Donegal Bay
Special Protection Area

(Site Code 4151)

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Conservation Objectives Supporting Document

VERSION 1

National Parks & Wildlife Service

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SUMMARY

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

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

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

Part Four reviews the conservation condition of the site 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 SCI 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 Donegal Bay SPA, and examines waterbird distribution recorded during the 2009/10 Waterbird Survey Programme, drawing also on data from NPWS monitoring programmes (e.g. benthic surveys) and the Irish Wetland Bird Survey (I-WeBS). Part Five concludes with information on activities and events that occur in and around the site which may interact with waterbirds during the non-breeding season and includes an assessment of activities that were recorded to cause disturbance to non-breeding waterbirds at Donegal Bay during the 2009/10 Waterbird Survey Programme.

PART ONE - INTRODUCTION

1.1 Introduction to the designation of Special Protection Areas

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

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

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

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

The National Parks & Wildlife Service (NPWS) is responsible for the selection and designation of SPA sites in Ireland. NPWS have developed a set of criteria, incorporating information relating to the selection of wetland sites developed under the Ramsar Convention **(**Ramsar Convention Bureau 1971), which are used to select sites for SPA designation**.** Sites that meet any of the following criteria may be selected as SPAs:

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

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

Site specific information relevant to the selection and designation of a SPA is collated from a range of sources including the Irish Wetland Bird Survey (I-WeBS), The Wetland Bird Survey (WeBS) in Northern Ireland, species specific reports and a wide range of scientific publications, reports and other surveys. When a site is selected for SPA designation, a list of Special Conservation Interests is compiled. The **Special Conservation Interests** of a site can be divided into two categories:

Selection species:

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

- An Annex I species that occurs at the site in numbers that exceed the all-Ireland 1% population threshold;
- A migratory species that occurs at the site in numbers that exceed the biogeographic 1% population threshold; and/or

- A species for which the site is considered to be one of the *'n'* most suitable sites in Ireland for the conservation of that species (where *n* is a variable that is related to the proportion of the total biogeographic population held by Ireland) (NPWS, 2011a).

Additional Conservations Interests:

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

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

1.2 Introduction to Donegal Bay Special Protection Area

Donegal Bay SPA is a large, mostly shallow, sea bay which extends from Doorin Point in the north to Tullaghan Point in the south, a distance of approximately 15 km along its north-east/ south-west axis. The site varies in width from about 3 km to over 8 km.

The inner bay is very sheltered, partially enclosed from the open sea by two opposing, north-south orientated land masses comprising St Ernan's Island in the north and the Murvagh Peninsula in the south. This inner section represents the main estuarine intertidal area within the site, receiving water from a number of rivers and streams including the River Eske which flows out through Donegal Town. The inner bay has numerous small, grassy islands and areas of salt marsh. It has a diversity of marine biotopes and supports a range of macroinvertebrates, including polychaete worms (*Hediste diversicolor*, *Arenicola marina* and *Nephtys hombergii*) and bivalves (*Scrobicularia plana*, *Cerastoderma edule* and *Macoma balthica*).

Much of the shoreline is rocky or stony which varies from well-developed littoral reefs to shingle or cobble beaches. Rocky shoreline is particularly present along the northern section of the site, west to Doorin point and sections south of Rossnowlagh.

The seaward side of the Murvagh Peninsula has a sand dune complex and an extensive stretch of sandflats (sandy beach), which extends southwards some 8km to Rossnowlagh.

In the south of the site the Erne Estuary flows to sea west past the town of Ballyshannon. This sheltered estuary is partially enclosed by a large sand dune system at its mouth. Intertidal sand flats are the dominant estuarine habitat while the sand extends as a beach south to Bundoran.

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

1.3 Introduction to Conservation Objectives

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

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

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

PART TWO – SITE DESIGNATION INFORMATION

2.1 Special Conservation Interests of Donegal Bay Special Protection Area

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

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

1. During winter the site regularly supports 1% or more of the all-Ireland population of Light-bellied Brent Geese (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 207 individuals.

