) on the same date (194 Lapwings).

1,765 Lapwings were recorded roosting/other during the high tide survey. Brickey Upper (0M416) held the greatest number (575). 0M427 (Cunnigar south) supported 415, roosting along with several other species, within saltmarsh in the south-eastern corner of the subsite. 0M414 (Dungarvan Town) supported 268 while 0M412 (Shandon Island) held 260 individuals. 0M424 (Old railway) supported 164 individuals roosting on the saltmarsh that extends out from the eastern edge.

No Lapwings were recorded during the high tide survey on 8th March 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. The Knot that winter in Ireland are almost entirely from the *islandica* population. 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 rose from 230 individuals on 07/10/09 to a site peak of 729 during the final low tide survey (11/02/10). A total of 541 Knot were recorded during the high tide survey. The wader was recorded within seven subsites overall: 0M418, 0M419, 0M420, 0M421, 0M423, 0M425 and 0M427. 0M427 (Cunnigar south) supported peak numbers during all four low tide surveys. 0M421 (Ballynacourty North) held peak numbers (475) during the high tide survey.
Foraging Distribution
Knots are mud and sandflat foragers; pecking visible 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). 0M427 (Cunnigar south) supported peak numbers foraging intertidally during all four low tide surveys. The foraging distribution of Knot was similar to that of Dunlin and Grey Plover and in most low tide surveys the species foraged as a widely scattered and constantly moving loose 'flock' positioned centrally within the subsite. 0M427 (Cunnigar south) comprises two broad benthic community types: 'estuarine sandy mud and mud' and 'fine sand with *Angulus tenuis* and *Scoloplos armiger* (NPWS, 2011b). The estuarine sandy mud and muds occur mainly along the western half of the subsite and exhibits such distinguishing species as Ragworm *Hediste diversicolor,* amphipod *Corophium volutator,* Mud Snail *Hydrobia ulvae* and *Scrobicularia plana.* The fine sand community with *Angulus tenuis* and *Scoloplos armiger* is present along the eastern section of 0M427 and is equally diverse with high abundances of polychaete worms in places (e.g. *Spio martinensis, Pygospio elegans* and *Nephtys hombergi*). The benthic data therefore suggests a diversity of prey options across this subsite. Other records of foraging individuals were often single observations within subsites e.g. 27 Knot within 0M418 (Reencrehy) on 17/12/09, although 0M420 (Whitehouse Bank) held individuals on three occasions and 0M425 (Ballyrandle) on two occasions. The highest intertidal foraging density recorded for a single subsite was 4.8 Knot ha^{-1} (0M427 Cunnigar south on 11/02/10). Average subsite foraging density was also highest for 0M427 (3 individuals ha^{-1}). The whole site average feeding density (intertidal habitat) was 0.5 Knot ha^{-1}.
Roosting Distribution
539 Knot were recorded roosting during the high tide survey (27/01/10) the majority located within 0M421 (Ballynacourty north). 475 roosted as part of a large mixed-species flock on Whitehouse Bank within 0M421 (Ballynacourty north). 75 individuals roosted in a similar position during the roost survey on 8th March 2010, the only knot recoded during this survey. This roosting area appears to be used when tides allow; on higher tides birds settle here for a time before moving elsewhere as the tide encroaches. Smaller numbers of Knot were recorded roosting within 0M418, 0M419 and 0M427 during the high tide survey (31, 1 and 32 individuals respectively).

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

Whole site numbers of Curlew varied between months with 437 recorded on 07/10/09, dropping back to just over 200 during the next two surveys and increasing to a peak of 659 during the final low tide survey (11/02/10).

The species was widespread occurring in all subsites except 0M426. Thirteen subsites recorded the species during all four low tide surveys: 0M412, 0M413, 0M414, 0M415, 0M417, 0M418, 0M419, 0M420, 0M421, 0M423, 0M424, 0M425 & 0M427.

0M427 (Cunnigar south) supported peak numbers during the first four surveys (including the HT survey) and 0M421 (Ballynacourty North) held peak numbers on 11/02/10. The subsite peak count of 279 was recorded within 0M427 on 27/01/10.

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.

0M427 (Cunnigar south) supported peak numbers foraging intertidally during all five surveys. 0M425 (Ballyrandle) and 0M419 (Cunnigar west) supported numbers ranked in the top four during all surveys.

0M427 (Cunnigar south) and 0M419 (Cunnigar west) comprise two broad benthic community types. The eastern margin (behind Cunnigar spit) is classified as 'fine sand with *Angulus tenuis* and *Scoloplos armiger'* and this grades into 'estuarine sandy mud and mud' as one moves westwards (NPWS, 2011b). The Lugworm *Arenicola marina* is a widespread species of sand and muddy sand and was recorded across a wide range of sampling sites within these subsites as well as within 0M425 (Ballyrandle). Not surprisingly, Curlew showed a widely scattered distribution when feeding, but this wader was also likely to be feeding upon other species at times such as *Hediste diversicolor* and *Nepthys hombergi*.

Terrestrial foraging was observed adjacent to two subsites during the high tide survey but is likely to be widespread around the site in undesignated areas.

The highest intertidal foraging density recorded for a single subsite was 1.25 Curlew ha^{-1} (0M428 Bridge on 17/12/09). Average subsite foraging density was highest for 0M428 and 0M412 (Shandon island) (0.6 individuals ha^{-1}). The whole site average feeding density (intertidal habitat) was 0.2 Curlew ha^{-1}.

Roosting Distribution

Records of Curlew undertaking roosting/other behaviour were widespread across the site during low tide surveys with regular observations (three or more LT surveys) within 0M412, 0M414, 0M417 and 0M425. Observations were most numerous during the final low tide survey when 351 Curlews roosted intertidally across 12 subsites. 0M412 (Shandon Island) held good numbers in all surveys with 29 roosting intertidally on 17/11/09.

In contrast, fewer Curlews were recorded roosting during the high tide survey (total 188 individuals), many Curlews likely foraging within fields e.g. 98 recorded foraging within fields to the NE of Ballyrandle (0M425). 0M427 (Cunnigar south) supported the greatest number roosting (99), 68 of which were within saltmarsh in the south-eastern corner of the subsite. 0M419 (Cunnigar west) supported a further 38 individuals positioned along the western margins of Cunnigar spit.

165 Curlews roosted during the roost survey (08/03/10). 0M418 (Reencrehy) held peak numbers (67) with a further 52 individuals within 0M412 (Shandon island). 0M427 (Cunnigar south) supported 44 Curlews in two locations: saltmarsh in the SE corner and an area of mixed substrata shore along the western margins of Cunnigar spit where the Curlews roosted together with Oystercatchers, amongst other species.

5.4 Dungarvan Harbour – 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.

This section provides information on activities and events that occur at Dungarvan Harbour 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, Waterford County Development Plan 2011-2017 (Waterford County Council, 2011), related documents (e.g. Dungarvan Town Council, 2006), Waterford County Local Biodiversity Action Plan (Waterford County Council, 2008) and other available documents relevant to the ecology of the site.

The information collected was 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), factors associated with pollution (e.g. industrial discharges and waste water treatment plants), various recreational and non-recreational activities as well as biological factors such as the presence of Common Cord-grass (*Spartina* sp.), eutrophication and erosion.

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 at Dungarvan Harbour 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 within Dungarvan Harbour 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. Activities are highlighted that occur currently at Dungarvan Harbour SPA that have the potential to cause disturbance to waterbird species.

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 IMPACT SCORE OF THREAT 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 and spatial assessment of activities/events at Dungarvan Harbour

Activities and events identified to occur at Dungarvan Harbour are listed in Appendix 9 in relation to the subsite[14] within which they are known to occur.

[14] Relates to count subsites used during the 2009/10 Waterbird Survey Programme.

Dungarvan Harbour is surrounded by a diverse topography and a diversity of landuse types. The upland to the north, north-east and south provide a dramatic backdrop to the scenery, most obvious as one travels towards Dungarvan Town from the south along the N25. Much of the site is surrounded by agricultural land that gently rolls down to the sea, comprising grazing, rough grazing and tillage.

The main populated area adjacent to the site is Dungarvan Town that straddles the River Colligan as it enters the harbour through a narrow opening. This narrow mouth forms the main harbour area; overlooked by Dungarvan Castle (ruined) and semi-enclosed by a narrow bridge (Devonshire Bridge) and a causeway. The Waterford-Dungarvan railway also once crossed here. Upstream of this, the river channel is narrowed in half by historic land claim (evident from 6'' mapping) and further crossed by the N25 road. The small harbour has a slipway and moorings and is home to Dungarvan Harbour Sailing Club (relates to subsite 0M415). Navigating the harbour for most vessels is only possible at high water and with care, and the channel requires regular dredging for it to remain navigable.

The western side of the Colligan estuary has an adjacent road which crosses the estuary at Ballyneety Bridge. The eastern side of the estuary also has an adjacent road for much of its length. Housing is the dominant landuse on both sides as far as Ringaphuca to the east and Shandon to the west before agricultural land predominates. Upstream of Ballyneety Bridge is the site of the former Dungarvan Landfill (Ballynamuck middle) now closed.

To the east of the river mouth opening, Dungarvan Town expands eastwards as far a Skehacrine. Developed land becomes less of a feature thereafter with single dwellings interspersed with farmland. The coast road to Ballynacourty Point that forms the eastern boundary of count subsite 0M425 (Ballyrandle) has regular adjacent housing and there are several slips along this road as well as a pier.

At Barnawee in the north-east of the site, the River Glenadine enters the bay. The estuary is dissected by a road (R675) and a causeway, formerly part of the Waterford-Dungarvan railway and is now a regularly-used recreational walking route. The small area enclosed by these two man-made features is subsite 0M424 (Old Railway) which is small and sheltered, and has raised areas of saltmarsh. Upstream of the road crossing, the estuary splits into two channels (Glenadine River & Douglas Stream), the dividing land now a golf course. The Brickey Estuary in the south-west of the site is divided by the N25 road.

The south-western edge of the site is the least populated and mainly surrounded by agricultural land that rolls gently down to marsh and saltmarsh. Some grazing of saltmarsh habitat is evident. Cattle also graze the dunes and saltmarsh of Cunnigar Point (McCorry & Ryle, 2009).

The invasive species Common Cord-grass (*Spartina* sp.) has been known at the site since 1960 (Nairn, 1986) and is most prevalent at the northern end of Cunnigar Point and in the Brickey Estuary (McCorry & Ryle, 2009).

Some small-scale fishing activities occur within the site (spatial scale unknown); professional inshore fishery activity located mostly outside of the site to the east (DoEHLG, 2009). The main fishing harbour is located at Helvick Head (within 0M422) which is a small fishing harbour with an associated fish processing plant. Shore fishing (angling) is known to be a regular activity particularly off Helvick Pier and Cunnigar spit. Hand-gathering of edible molluscs (e.g. Periwinkles *Littorina littorea*) is common and bait-digging also occurs.

In 2009 Dungarvan Bay was designated as a Shellfish Water under the EU Shellfish Waters Directive.[15] This designated shellfish area (No. 36) has an area of 6.96km^2 and is located to the east of Cunnigar spit (DoEHLG, 2009). The predominant species cultivated is the Oyster *Crassostrea gigas*, trestle cultivation occurring on the lower shore and shallow subtidal of count subsites 0M420 (Whitehouse Bank) and 0M421 (Ballynacourty north). The Sea Fisheries Protection Authority is responsible for classifying shellfish production areas and the current classification of the Dungarvan Bay Bivalve Mollusc Production Area (as of 15th July 2011) is Class B (www.sfpa.ie) meaning 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[16]. The DoEHLG published Draft Pollution Reduction Programmes for Dungarvan Bay in November 2009 to ensure compliance with the standards and objectives established by the regulations. One feature highlighted by this document was the on-going issue of water quality.

Aquacultural activities are likely to be one of the most regularly-occurring activities at the site and includes the use of machinery including tractors to access the trestles at low tide (subsites 0M420, 0M421). McCorry & Ryle (2009) note that saltmarsh situated in the south-eastern corner of their survey site (within subsite 0M427) has been impacted by aquacultural activities, including the creation of shellfish holding ponds within upper saltmarsh habitat. They also noted abandonment of old machinery along these embankments and the presence of man-made drains around holding ponds and across the saltmarsh to link to the intertidal flats.

While the river waters entering the site are classified as of good quality (SERBD, 2010a), the South Eastern River Basin District Transitional and Coastal Waters Action Plan (SERBD, 2010b) classifies the waters of Dungarvan Harbour as 'Moderate' because of below-par recorded levels of dissolved oxygen (DO). The Colligan Estuary is also classed as 'Moderate' based on DO and opportunistic algae. While the Colligan is deemed 'at risk' from point source discharges (WWTP's, combined sewer overflows, treatment plant overflows and local authority licensed discharges), the transitional waters of Dungarvan Harbour are deemed 'at risk' from nutrient inputs. DoEHLG (2009) suggest that the predominantly agricultural nature of the catchment plus livestock densities and fertiliser usage at higher levels than the national averages, highlights agriculture as a contributory factor.