2. During winter the site regularly supports 1% or more of the biogeographical population of Great Northern Diver (*Gavia immer*). The mean peak number of this Annex I species within the SPA during the baseline period (1995/96 – 1999/00) was 139 individuals.

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

3. During winter the site regularly supports 1% or more of the all-Ireland population of Common Scoter (*Melanitta nigra*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 860 individuals.

4. During winter the site regularly supports 1% or more of the all-Ireland population of Sanderling (*Calidris alba*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 68 individuals.

5. The wetland habitats contained within Donegal Bay 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.

[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.

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

	Special Conservation Interests	Annex I species	Baseline Population[a]	Population status at baseline	National Importance Rank[1]	Regional Importance Rank[2]	County Importance Rank[3]
Selection Species	Light-bellied Brent Goose		207	All-Ireland Importance	22	3	2
	Great Northern Diver	Yes	139	All-Ireland Importance	1	1	1
Additional Special Conservation Interests	Common Scoter		860	All-Ireland Importance	3	1	1
	Sanderling		68	All-Ireland Importance	15	1	1
Other conservation designations associated with the site[b]		**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**	
		Yes	Yes	Yes			

[a] Baseline data are the 4-year mean peak counts for the period 1995/96 – 1999/00 (incomplete count 1997/98) (I-WeBS).
[b] Note that other designations associated with Donegal Bay may relate to different areas and/or some of these areas may extend outside the SPA boundary.
[1]National importance rank – the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites in Ireland.
[2]Regional importance rank – the number given relates to the importance of the site for the non-breeding population of a SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within the Border region (includes the cross-border sites Lough Foyle and Carlingford Lough).
[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 Donegal (includes the county cross-border site Lough Foyle).

PART THREE – CONSERVATION OBJECTIVES FOR DONEGAL BAY SPA

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

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

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

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

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

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

- To be favourable, the long term **population trend** for each waterbird Special Conservation Interest species should be stable or increasing.[4] Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.[5]

- To be favourable, there should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.[6]

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

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

- ❖ Disturbance: anthropogenic disturbance that occurs in or near the site, and is either singular or cumulative in nature, could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and/or a reduction in their numbers (for further discussion on this topic please refer to Section 5.4).

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

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

[6] Waterbird distribution from the 2009/2010 waterbird survey programme is examined in Section 5.

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

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

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

- To be favourable, the permanent area occupied by the wetland habitat should be stable and not significantly less than the area of **10,461 ha,** other than that occurring from natural patterns of variation.

The boundary of this SPA includes the core wetland area known as Donegal Bay. Objective 2 seeks to maintain the permanent extent of this wetland habitat, which constitute an important resource for regularly-occurring migratory waterbirds.

The total wetland habitat contained within the SPA is **10,461ha** and the majority of this area is permanent marine waters not exposed by the tides. These subtidal areas, which also include tidal rivers, creeks and channels, are continuously available for benthic feeding ducks (e.g. Common Scoter) and piscivorous waterbirds including Great Northern Diver.

A significant amount of the overall wetland habitat contained within the SPA is intertidal i.e. the area exposed at low water but inundated by the sea at high tide. 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 areas. When the intertidal area is inundated by the tide it becomes available for benthic feeding ducks (e.g. Common Scoter) and piscivorous waterbirds (e.g. divers and grebes). During this tidal state this area can be used by various waterbirds as a loafing/roosting resource (e.g. Light-bellied Brent Geese)

The supratidal category refers to areas that are not frequently inundated by the tide and contain areas of the shoreline and can be regarded as an integral part of the shoreline. These areas are used by a range of waterbird species as a roosting resource as well as providing feeding opportunities for some species.

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. At present the SPA boundary is based on the traditional 6-inch map base. This boundary is due to be re-projected onto a new 1:5000 map base which will enable the reporting of more accurate estimates of the extent of these subcomponents. This section will be updated in due course.

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.

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

Objective 1: *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Donegal Bay SPA, which is defined by the following list of attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Population	Population trend	Percentage change as per population trend assessment using waterbird count data collected through the Irish Wetland Bird Survey and other surveys.	The long term population trend should be stable or increasing	Waterbird population trends are presented in Part Four of this document.
Range	Distribution	Range, timing and intensity of use of areas used by waterbirds, as determined by regular low tide and other waterbird surveys.	There should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.	Waterbird distribution from the 2009/10 waterbird survey programme is reviewed in Part Five of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at Donegal Bay SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Area	Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 10,461 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated using OSI data and relevant orthophotographs.

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

4.1 Population data for waterbird SCI species of Donegal Bay SPA

Non-breeding waterbirds of Donegal Bay have been counted at least once every season as part of the Irish Wetland Bird Survey (I-WeBS) which commenced in 1994 (Crowe, 2005). The site is divided into inner bay and outer bay count subsites; in 1997/98 only outer bay subsites were covered. Note that the SPA area (Appendix 1) and the I-WeBS count area are not coincident; details of the latter are available in Crowe (2005).

Table 4.1 presents population[7] data for the waterbird Special Conservation Interest (SCI) species of Donegal Bay SPA. For the calculation of the individual species populations shown, total numbers were calculated from counts summed across all subsites counted in each month surveyed (I-WeBS months: Sept – March). The annual maxima was then identified and used to calculate the five-year mean peak. The baseline period was 1995/96 – 1999/00 although a four-year mean was used due to incomplete coverage in 1997/98, as noted above. The most recent five-year average relates to the period 2005/06 – 2009/10.

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

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

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

Site Special Conservation Interests (SCIs)	Baseline Period[1] (1995/96 – 1999/00)	Recent Site Data[2] (2005/06 – 2009/10)
Light-bellied Brent Goose*	207 (n)	389 (i)
Great Northern Diver*	139 (n)	93 (i)
Common Scoter	860 (n)	933 (n)
Sanderling	68 (n)	101 (n)

* denotes site selection species.
[1]Baseline data are the 4-year mean peak counts for the period 1995/96 – 1999/00 (incomplete count 1997/98); [2]recent site data are the five-year means for 2005/06 – 2009/10 (I-WeBS).
(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance.
International thresholds for the baseline and recent period are given in Wetlands International (2002) and Wetlands International (2006) respectively. All-Ireland thresholds are shown within Crowe et al. (2008).

4.2 Waterbird population trends at Donegal Bay SPA

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

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

For Donegal Bay, annual population indices were calculated for the I-WeBS data period 1994/95 to 2008/09 for Light-bellied Brent Geese and Sanderling. Trends were calculated for the 'long-term' 12-year period (1995/96–2007/08) and the recent ('short-term') five-year period (2002/03 - 2007/08) (Table 4.2). The values given represent the percentage change in index (population) values across the specified time period. Positive values equate to increases in population size while negative values reflect a decrease in population size.

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

Population indices were not calculated for Great Northern Diver and Common Scoter because consistent data are difficult to attain for these species; individuals often occurring at distances offshore and therefore difficult to monitor from land-based vantage points. For these two species, a measure of population change was calculated using the generic threshold method (JNCC, 2004) comparing population size at two time intervals, based on four or five-year means (see Appendix 3 for methods).

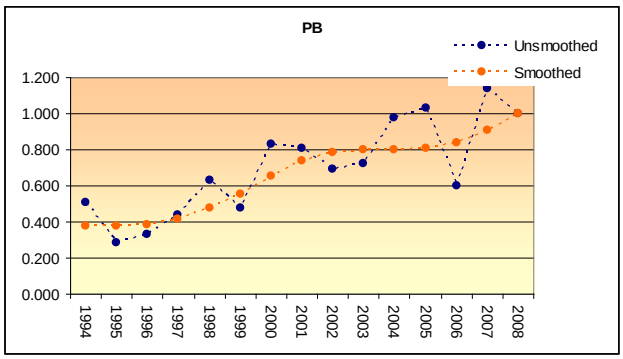
Table 4.2 Site Population Trends for waterbird Special Conservation Interest species of Donegal Bay SPA