Other activities at Dungarvan Harbour are related to recreation and marine/coastal leisure and tourism. Although no sandy beaches occur within the site, the Cunnigar spit is used extensively for walking, dog walking and some beach activities, especially during summer months. Horse riding also occurs along the sandy stretches of Whitehouse bank (subsites 0M420 and 0M421). Walking also occurs close to the site because of adjacent roads/pavements, for example along the western side of the Colligan Estuary. The disused railway line which dissects the Glenadine Estuary (adjacent subsite 0M424) is now a regularly-used walking route. Other recreational activities recorded across the site tend to be largely water-based including charter boats, angling and recreational fishing as noted above, and sailing. Surfing, kite-surfing, water skiing and sea kayaking are known to occur but were not recorded during the 2009/10 waterbird survey programme.

[15] Shellfish Waters Directive 2006/113/EC which is implemented in Ireland by the European Communities (Quality of Shellfish Waters) Regulations 2006 (SI No 268 of 2006) and the European Communities (Quality of Shellfish Waters) (Amendment) Regulation 2009, (SI 55 of 2009).

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

5.4.4 Disturbance events – spatial assessment

Appendix 10 highlights activities at Dungarvan Harbour that have the potential to cause disturbance to waterbird species. This includes features of the site (e.g. pier) whose associated activities have the potential to cause disturbance to waterbirds.

During the 2009/10 Waterbird Survey Programme, activities reported to cause disturbance to waterbirds were recorded from eight of the total 18 subsites (44%). These activities were as follows: walking (incl. dogs), motorised vehicles, horse riding, shooting, bait-digging, hand gathering of molluscs and activities associated with intertidal aquaculture.

A summary is shown in Table 5.8 and full results of the disturbance assessment are shown in Appendix 11. 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.

Walking (intertidal areas and including dogs) was the most widespread activity and responsible for the peak disturbance score for six subsites (Table 5.8). 55% of all field observations of humans walking in intertidal areas resulted in a response from waterbirds but responses varied from birds hardly moving at all to birds being displaced from the subsite for the duration of the count or longer. The higher score recorded for 0M425 (Ballyrandle) relates to this activity being observed more frequently and the presence of dogs that led to a greater response from waterbirds.

Hand gathering of molluscs was the second most widespread activity, recorded within four subsites but this activity resulted in very weak responses from waterbirds hence the overall low score. Aquaculture activities were reported within two subsites (0M420 and 0M421) in relation to the Oyster cultivation that occurs on the lower shore of Whitehouse Bank.

As a final review, Table 5.9 shows the peak disturbance scores overlaid on the subsite assessment table (total waterbird numbers, LT surveys). Where a species distribution and activity responsible for the peak score are not likely to coincide, the table is left unshaded. An example is 0M419 where humans walking in intertidal areas might affect Curlews or Oystercatchers but is unlikely to have any disturbance effects on Great Crested Grebes or Red-breasted Mergansers.

Table 5.8 Disturbance Assessment – Summary Table

Number of activities recorded to cause disturbance to waterbirds during field surveys (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
0M411	Ballyneety Bridge	1	6	• Shooting
0M412	Shandon Island			•
0M413	Monang			•
0M414	Dungarvan Town			•
0M415	Inner Dungarvan Town			•
0M416	Brickey Upper			•
0M417	Brickey Lower			•
0M418	Reencrehy	3	5	• Walking (incl. dogs) • Motorised vehicles
0M419	Cunnigar West	1	5	• Walking (incl. dogs)
0M420	Whitehouse Bank	4	4	• Walking (incl. dogs)
0M421	Ballynacourty North	4	5	• Walking (incl. dogs) • Horse riding
0M422	Helvick Pier - Ballynacourty Pt	1	2	• Hand gathering - molluscs
0M423	Duck's Pool			•
0M424	Old Railway	1	4	• Walking (incl. dogs)
0M425	Ballyrandle	4	6	• Walking (incl. dogs)
0M426	Clashnaloohan			
0M427	Cunnigar South	1	3	• Aircraft flying over
0M428	Bridge			•

Table 5.9 Subsite rankings based on total numbers (LT surveys) plus the peak disturbance score attained during surveys of the 2009/10 waterbird survey programme

Species► Subsites ▼	PB	GP	DN	BW	BA	RK	TT	SU	RM	GG	OC	GV	L.	KN	CU
0M411						L	L						M		
0M412	V	H	M	V	L	H		L			M		V		H
0M413				L		M		L			M		H		M
0M414	L	V	L	H		M		M			M		M		M
0M415	L			L	L	L					L				L
0M416						L							V		L
0M417	M		H	V		H		H			H		V		H
0M418	V		H	V	H	V	M	M			H	L	V	H	H
0M419	V		H	L	M	H	V	H	V	V	H	H	L	L	H
0M420	H	V	M		H	M	M		M	M	H	H		H	H
0M421	H			L	M	M					H	H		L	V
0M422	L					M	M		H	V	M				L
0M423	H		M	M	M	H	V				M		L	M	L
0M424	M		L	H		M					L		M		M
0M425	H	M	H	H	V	H	V		V	M	H	M	L	H	H
0M426				L		L					L				
0M427	L	H	V	V	H	V		V			V	V	M	V	V
0M428					M	L					M				L

5.4.5 Discussion

This review has highlighted that many 'activities and events' occur across the site.

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.), on-going modifications to intertidal habitats may 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 may occur from trampling or compaction (e.g. horse-riding, humans walking, motor vehicles). The grazing of salt marsh areas can modify waterbird roosting areas. Bait-digging and the hand gathering of molluscs may cause physical damage while at the same time removing waterbird prey items. Fisheries and aquaculture interact with waterbirds in a variety of ways including the direct removal of waterbird prey items (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.

Pollution and issues of water quality at Dungarvan Harbour have been raised in previous documents (e.g. DoEHLG, 2009) and may arise from domestic and urban wastewater discharges, agricultural run-off and marine-based pollution (i.e. that arising from shipping, harbours etc). These may translate into direct effects upon waterbirds (direct toxicity) or indirect effects due to changes to invertebrate community composition, spatial distribution and/or abundance. Organic enrichment, as evident at Dungarvan Harbour, can result in the growth of macroalgal mats that in themselves have a suite of positive and negative indirect effects upon waterbird species (for a review see Lewis et al. 2003).

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[17] (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:-

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

- 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 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: DUNGARVAN HARBOUR SPA

SITE CODE: 004032

Dungarvan Harbour SPA is located in south-west Co. Waterford and lies at the eastern end of the former valley of the River Blackwater - this river now turns south at Cappoquin, vacating its original course. The site includes Dungarvan Harbour as far east as Ballynacourty Point and west to include the tidal sections of the River Brickey. Three rivers flow into Dungarvan Harbour - the Colligan River, which runs south from the Comeragh Mountains, enters the bay by Dungarvan town, the River Brickey, which flows into the harbour from the west, and the Glendine River which enters from the north. The absence of a large river entering the site means that the bay is essentially a marine habitat, although it dries out at low tide to give extensive mud and sand flats. The inner bay is extremely sheltered, being almost closed off by the linear Cunnigar spit to the east.

Limestone underlies most of the area though this is only exposed as flat rocks at Ballynacourty. Elsewhere, saltmarsh, glacial drift and sand form the shore with a narrow stony beach occurring in places. The most natural areas of saltmarsh occur at Kilminnin on the north shore and west of the Cunnigar in the south. In several places the saltmarshes that were reclaimed in the past have been flooded again and are reverting to their natural vegetation. There is an abundance of Sea Rush (*Juncus maritimus*) in such places, often mixed with grasses, and with Common Reed (*Phragmites australis*) or Sea Club-rush (*Scirpus maritimus*) occurring in the drains.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Great Crested Grebe, Light-bellied Brent Goose, Shelduck, Red-breasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank and Turnstone. The site is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. 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.

A major part of the ecological importance of Dungarvan Harbour is the wintering waterbirds which are present in large numbers. The site is of international importance because it regularly supports an assemblage of over 20,000 wintering waterbirds. Furthermore, both Light-bellied Brent Goose (723) and Black-tailed Godwit (779) occur here in internationally important numbers (all counts given are mean peaks for the five year period 1995/96-1999/2000). A further thirteen species occur here in nationally important numbers - Great Crested Grebe (53), Shelduck (538), Red-breasted Merganser (52), Oystercatcher (767), Golden Plover (4,980), Grey Plover (444), Lapwing (3,233), Knot (698), Dunlin (4,984), Bar-tailed Godwit (1,068), Curlew (766), Redshank (731) and Turnstone (177).

Dungarvan Harbour SPA is an important site for wintering waterfowl, providing good quality feeding areas and roost sites for an excellent diversity of waterfowl species. The site is of high conservation importance, for supporting internationally important populations of Light-bellied Brent Goose and Black-tailed Godwit and because it regularly supports in excess of 20,000 wintering waterbirds. In addition, it holds nationally important populations of a further thirteen species, including Golden Plover and Bar-tailed Godwit, two species that are listed on Annex I of the E.U. Birds Directive.

NPWS 2009


Clonmel
CO. KILKENNY
CO. TIPPERARY
Waterford
CO. WATERFORD
Dungarvan
SPA 004032
CO. CORK
Ardmore
DUNGARVAN
Dún Garbhán
Dungarvan Harbour
Cuan Dhún Garbhán
Ballynacourty Point
An Rinn Bhán
Whitehouse Bank
Banc an Tí Ghil
Cunnigar
An Coinigéar
Spit Bank
Deadman Sand
RINGVILLE
An Rinn
Muggort's Bay
An Mhéa
Legend
SPA 004032
DUNGARVAN HARBOUR
SPA 004032
CO. WATERFORD
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SPA 004032
Version 1.04
Map Version 1
Date: Nov 2011

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. The months used to calculate index values varies according to the species concerned, the months chosen being representative of when the population is most stable, minimising for example, the inclusion of passage birds.

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

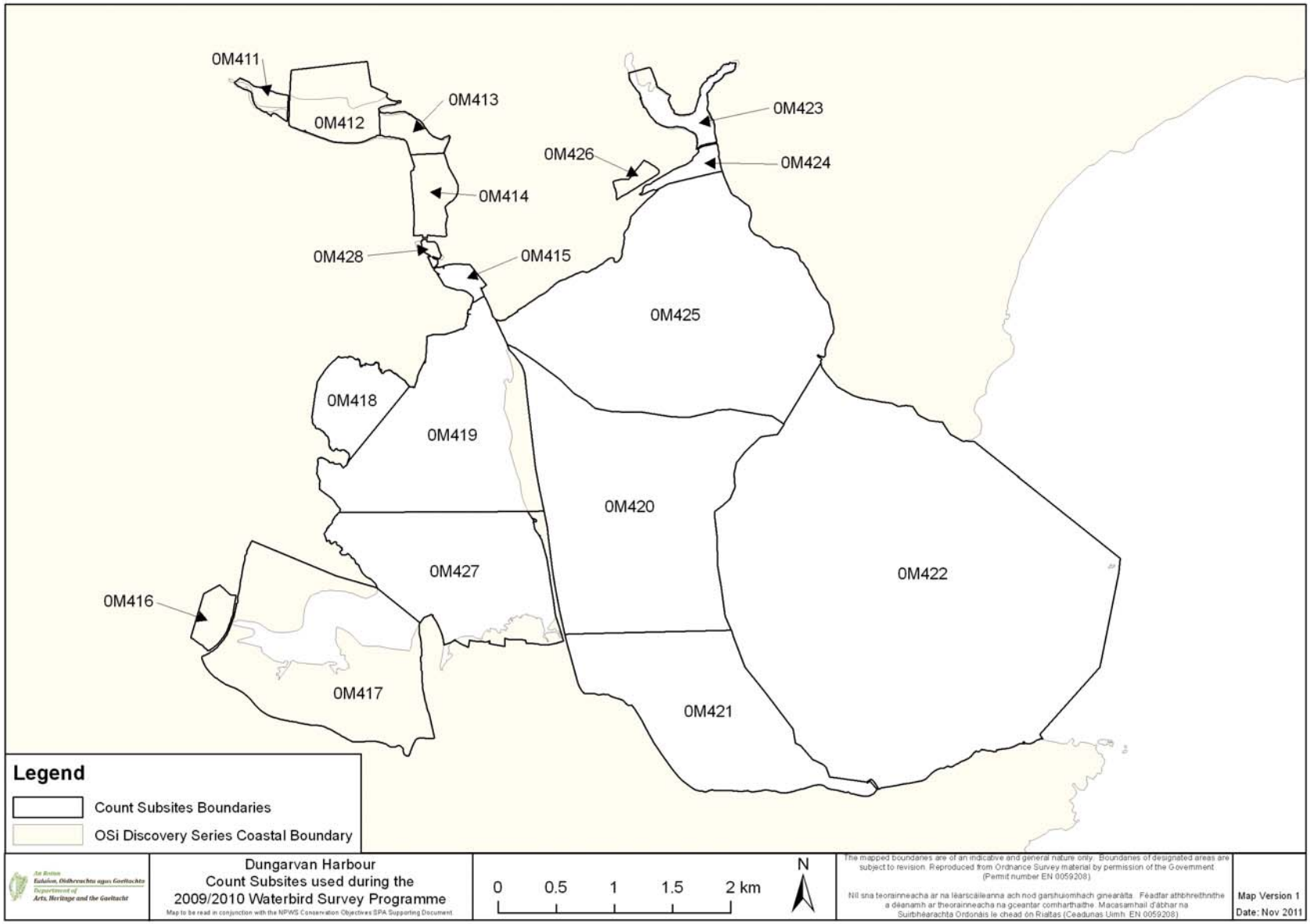
[a] dives <3m.