	Special Conservation Interests	Site Population Trend[1] 12 Yr	Site Population Trend[2] 5 Yr	Population Change[3]
Site Selection Species	Light-bellied Brent Goose	+ 140.9	+ 15.1	
	Great Northern Diver			- 32.6
Additional Special Conservation Interests	Common Scoter			+ 8.4
	Sanderling	+ 186.6	+ 28.0	

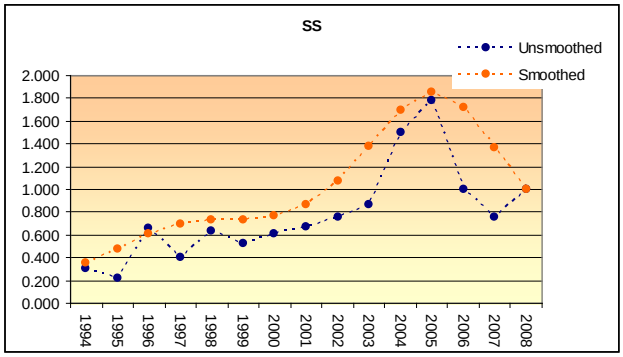
[1]Site population trend analysis: 12 yr = 1995/96 – 2007/08
[2]Site population trend analysis: 5 yr = 2002/03 – 2007/08.
[3]Site population change based on two five-year – means (1995/96 – 1999/00 and 2005/06 – 2009/10).

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

Light-bellied Brent Goose – despite widely fluctuating at times, the underlying trend is for increase, consistent with the all-Ireland trend (Crowe et al. 2008).



Sanderling – from the lowest number recorded during I-WeBS in 1995/96, Sanderling numbers increased steadily to a peak in 2005/06. Thereafter numbers returned to a level more in line with those recorded during the early 2000's.



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

Conservation condition of waterbird SCI species is determined using the longer-term site population trend and shown in Table 4.3. For Great Northern Diver and Common Scoter, conservation condition has been assigned using % population change but this is tentative given factors (described above) in relation to their count coverage during the non-breeding season. 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 condition 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 four waterbird species of Special Conservation Interest for Donegal Bay SPA, and based on the long-term population trend for the site, it has been determined that:-

1. One species is currently considered as **Unfavourable** (Great Northern Diver);
2. Three species are currently considered as **Favourable** (Light-bellied Brent Goose, Common Scoter and Sanderling);

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

Special Conservation Interests	Site Population Trend[a]	Site Conservation Condition	BoCCI Category[b]	Current all-Ireland Trend[c]	Current International Trend[d]
Light-bellied Brent Goose*	+ 140.9	Favourable	Amber	+ 58.0	Increase
Great Northern Diver*	- 32.6	Unfavourable	Green	n/c	n/c
Common Scoter	+ 8.4	Favourable	Red	n/c	Stable
Sanderling	+ 186.6	Favourable	Green	+ 109.4	Stable

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

Site conservation condition and population trends were also reviewed in light of species' all-Ireland and international trends (Table 4.3). The calculation of all-Ireland trends for the long-term (12-year) data period was facilitated by the provision of indices from the I-WeBS and the WeBS database[8]; International trends follow Wetlands International (2006).

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

- Grey - assessment not undertaken.
- 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% 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 Donegal Bay, 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).

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

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 Donegal Bay SPA.

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

The information provided is intended to:-

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

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

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

Waterbirds, defined as "*birds that are ecologically dependent on wetlands"* (Ramsar Convention, 1971), are a diverse group that includes divers, grebes, swans, geese and ducks, gulls, terns and wading birds. The I-WeBS database shows a total of 64 waterbird species that have been recorded at Donegal Bay SPA during the data period 1994/95 – 2009/10 representing ten families: *Gaviidae* (divers), *Podicipedidae* (grebes), *Anatidae* (swans, geese and ducks), *Rallidae* (Water Rail, Moorhen & Coot), *Haematopodidae* (oystercatchers), *Charadriidae* (plovers and lapwings), *Scolopacidae* (sandpipers and allies) and *Laridae* (gulls and terns) plus *Phalacrocoracidae* (Cormorants) and *Ciconiiformes* (Herons).

As described in Section 1.1, the wetland habitats contained within this SPA are considered to be a Special Conservation Interest in their own right. The wetland habitat is an important resource for listed species and for other waterbird species that make up 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[9] or species that use the site at certain times only (e.g. as a cold weather refuge).

Of the total 64 waterbird species listed in the I-WeBS database for Donegal Bay during the period 1994/95 – 2009/10, 30 species were recorded on a regular basis.[10] Of these species, four are listed as SCI species for the site and a further 26 are non-SCI species. These regularly-occurring non SCI species are listed in Table 5.1 together with population data taken from the I-WeBS database.

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

[10] Regular is defined as a species that has occurred in 12 or more years out of the 15-year data period

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

Species	Baseline Data Period[1] (1995/96 – 1999/00)	Recent Site Average[2] (2005/06 – 2009/10)
Mute Swan (*Cygnus olor*)	12	38
Shelduck (*Tadorna tadorna*)	24	67
Wigeon (*Anas penelope*)	224	498
Teal (*Anas crecca*)	31	130
Mallard (*Anas platyrhynchos*)	100	144
Long-tailed Duck (*Clangula hyemalis*)	14	5
Red-breasted Merganser (*Mergus serrator*)	38 (n)	79 (n)
Red-throated Diver (*Gavia stellata*)	21 (n)	21 (n)
Little Grebe (*Tachybaptus ruficollis*)	9	19
Great Crested Grebe (*Podiceps cristatus*)	9	15
Cormorant (*Phalacrocorax carbo*)	29	86
Grey Heron (*Ardea cinerea*)	20	46 (n)
Oystercatcher (*Haematopus ostralegus*)	581	1,048 (n)
Ringed Plover (*Charadrius hiaticula*)	99	148
Golden Plover (*Pluvialis apricaria*)	137	169
Grey Plover (*Pluvialis squatarola*)	17	10
Dunlin (*Calidris alpina*)	269	429
Bar-tailed Godwit (*Limosa lapponica*)	49	91
Curlew (*Numenius arquata*)	359	463
Greenshank (*Tringa nebularia*)	12	26 (n)
Redshank (*Tringa totanus*)	93	197
Turnstone (*Arenaria interpres*)	53	117
Black-headed Gull (*Chroicocephalus ridibundus*)	239	185
Common Gull (*Larus canus*)	297	353
Herring Gull (*Larus argentatus*)	114	195
Great Black-backed Gull (*Larus marinus*)	27	71

[1] Baseline data are the 4-year mean peak counts for the period 1995/96 – 1999/00 (incomplete count 1997/98);
[2] Recent site data are the five-year means for 2005/06 – 2009/10 (I-WeBS).
(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[11] provides selected ecological information for waterbird SCI species of Donegal Bay SPA. Information is provided for Selection Species and for additional Special Conservation Interests in the following categories:

- waterbird family (group);
- winter distribution – species distribution range during winter (this is based on the period 1996/97 – 2000/0, 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 habitats in/around the site;
- site fidelity (species 'faithfulness' to wintering sites).

A single wetland site seldom meets all the ecological requirements of a diverse assemblage of waterbirds (Ma et al. 2010). Although some waterbird species will be faithful to specific

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

habitats within the SPA, many will at times also use habitats situated within the immediate hinterland of the site or in areas ecologically connected to the SPA. These areas may be used as alternative high tide roosts, as a foraging resource or, be simply flown over, either on migration or on a more frequent basis throughout the non-breeding season as waterbirds move between different areas used (e.g. commuting corridors between feeding and roosting areas).