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

Dungarvan Harbour SPA (4032) – Waterbird Survey Programme 2009/10 – Count Subsites

Subsite	Subsite Name	Notes
0M411	Ballyneety Bridge	
0M412	Shandon Island	
0M413	Monang	
0M414	Dungarvan Town	
0M415	Inner Dungarvan Town	
0M416	Brickey Upper	
0M417	Brickey Lower	
0M418	Reencrehy	
0M419	Cunnigar West	
0M420	Whitehouse Bank	
0M421	Ballynacourty North	
0M422	Helvick Pier - Ballynacourty Pt	
0M423	Duck's Pool	
0M424	Old Railway	
0M425	Ballyrandle	
0M426	Clashnaloohan	Terrestrial subsite (wet grassland). Not counted on LT survey 17/12/09
0M427	Cunnigar South	
0M428	Bridge	


0M411
0M412
0M413
0M414
0M415
0M416
0M417
0M418
0M419
0M420
0M421
0M422
0M423
0M424
0M425
0M426
0M427
0M428
Legend
Count Subsites Boundaries
OSi Discovery Series Coastal Boundary
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Dungarvan Harbour
Count Subsites used during the
2009/2010 Waterbird Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
0 0.5 1 1.5 2 km
N
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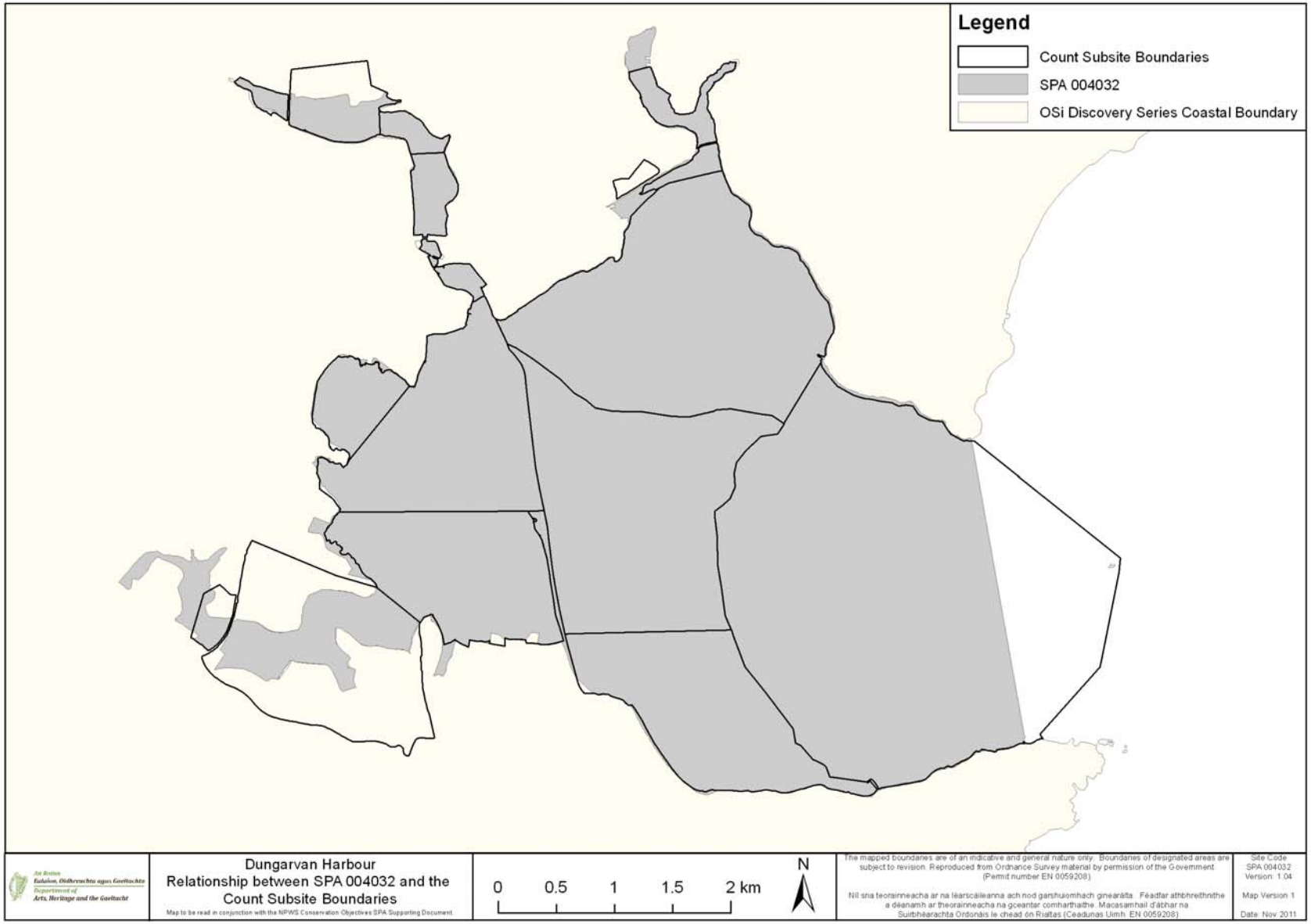
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'athar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
Map Version 1
Date: Nov 2011


Legend
Count Subsite Boundaries
SPA 004032
OSi Discovery Series Coastal Boundary
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Dungarvan Harbour
Relationship between SPA 004032 and the Count Subsite Boundaries
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
0 0.5 1 1.5 2 km
N
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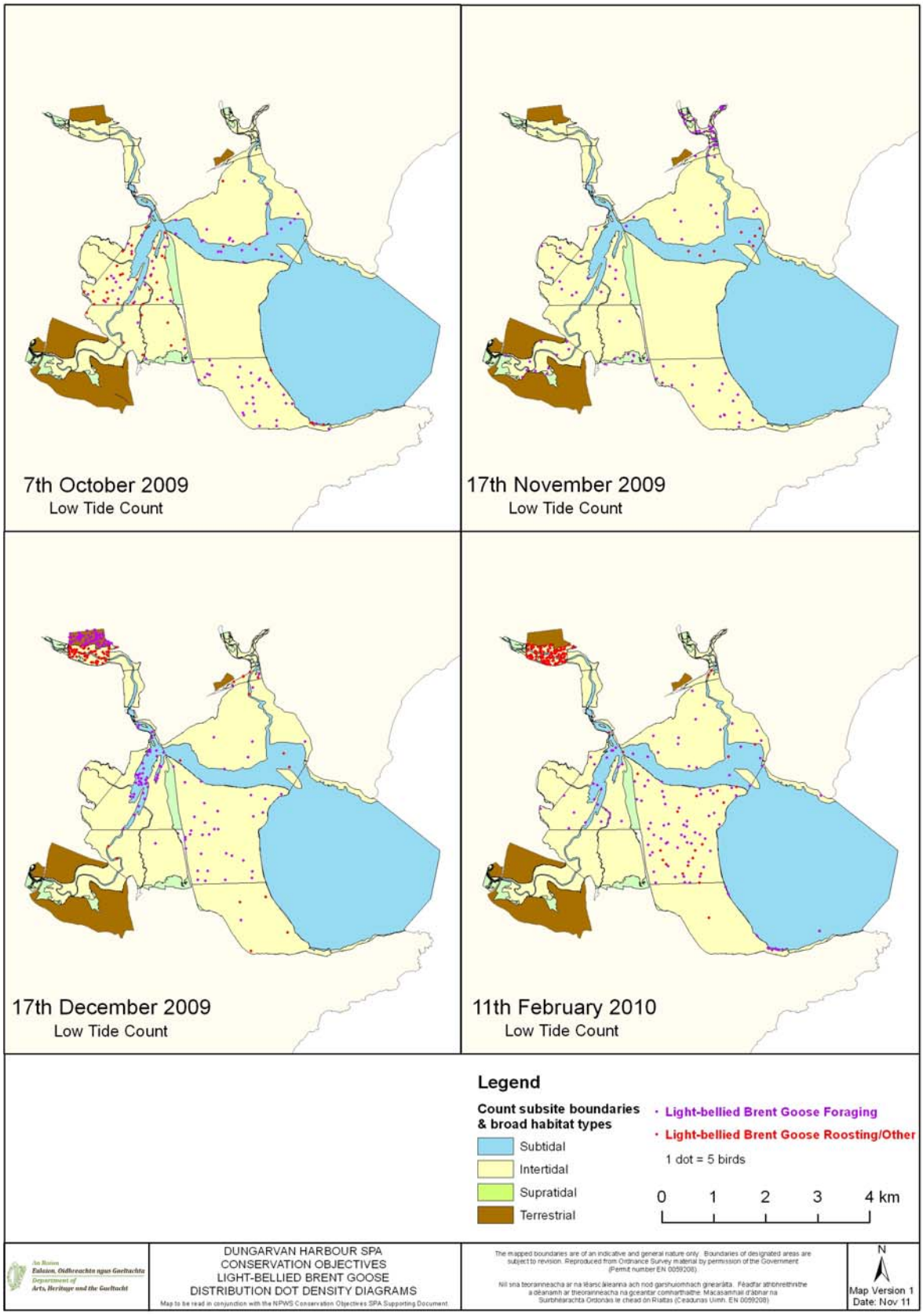
Site Code: SPA 004032
Version: 1.04
Map Version: 1
Date: Nov 2011

APPENDIX 7

Dungarvan Harbour (4032)

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


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th 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 = 5 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachtaí agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
LIGHT-BELLIED BRENT GOOSE
DISTRIBUTION DOT DENSITY DIAGRAMS
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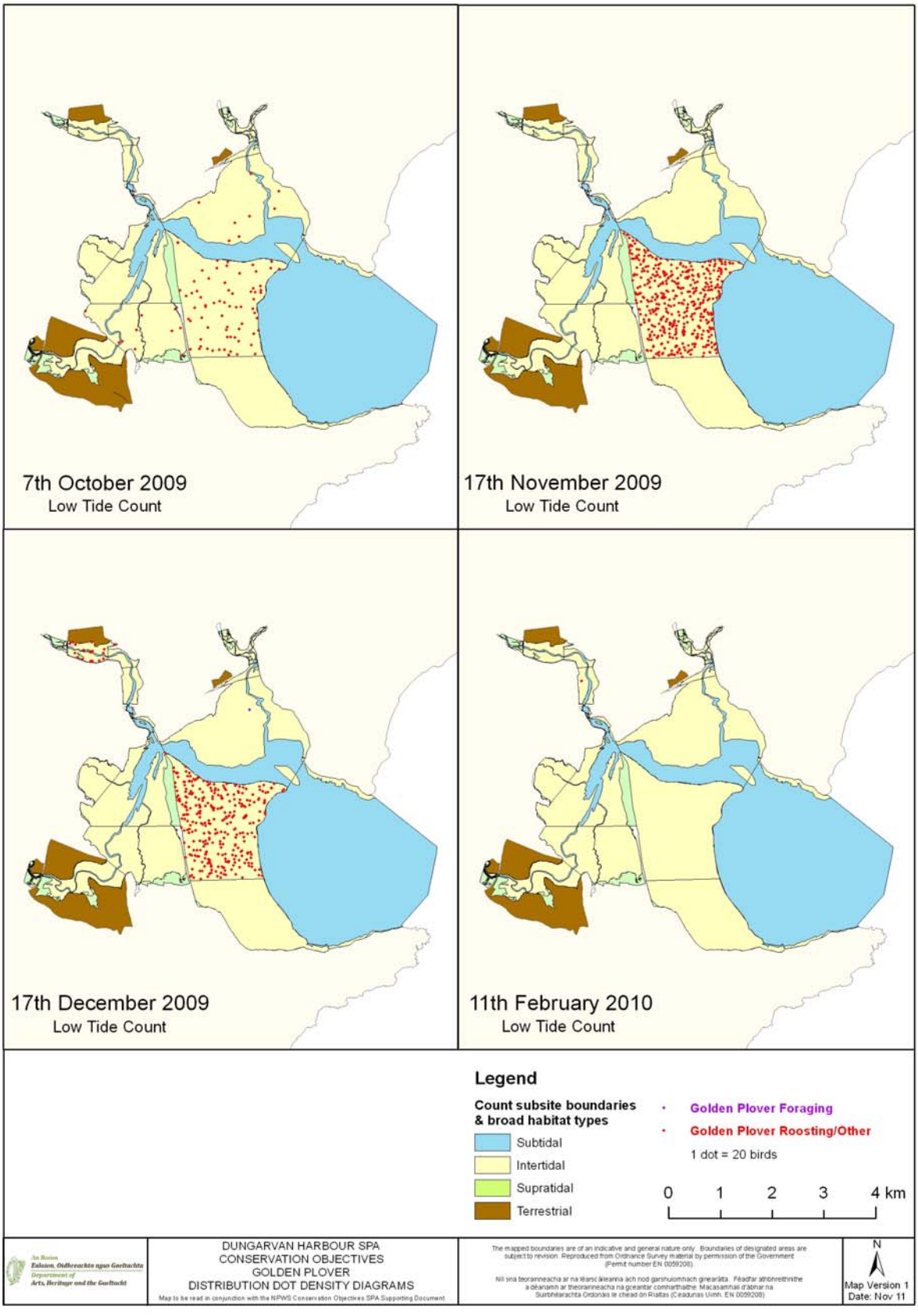
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Golden Plover Foraging
Golden Plover Roosting/Other
1 dot = 20 birds
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
GOLDEN PLOVER
DISTRIBUTION DOT DENSITY DIAGRAMS
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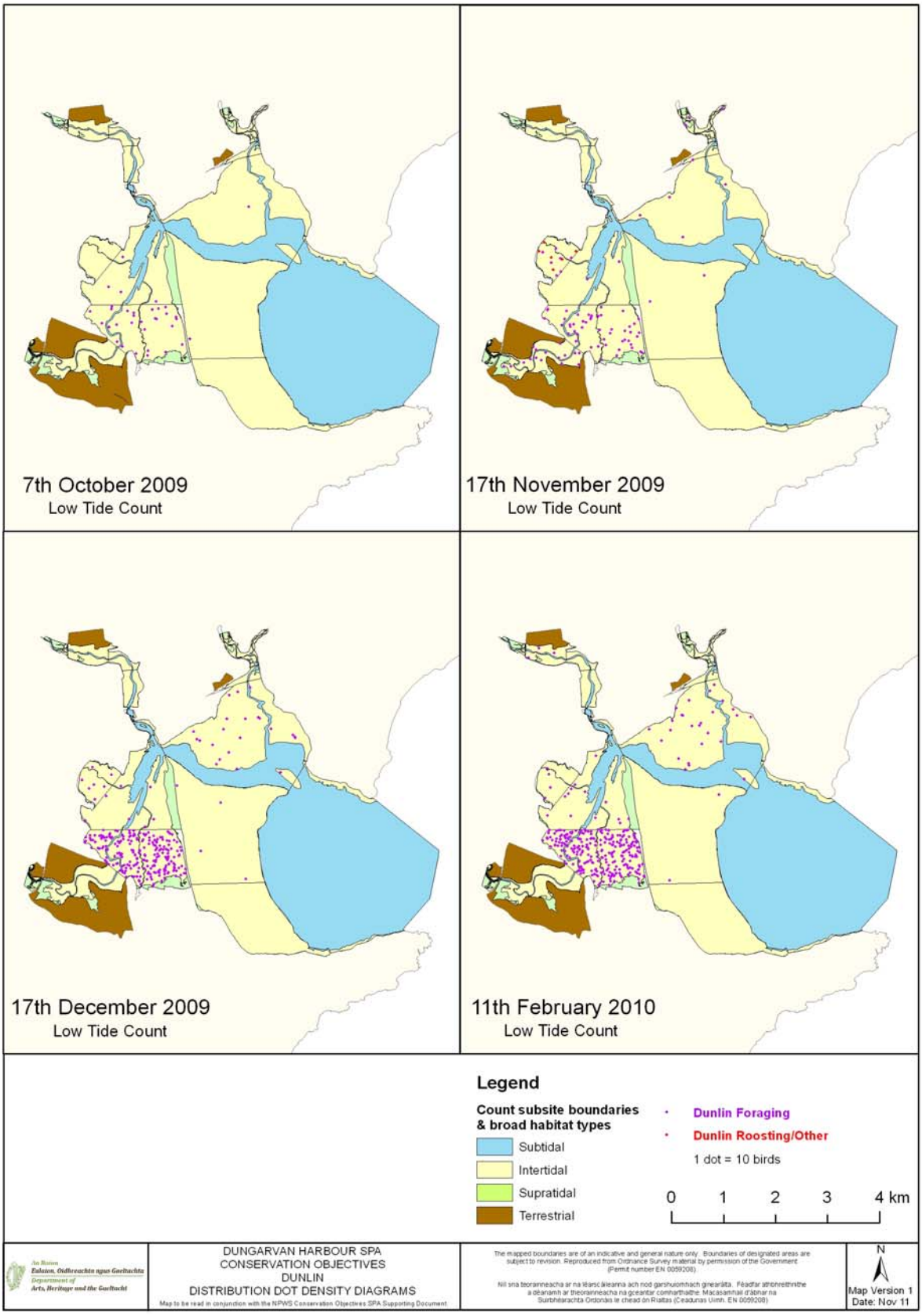
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Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Dunlin Foraging
Dunlin Roosting/Other
1 dot = 10 birds
0 1 2 3 4 km
Department of Arts, Heritage and the Gaeltacht
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
DUNLIN
DISTRIBUTION DOT DENSITY DIAGRAMS
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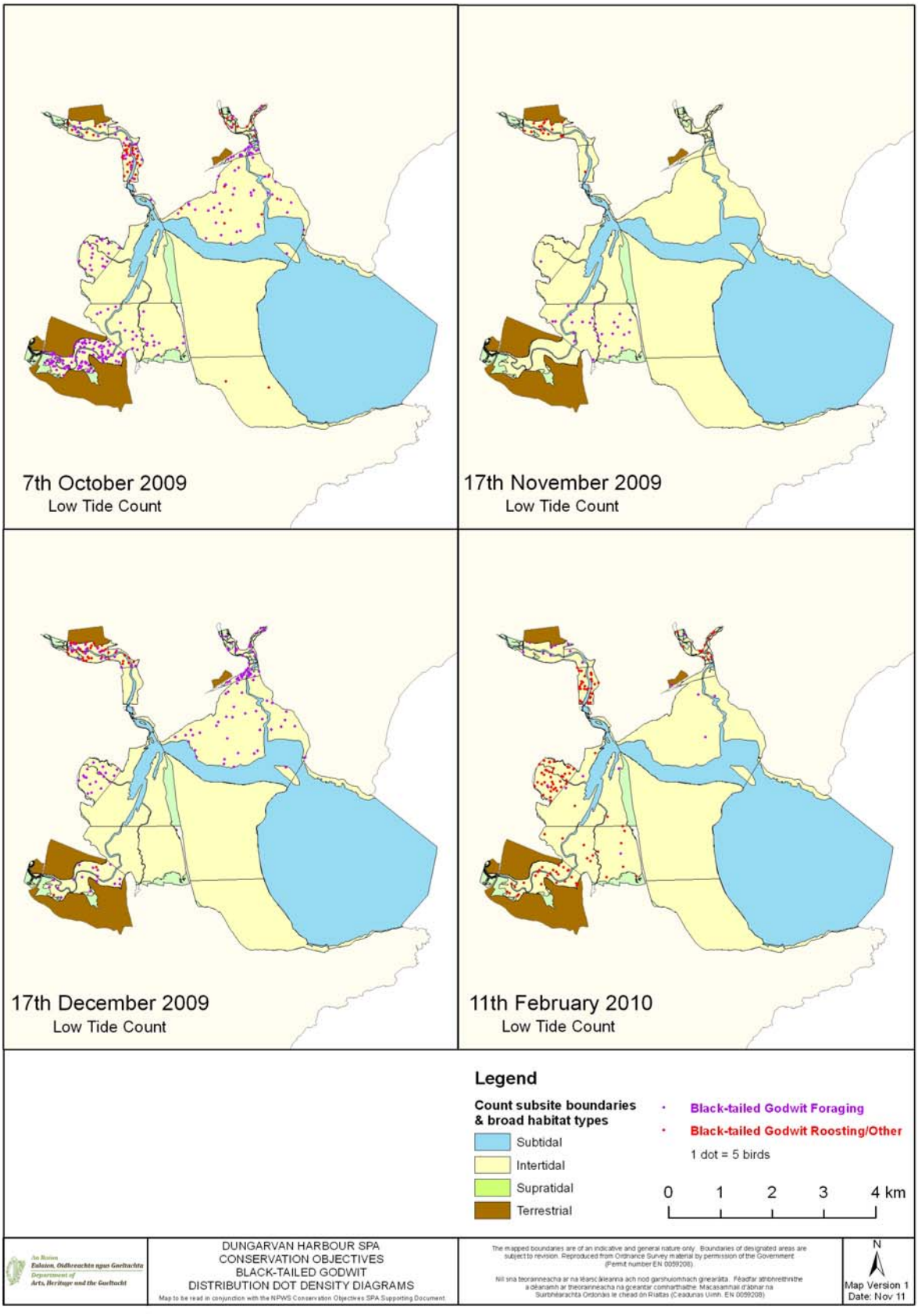
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17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Black-tailed Godwit Foraging
Black-tailed Godwit Roosting/Other