Reliance on alternative habitats will vary between species and from site to site. Use of alternative habitats is also likely to vary through time, from seasonally through to daily, and different habitats may be used by day and night (Shepherd et al. 2003). Different waterbirds may utilise wetland habitats in different ways. For example, while the majority of wading birds forage across exposed tidal flats, species such as Lapwing and Golden Plover are considered as 'terrestrial waders', typically foraging across grassland and using tidal flats primarily for roosting. When tidal flats are covered at high water, intertidally-foraging waterbirds are excluded and many will move to nearby fields to feed. Terrestrial foraging is also important when environmental factors (e.g. low temperature) reduce the profitability of intertidal foraging (e.g. Zwarts & Wanink, 1996). Some waterbird species are simply generalists, and make use of a range of habitats, for example the Black-tailed Godwit that forages across intertidal mudflats and grassland habitats. Other waterbird species such as Greenland White-fronted Goose (*Anser albifrons flavirostris*) or Bewick's Swan (*Cygnus columbianus bewickii*) are herbivores and are therefore reliant on terrestrial areas, often outside of the SPA boundary, and use the wetland site primarily for roosting. Some species switch their habitat preference as food supplies become depleted; an example being Light-bellied Brent Geese that exploit grasslands increasingly when intertidal seagrass and algae become depleted.

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

Thus areas designated as Special Protection Areas represent a variable portion of the overall range of the listed species. To this end, field data, where available, are being compiled on waterbird alternative habitat use. Such a resource is warranted for the effective conservation management of mobile waterbird species. Indeed, the isolated protection of single sites may be inadequate to provide effective species protection thereby underlining the need for wider countryside conservation measures (Kushlan, 2006). Furthermore, it is recommended that assessments that are examining factors that have the potential to affect the achievement of the site's conservation objectives should also consider the use of these habitats, and their significance to the listed bird species.

Table 5.2 Waterbirds – Ecological characteristics, requirements & specialities – waterbird species of Special 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]
Light-bellied Brent Goose *Branta bernicla hrota*	Anatidae (geese)	Highly restricted	1, 5, 7	Highly specialised	Intertidal mud and sand flats	2	High
Great Northern Diver *Gavia immer*	Gaviidae (divers)	Intermediate	3	Highly specialised	Sheltered & shallow subtidal	1	Unknown
Common Scoter *Melanitta nigra*	Anatidae (sea ducks)	Localised	3	Highly specialised	Sheltered & shallow subtidal	1	Unknown
Sanderling *Calidris alba*	Scolopacidae (wading birds)	Localised	4, 6	Wide	Intertidal 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 Donegal Bay SPA. Note that this is the main habitat used when foraging.

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

5.3 The 2009/10 waterbird survey programme

5.3.1 Introduction

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

At Donegal Bay SPA, a survey programme of four low tide counts (October, November and 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) across the site (Appendix 6) although one subsite (0A050) relates to another SPA site (Durnesh Lough SPA, Site Code 004145) and was therefore excluded from the data analyses for Donegal Bay SPA. Count subsites used were based on I-WeBS subsites (see Crowe, 2005). Note that there are differences between the total area counted and the total SPA area, and that both of these areas may not cover exhaustively all areas utilised by SCI species. Certain species for example, may occur further offshore at times (e.g. Great Northern Diver, Common Scoter) and some areas within the SPA are simply not visible from land-based counts.

During field surveys, 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). Note that the definitions of broad habitats (Table 5.3) were defined specifically for the survey programme and do not follow strict habitat-based definitions for these areas.

Table 5.3 Definition of broad habitat types used

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

In addition to the main survey programme described above, a high-tide roost survey was undertaken on the 9th 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 the site of Donegal Bay SPA during the autumn and winter months. By assessing patterns of waterbird distribution at low and high tide, together with examination of data on sediment and

[12] Low tide surveys: 21/10/09, 04/11/09, 02/12/09 & 17/02/10 plus a high tide survey on 07/02/10.

invertebrate distribution and abundance, we aimed to identify areas (subsites) within the site that are the most important for foraging and roosting on a species by species basis.