1 dot = 5 birds
0 1 2 3 4 km
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DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
BLACK-TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
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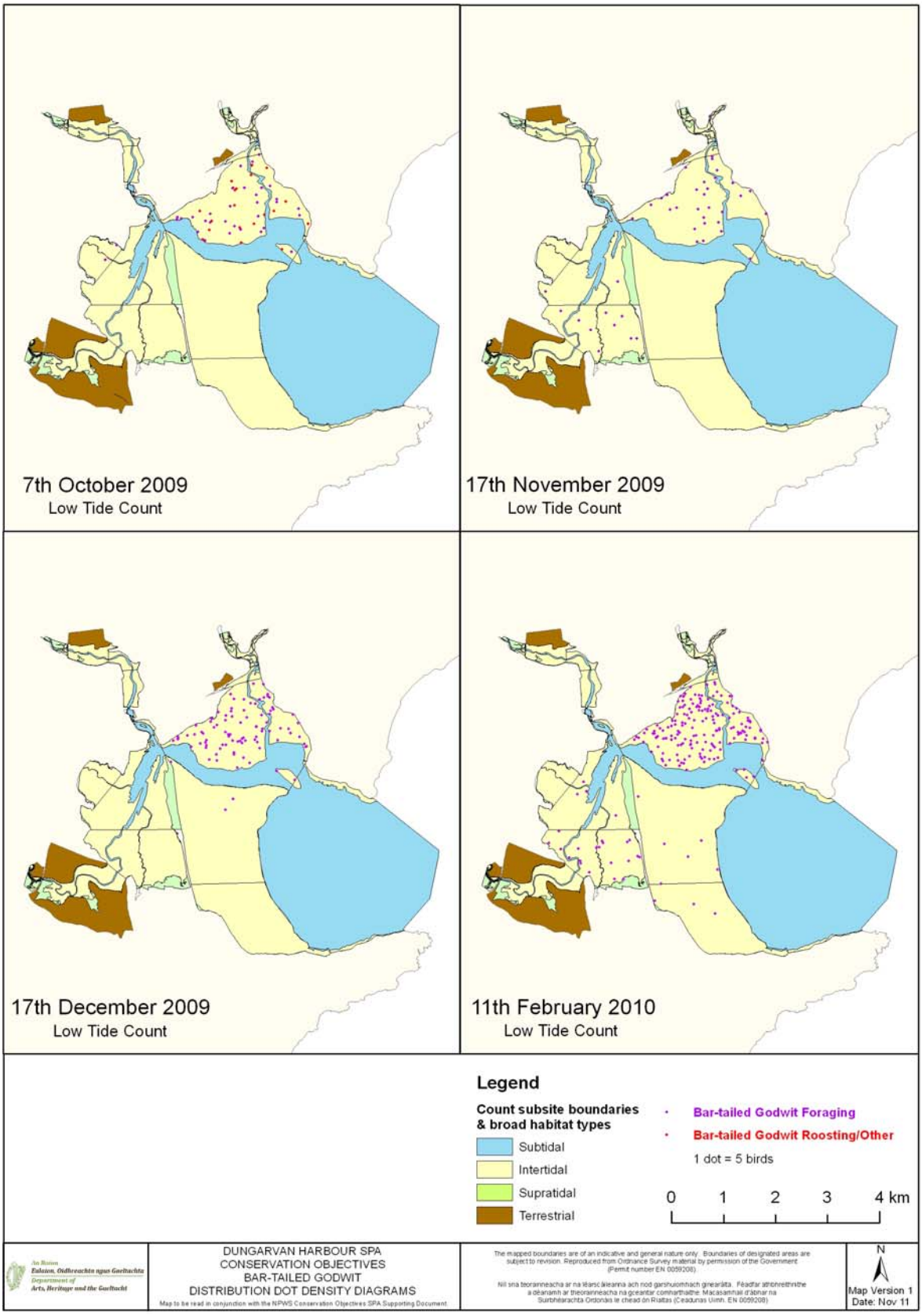
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17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Bar-tailed Godwit Foraging
Bar-tailed Godwit Roosting/Other
1 dot = 5 birds
0 1 2 3 4 km
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DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
BAR-TAILED GODWIT
DISTRIBUTION DOT DENSITY DIAGRAMS
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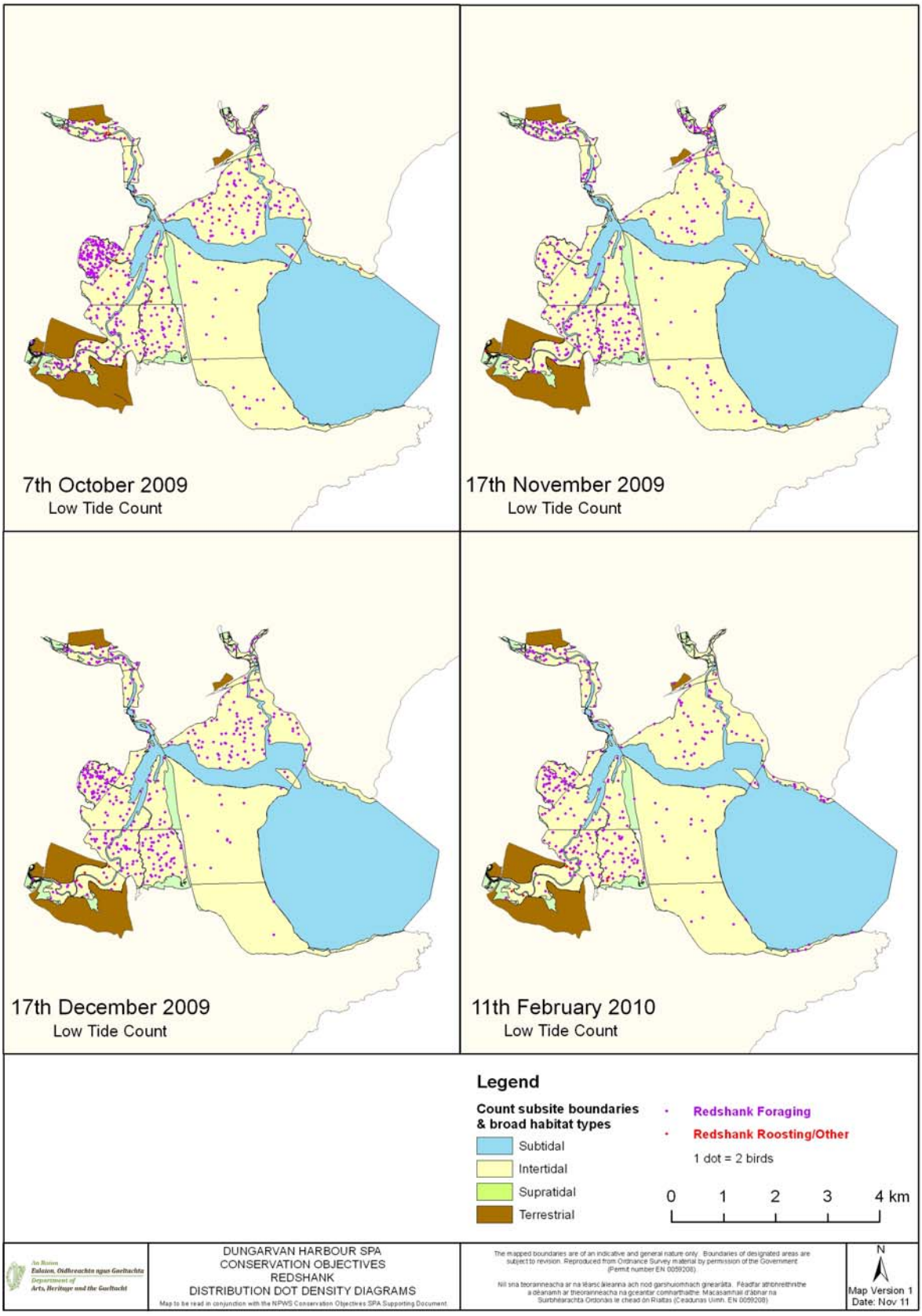
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17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Redshank Foraging
Redshank Roosting/Other
1 dot = 2 birds
0 1 2 3 4 km
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CONSERVATION OBJECTIVES
REDSHANK
DISTRIBUTION DOT DENSITY DIAGRAMS
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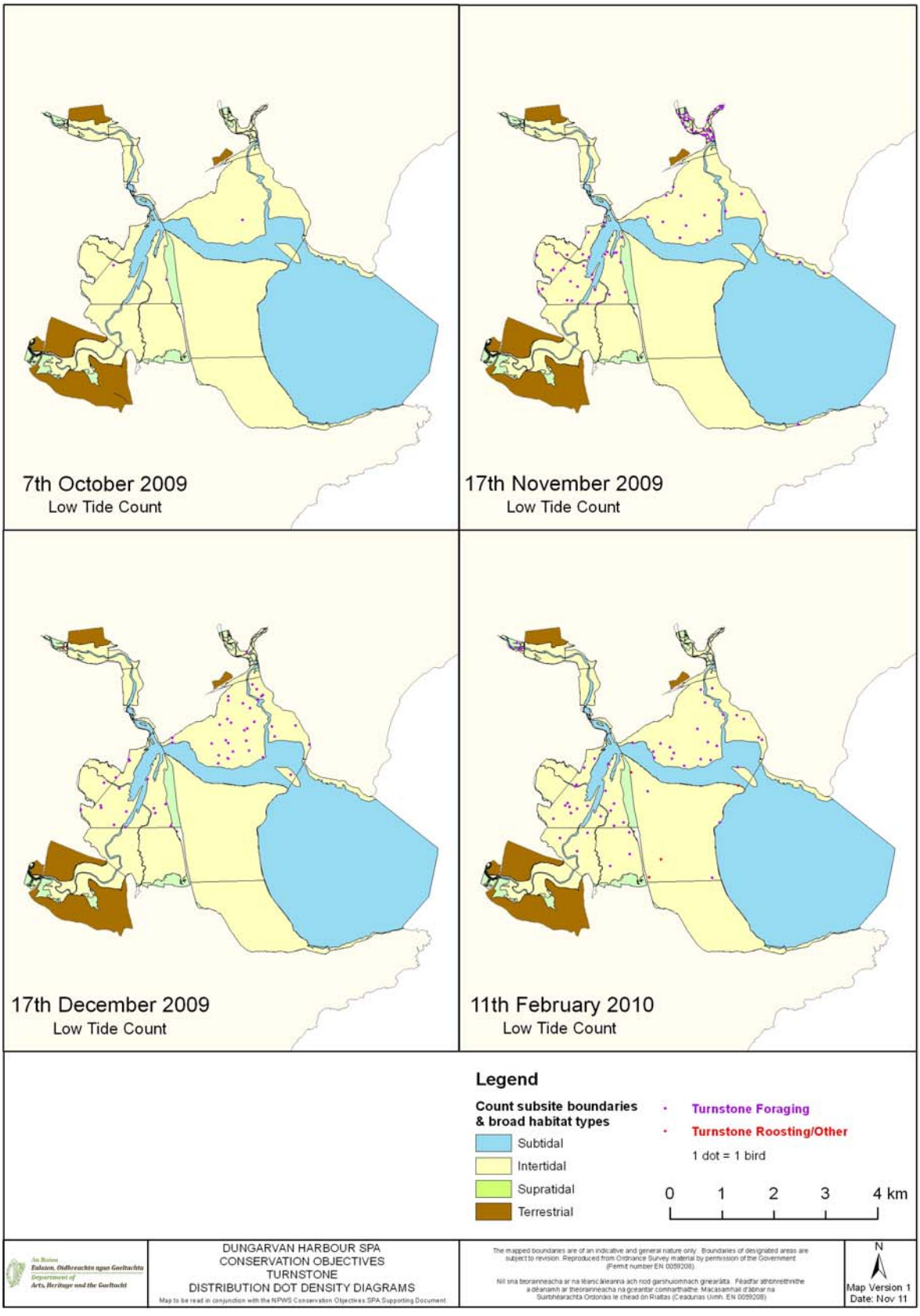
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17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Turnstone Foraging
Turnstone Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
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DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
TURNSTONE
DISTRIBUTION DOT DENSITY DIAGRAMS
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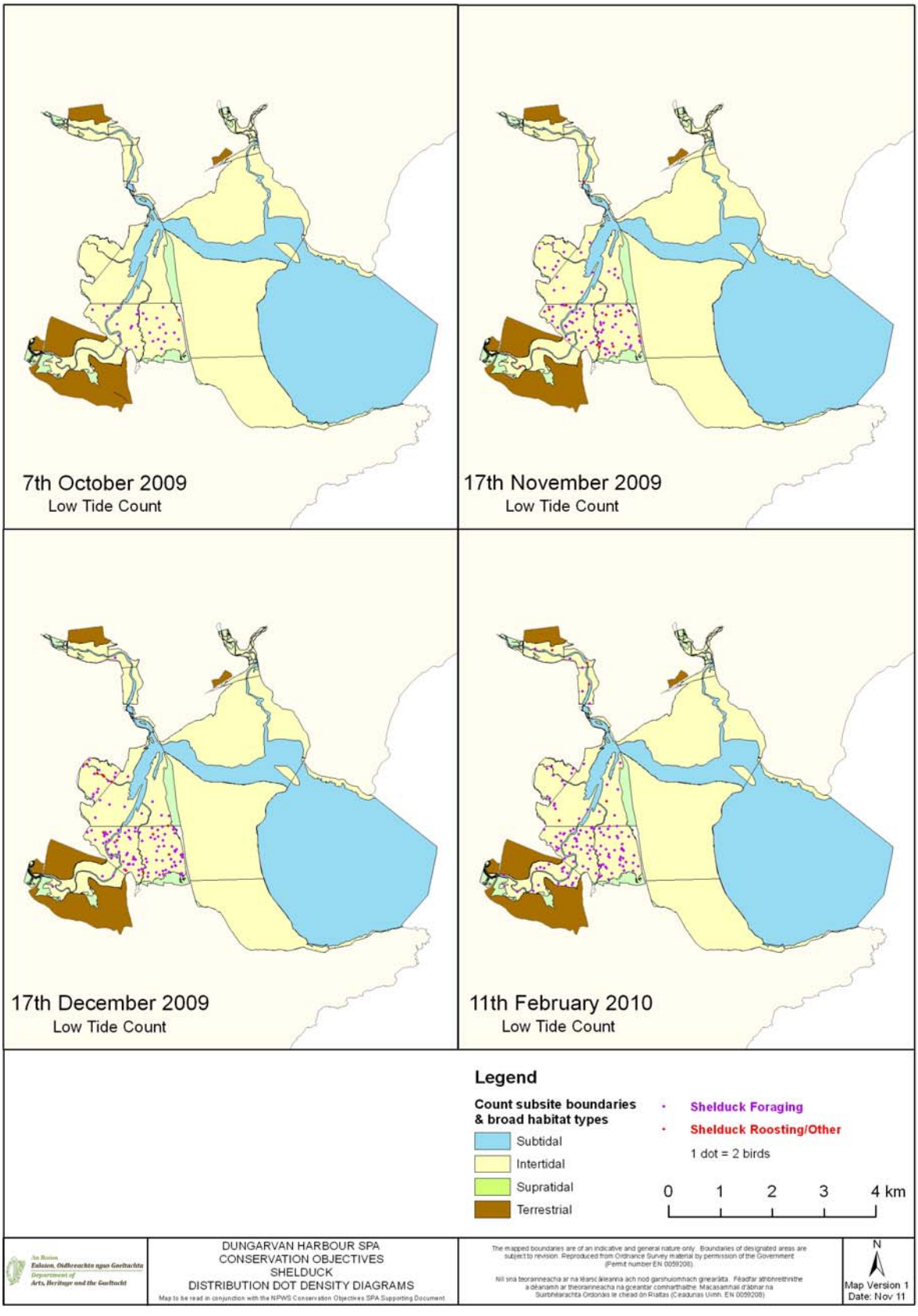
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th 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
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
SHELDUCK
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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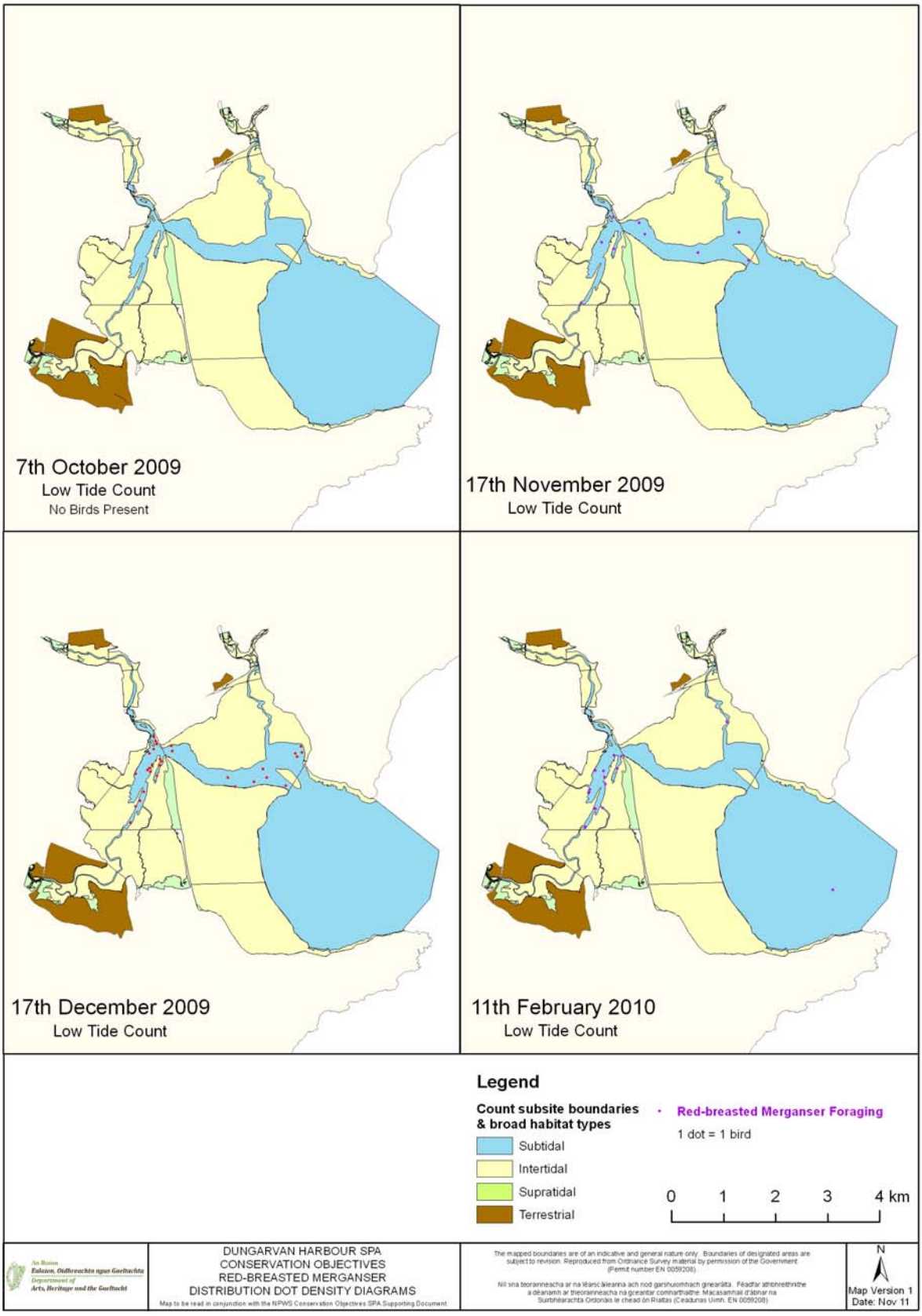
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
No Birds Present
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Red-breasted Merganser Foraging
1 dot = 1 bird
0 1 2 3 4 km
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
RED-BREASTED MERGANSER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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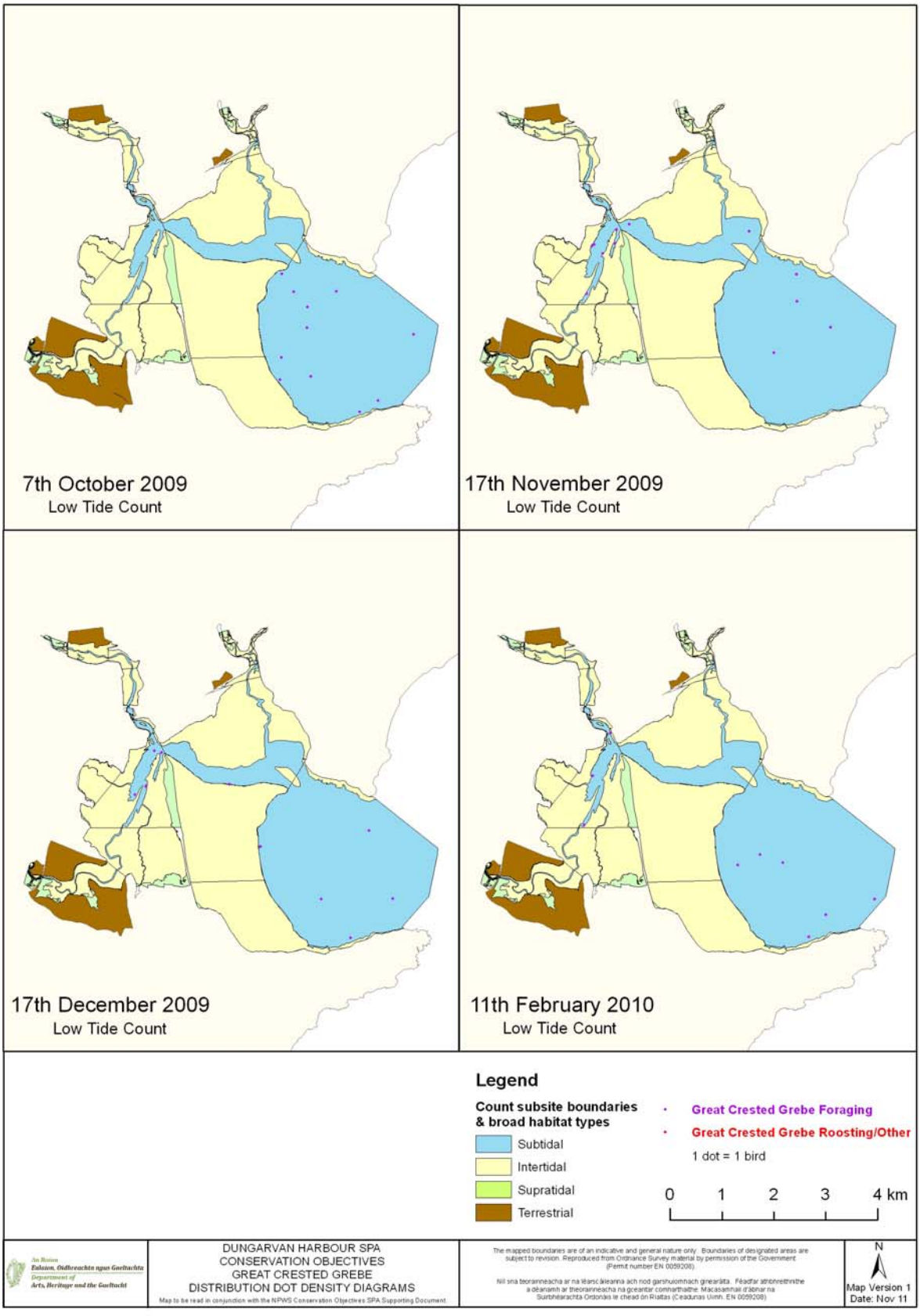
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Great Crested Grebe Foraging
Great Crested Grebe Roosting/Other
1 dot = 1 bird
0 1 2 3 4 km
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Department of Arts, Heritage and the Gaeltacht
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
GREAT CRESTED GREBE
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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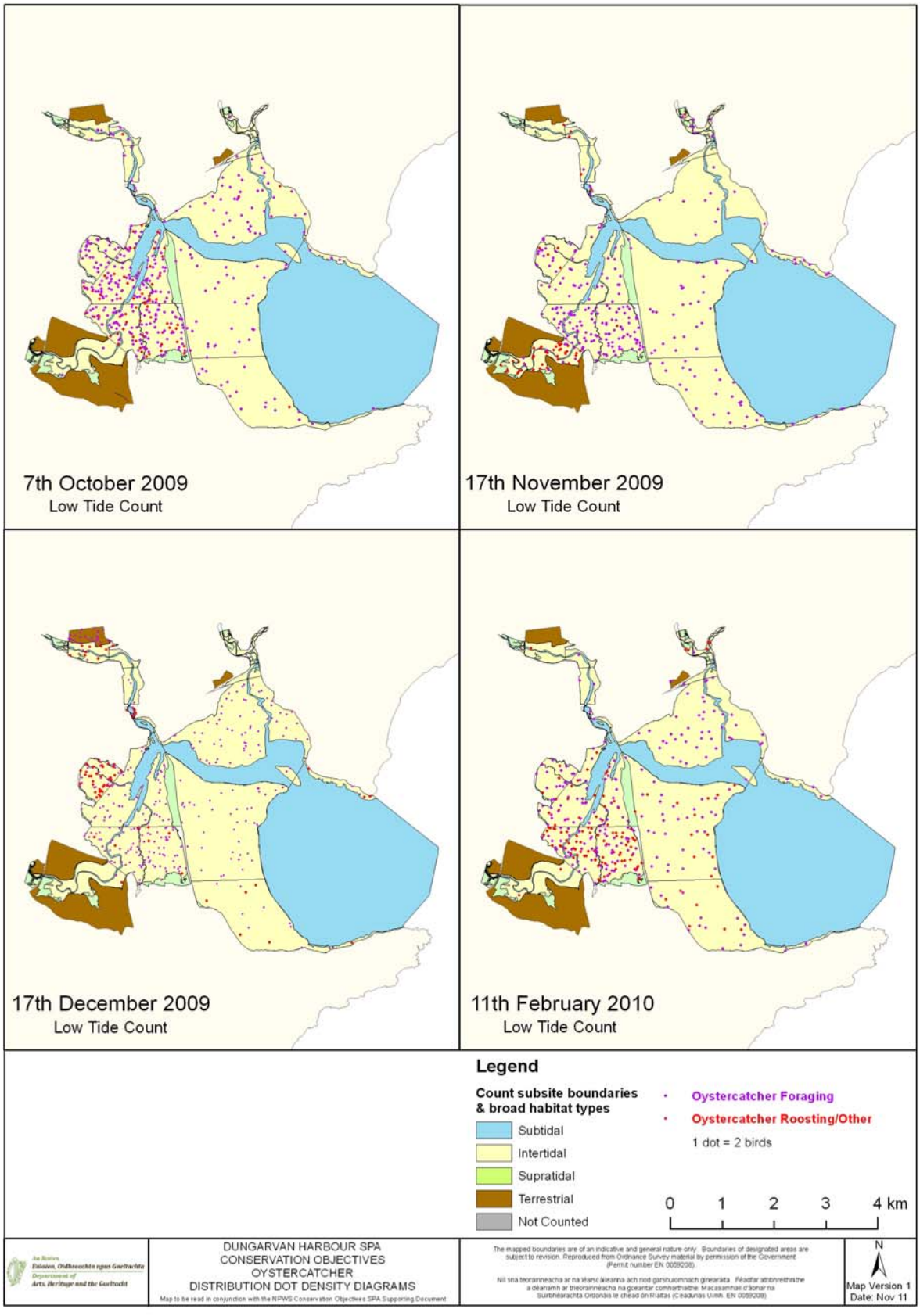
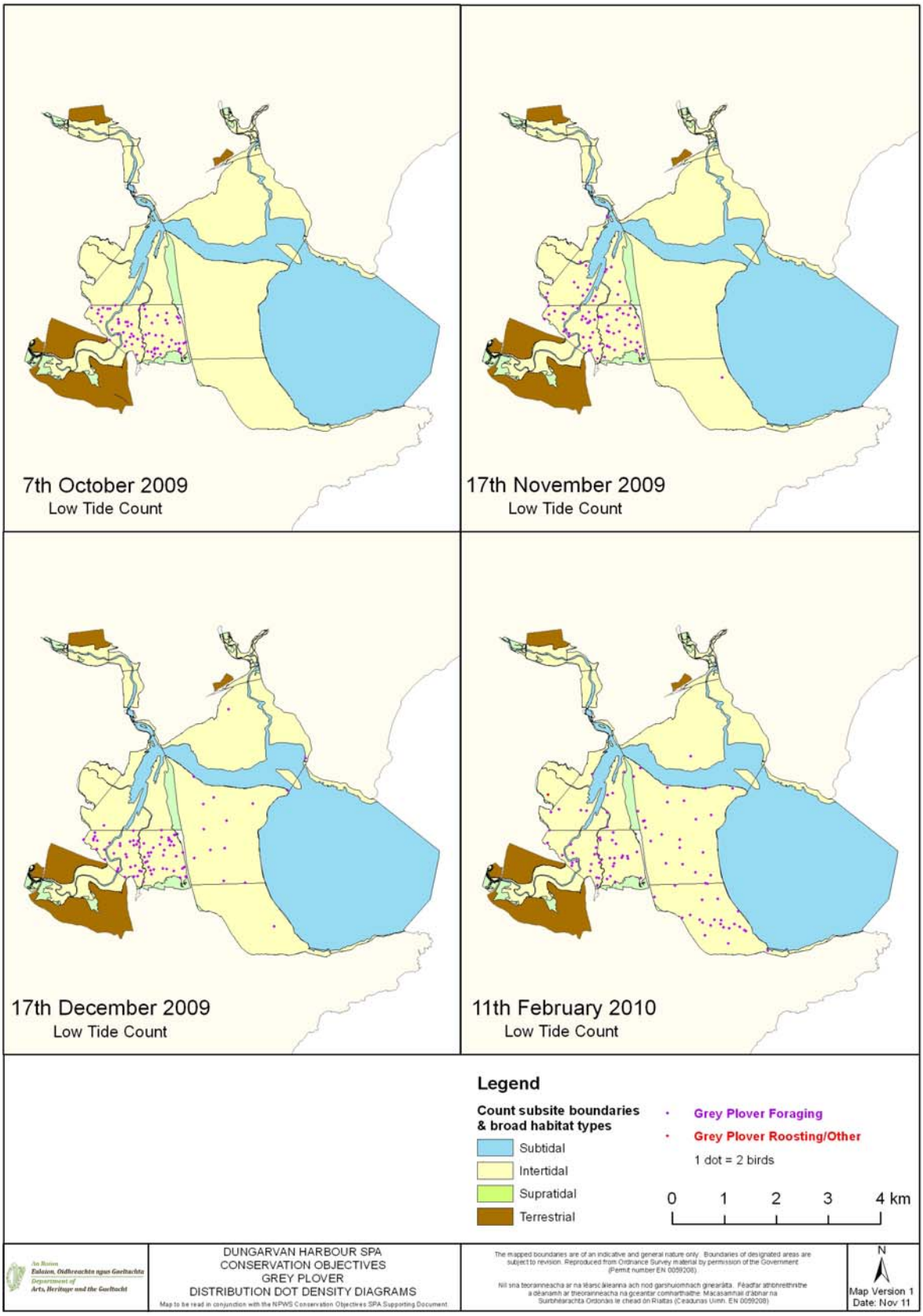
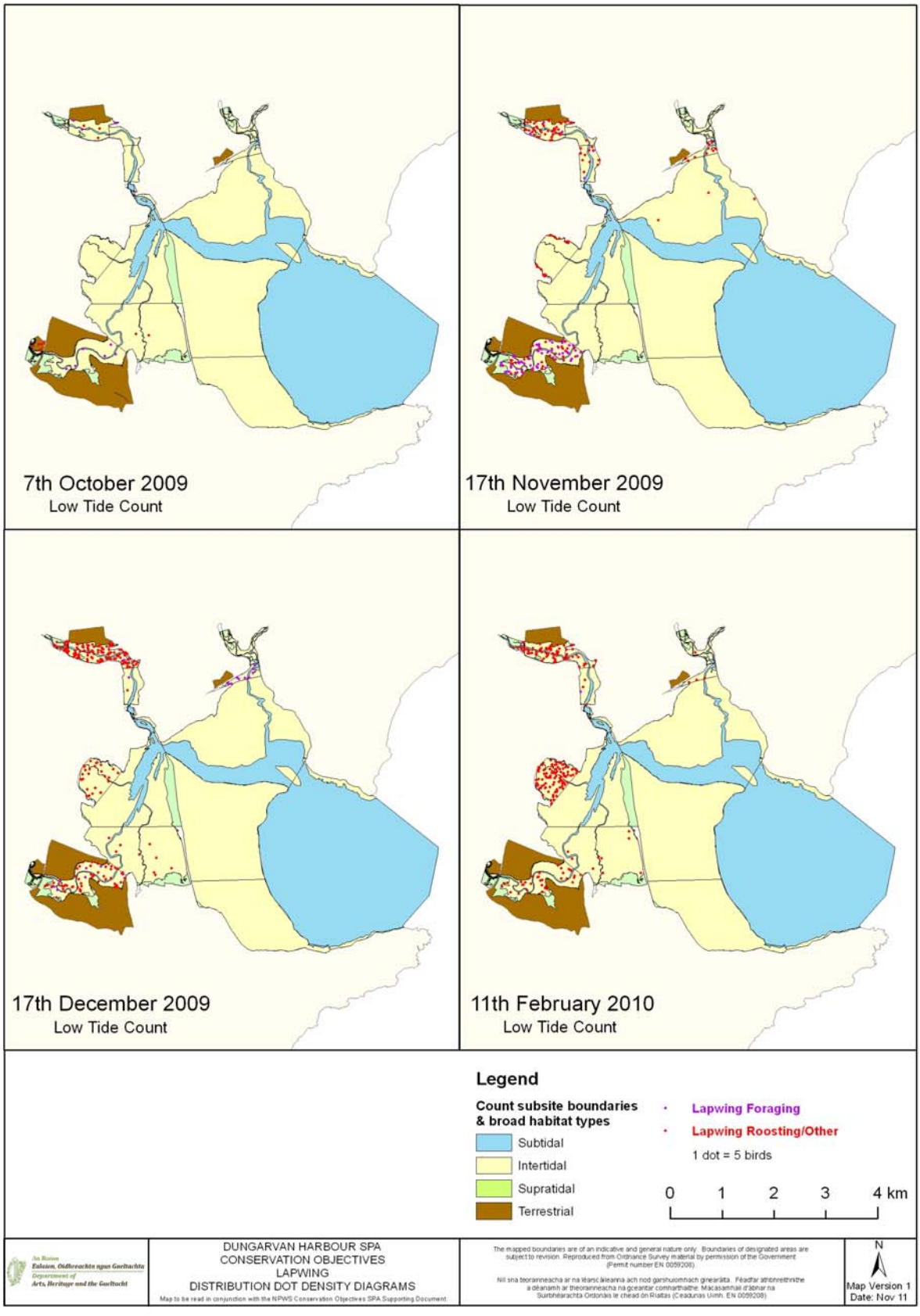
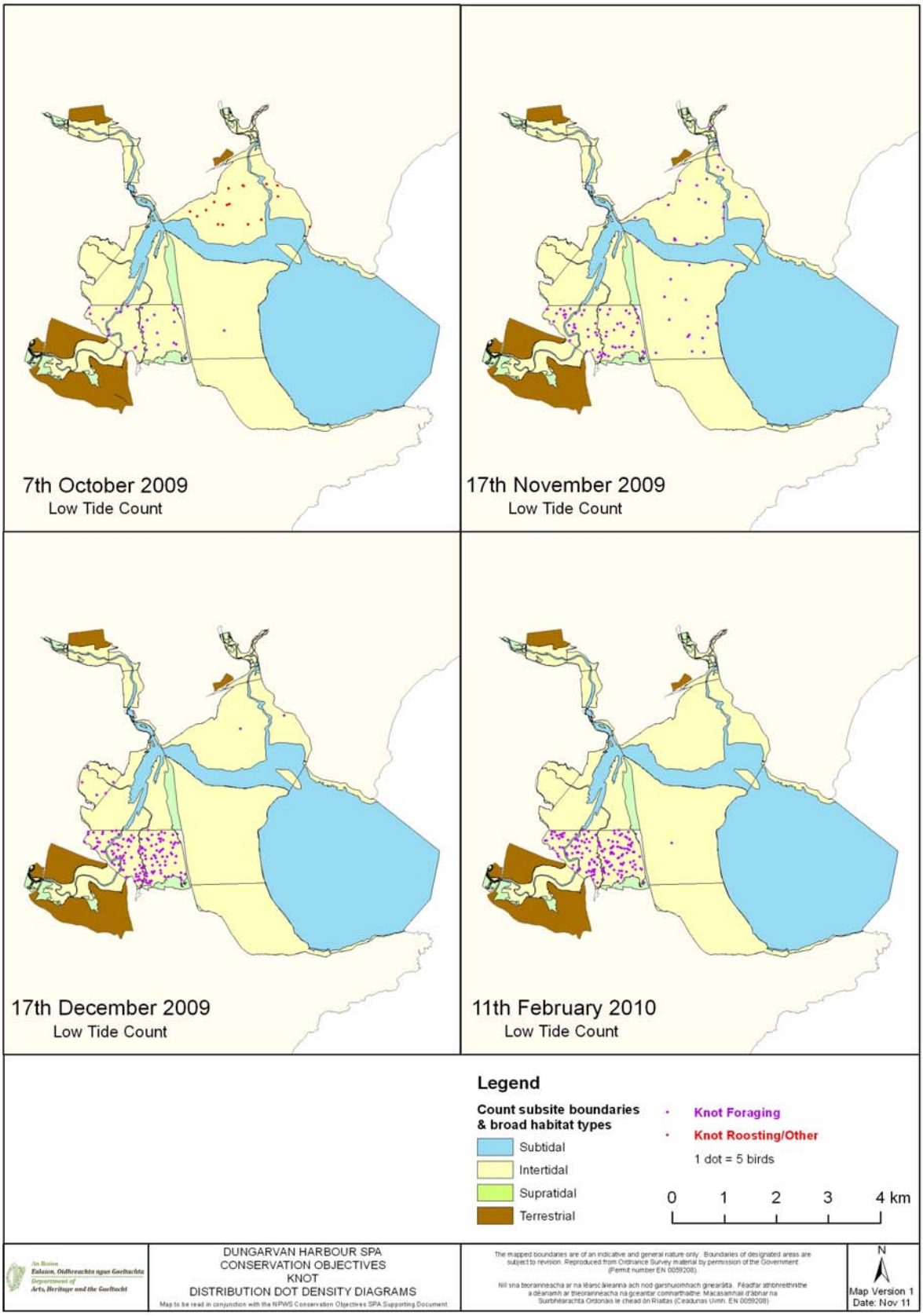
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Not Counted
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
DUNGARVAN HARBOUR 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)
Nil sna teorainneacha ar na léarsí áileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Grey Plover Foraging
Grey Plover 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
DUNGARVAN HARBOUR 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).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comhartha. Macasamhail d'obair na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
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
DUNGARVAN HARBOUR 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)
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordanáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Terrestrial
Knot Foraging
Knot 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
DUNGARVAN HARBOUR 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).
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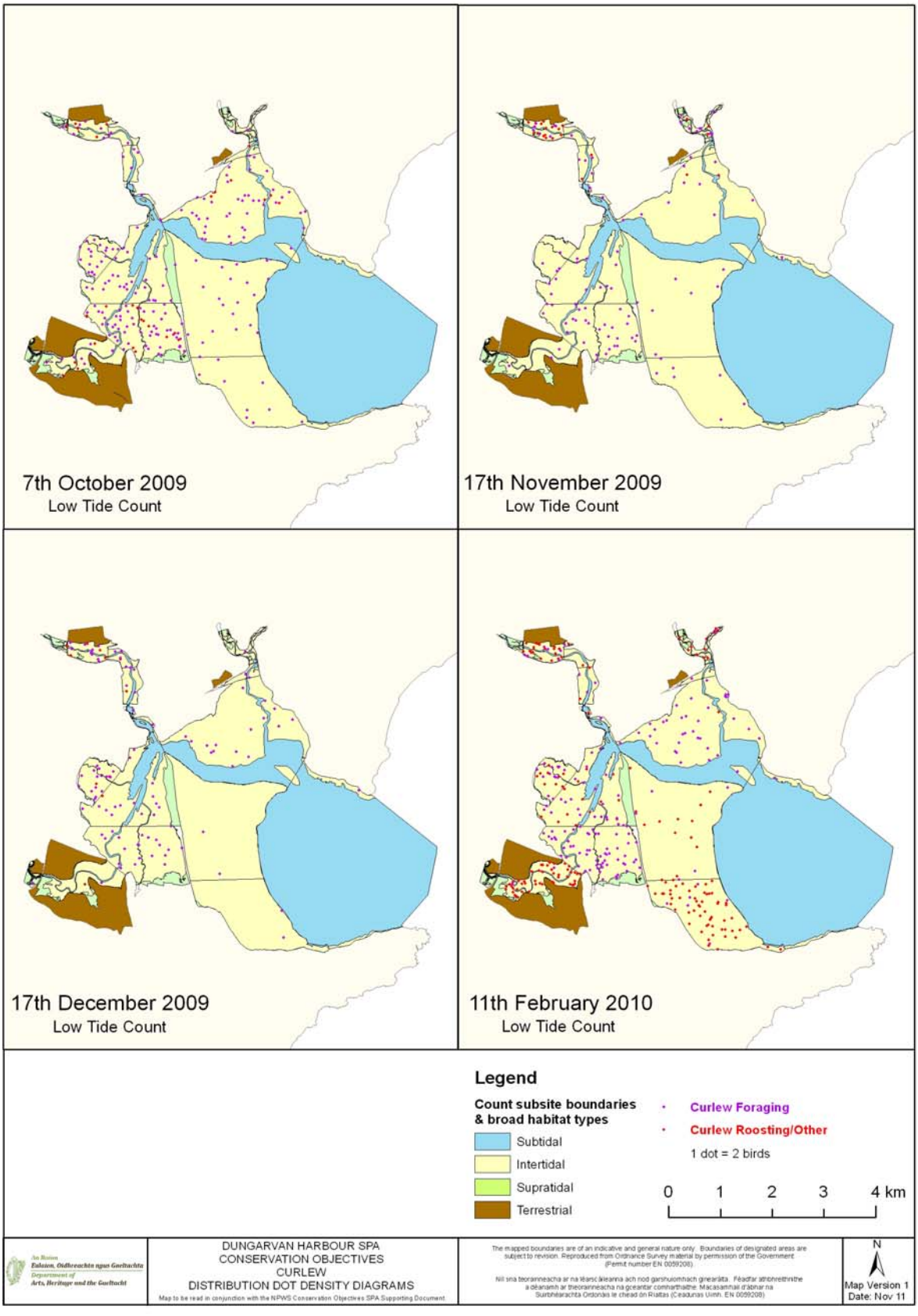
Map Version 1
Date: Nov 11


7th October 2009
Low Tide Count
17th November 2009
Low Tide Count
17th December 2009
Low Tide Count
11th 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
DUNGARVAN HARBOUR SPA
CONSERVATION OBJECTIVES
CURLEW
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
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N
Map Version 1
Date: Nov 11

APPENDIX 8

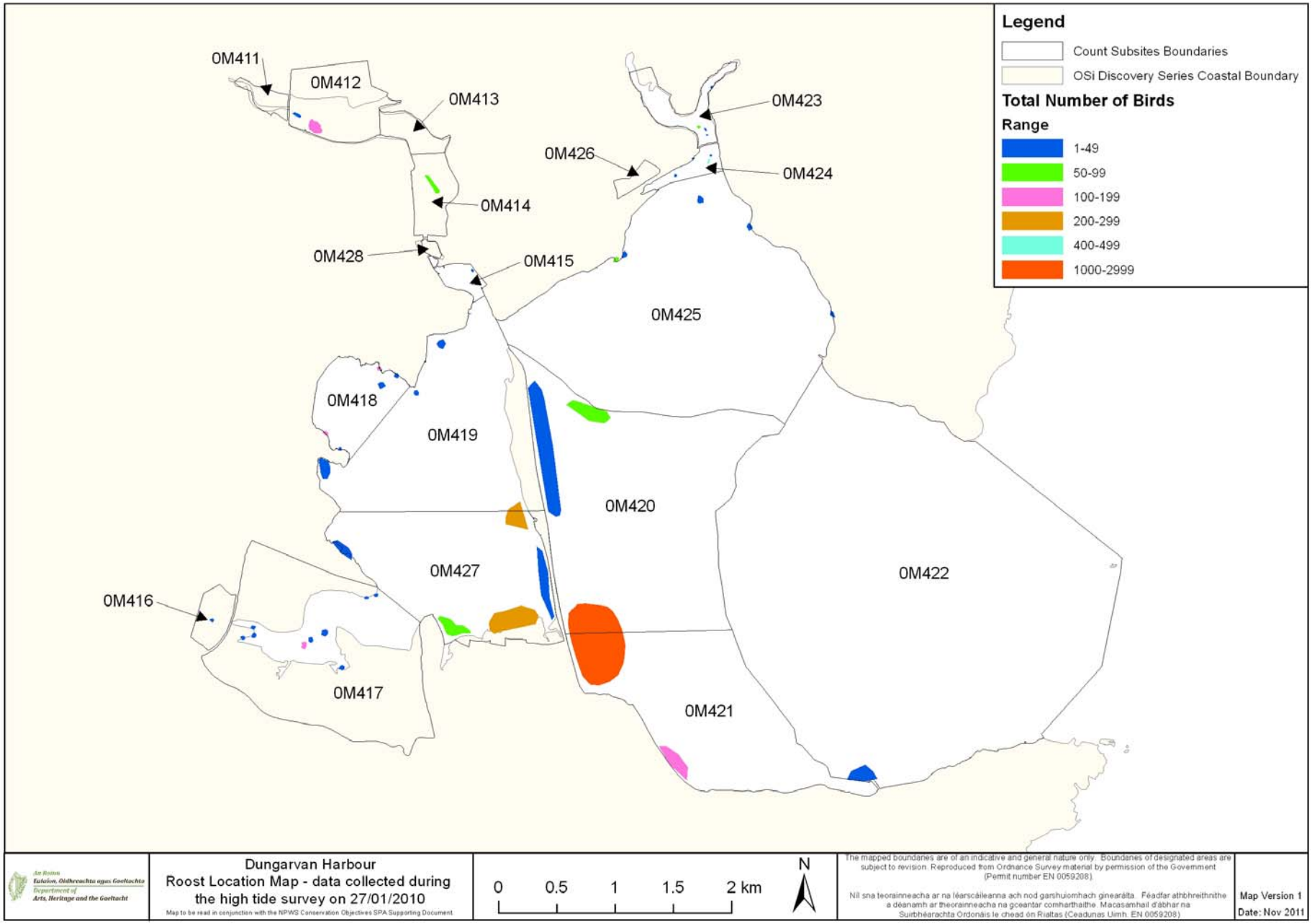
Dungarvan Harbour SPA (4032)

Summary data and roost location maps from the roost survey (08/03/10)

The table and accompanying map summarises data collected from the coordinated roost survey undertaken on 8th March 2010. (Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations)

Dungarvan Harbour SPA (4032) - Roost Summary Table

Subsite	Number individual roost locations	No. Species	Total No. birds	Species (alphabetical order)
0M411	-	-	-	
0M412	2	4	170	BH, BW, CU, OC
0M413	-	-	-	
0M414	1	2	68	BH, CM
0M415	1	1	8	PB
0M416	1	1	4	ET
0M417	9	9	230	BH, BW, CM, MA, OC, SU, PB, RK, T.
0M418	5	8	291	BW, CU, DN, OC, PB, RK, SU, WN
0M419	3	4	81	CM, OC, PB, SU.
0M420	2	7	113	BH, CA, CM, GV, HG, LB. OC
0M421	3	11	1,976	BA, BH, CM, CU, DN, GV, HG, KN, LB, OC, PB
0M422	-	-	-	
0M423	4	6	139	BH, CM, OC, RK, TT, WN
0M424	4	5	461	BA, BH, CM, DN, OC
0M425	5	5	111	CM, OC, PB, RK, TT
0M426	-	-	-	
0M427	5	9	610	BA CU, DN, GV, OC, PB, RK, SU. T.
0M428	-	-	-	


Legend
Count Subsites Boundaries
OSi Discovery Series Coastal Boundary
Total Number of Birds
Range
1-49
50-99
100-199
200-299
400-499
1000-2999
0M411
0M412
0M413
0M423
0M426
0M424
0M414
0M428
0M415
0M425
0M418
0M419
0M420
0M427
0M422
0M416
0M417
0M421
Dungarvan Harbour
Roost Location Map - data collected during the high tide survey on 27/01/2010
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
0 0.5 1 1.5 2 km
N
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Map Version 1
Date: Nov 2011

APPENDIX 9

Dungarvan Harbour SPA (4032) - 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 within Dungarvan Harbour 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.

	OM411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
Coastal protection, sea defences & stabilisation																	
1.1 Linear defences		O	O	O				O	O			O		O	O	O	O
1.2 Training walls				O	O		O							O			O
1.4 *Spartina* planting/growing									O							O	
1.5 Marram grass planting																H	
1.6 Other modifications						O	O										
Barrage schemes/drainage																	
2.2 Altered drainage/river channel				H	H	P	P	H									H
2.3 Other channel modifications					H	H	H							O			O
3.3 Wind-power generation																	
Industrial, port & related development																	
4.2 Fishing harbour					O												
4.3 Slipway					O				O						O		
4.4 Pier												O			O		
4.7 Ship & boat building/repair					O												
Pollution																	
6.1 Domestic & urban waste water					O							O	O		O		
6.3 Landfill	O																
6.4 Agricultural and forestry effluents	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
6.7 Solid waste incl. fly-tipping	O	O							O				O			O	
Sediment extraction (marine & terrestrial)																	
7.1 Channel dredging (maintenance & navigation)					O										O		

	OM411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
Transport & communications																	
8.2 Flight path																O	
8.3 Bridges & aqueducts	O	O		O	O	O											O
8.4 Tunnel				O	O									O			O
8.5 Road schemes	O	O		O	O	O		O					O	O	O		O
8.6 Car parks					O			O							O		Y
8.7 Shipping channel, shipping lanes															O		
8.8 Rail lines															H		
Urbanisation																	
9.1 Urbanised areas, housing				O	O			O	O						O		
9.2 Commercial & industrial areas				O	O			O							O		O
9.3 Hotel & leisure complex				O	O												
Tourism & recreation																	
12.1 Marinas					P												
12.2 Non-marina moorings					O				O								
12.5 Leisure centres, sports ground									O								
12.6 Power boating & water-skiing									O								
12.7 Jet-skiing									O								
12.8 Sailing					O				O						O		
12.9 Sailboarding & wind-surfing										O	O						
12.12 Surfing										O	O						
12.13 Rowing															O		
12.14 Tourist boat trips									O								
12.15 Angling	O				O				O						H		
12.16 Other non-commercial fishing					O												
12.17 Bathing & general beach recreation									O						O		

	OM411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
12.18 Walking, incl. dog walking		O	O	O	O			O	O	O	O			O	O	O	O
12.19 Birdwatching						O	O	O	O						O	O	
12.21 4WD, trial & quad bikes									O							O	
12.22 Motorised vehicles		O						O	O	O	O					O	
12.23 Horse-riding									O	O	O				O	O	
12.25 Golf courses								O					O				
Wildfowl & hunting																	
13.1 Wildfowling						H	H	H	O							O	
13.2 Other hunting-related activities	O																
Bait-collecting																	
14.1 Digging for lugworms/ragworms					O			O	O	O					O		
Fisheries & Aquaculture																	
15.2 Professional active fishing												U					
15.5 Leisure fishing					O												
15.6 Molluscs - hand-gathering								O	O		O	O			O		
15.9 Intertidal aquaculture e.g. trestles										O	O						

	OM411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
Agriculture & forestry																	
16.1 Saltmarsh grazing/harvesting	O		O						O							O	
16.2 Grazing: intensive (terrestrial)						O	O	O							O		
16.3 Grazing: non-intensive (terrestrial)									O							O	
16.4 Sand dune grazing									O							O	
16.5 Stock feeding									O							O	
16.6 Crop production: intensive						O	O	O									
16.9 Removal of hedges, scrub							H	H					O		H		
16.10 Mowing/grassland cutting						O	O	O							O		
16.13 Agricultural land-claim	H	H		H				H								H	
16.14 In-filling (ditches, ponds, pools, marshes & pits)	H						H							H		H	
16.20 Others									O							O	
Natural events																	
19.1 Storms, floods and storm surges									O							O	
19.2 Severe cold weather	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
19.3 Eutrophication		O	O	O													

APPENDIX 10

Dungarvan Harbour SPA (4032)

Activities or activities associated with features at the site, that are considered to have the potential to cause disturbance to waterbird species

Code	Legend
	Activities considered likely to cause disturbance to waterbirds

	OM411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
Industrial, port & related development																	
4.2 Fishing harbour					■												
4.3 Slipway					■				■						■		
4.4 Pier												■			■		
Sediment extraction (marine & terrestial)																	
7.1 Channel dredging					■										■		
Transport & communications																	
8.2 Flight path																■	
8.3 Bridges & aqueducts	■	■		■	■	■											■
8.4 Tunnel				■	■									■			■
8.5 Road schemes	■	■		■	■	■		■					■	■	■		■
8.7 Shipping channel, shipping lanes															■		
Tourism & recreation																	
12.2 Non-marina moorings					■				■								
12.6 Power boating & water-skiing									■								
12.7 Jet-skiing									■								
12.8 Sailing					■				■						■		
12.9 Sailboarding & wind-surfing										■	■						
12.12 Surfing										■	■						
12.13 Rowing															■		
12.14 Tourist boat trips									■								
12.15 Angling	■				■				■								
12.16 Other non-commercial fishing					■												
12.17 Bathing & general beach recreation									■						■		
12.18 Walking, incl. dog walking		■	■	■	■			■	■	■	■			■	■	■	■
12.19 Birdwatching						■	■	■	■						■	■	

	OM411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
12.21 4WD, trial & quad bikes																	
12.22 Motorised vehicles																	
12.23 Horse-riding																	
Wildfowl & hunting																	
13.1 Wildfowling																	
13.2 Other hunting-related activities																	
Bait-collecting																	
14.1 Digging for lugworms/ragworms																	
Fisheries & Aquaculture																	
15.2 Professional active fishing																	
15.5 Leisure fishing																	
15.6 Molluscs - hand-gathering																	
15.9 Intertidal aquaculture e.g trestles																	

APPENDIX 11

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

	0M411	0M412	0M413	0M414	0M415	0M416	0M417	0M418	0M419	0M420	0M421	0M422	0M423	0M424	0M425	0M427	0M428
Transport & communications																	
8.2 Flight path/aircraft flying over																3	
Tourism & recreation																	
12.18 Walking, incl. dog walking								5	5	4	5			4	6		
12.22 Motorised vehicles								5									
12.23 Horse-riding										3	5				4		
Wildfowl & hunting																	
13.2 Other hunting-related activities	6																
Bait-collecting																	
14.1 Digging for lugworms/ragworms										3					4		
Fisheries & Aquaculture																	
15.6 Molluscs - hand-gathering								2			2	2			3		
15.9 Intertidal aquaculture e.g. trestles										3	4						