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

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

For each of the analyses listed above and for each survey date completed, subsites were ranked in succession from the highest to the lowest in terms of their relative contribution to each species' distribution across the subsites surveyed.

Rank positions were then converted to categories (see box below). The highest rank position for each subsite across any of the low tide count dates is presented for each SCI species in a subsite by species matrix. The only exception to this is the presentation of results for the single high tide survey, these being shown simply as rank numbers.

Subsite Rank Position - Categories

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

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

Waterbird count data for low tide surveys are also presented as species distribution maps ('dot density maps'). Dot-density maps show waterbird species distribution within intertidal or subtidal habitat divided into 'foraging' birds and 'roosting/other' birds. These maps show the number of birds represented by dots; each dot representing one, or a pre-determined number of birds. As the dots are placed in the appropriate subsites and broad habitat types for the birds counted, the resulting map is equivalent to presenting numbers and densities and provides a relatively quick way of assessing species distribution. **Note however, that dot-density maps are not intended to show the actual position of each bird; the dots are placed randomly within subsites so no conclusions can be made at a scale finer than subsite.**

In contrast to dot-density maps, roost maps produced from data obtained from the roost survey (09/03/10) show the mapped locations of waterbird roosts, but note the limitations in relation to field mapping discussed below.

Notes on data interpretation and methodological limitations

Subsite rankings and dot-density maps relate to the distribution of waterbirds at subsite level as recorded within the survey area during the 2009/10 waterbird survey programme. Care must be taken in the interpretation of these data, and subsite rankings in isolation should not be used to infer a higher level of conservation importance to one area over another without a detailed examination of data and understanding of each species' ecology. For instance, while some species are known to be highly site-faithful, both at site level and within-site level (e.g. Dunlin), other species may range more widely across a site(s). While some species by their nature may aggregate in high numbers, others such as Greenshank or Grey Heron may not. It is also important to consider that distribution maps and data refer to a single season of low tide surveys. Although important patterns of distribution will emerge, these distributions should not be considered absolute; waterbirds by their nature are highly mobile and various factors including tide (e.g. spring/neap), temperature, direction of prevailing winds, changing prey densities/availabilities and degree of human activity across the site, could lead to patterns that may change in different months and years.

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

5.3.3 Summary Results

A total of 45 waterbird species were recorded during the 2009/10 survey programme at Donegal Bay SPA. Cummins and Crowe (2010) provide a summary of data collected[13].

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.

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

Site Special Conservation Interests (SCIs)	Peak number LT surveys[I]	Peak number HT survey[II]	Average subsite % occupancy [III]	Average % area occupancy [III]
Light-bellied Brent Goose*	320 (i)	358 (i)	29.4 (14.4)	47.5 (32.5)
Great Northern Diver*	84 (i)	43	39.7 (10.0)	68.5 (14.0)
Common Scoter	2, 534 (n)	1, 939 (n)	23.5 (8.3)	50.1 (19.4)
Sanderling	271 (n)	271 (n)	13.2 (7.4)	29.6 (30.9)

* site selection species; (i) denotes numbers of International importance; (n) denotes numbers of all-Ireland importance.

[I] 4 low-tide counts undertaken on 21/10/09, 04/11/09, 02/12/09 & 17/02/10; [II] 1 high-tide count undertaken on 07/02/10; [III] Mean (± s.d.) calculated across 4 low tide counts.

Average percentage occupancy, defined as the average proportion of subsites in which a species occurred during low tide counts, ranged from the relatively restricted distribution of Sanderling (average 13% of subsites) to Great Northern Diver that occurred, on average, in 39% of subsites (Table 5.4). During the high tide survey, Sanderling occurred in 17% of subsites, Common Scoter in 29%, Light-bellied Brent Geese in 47% and Great Northern Diver in just over 50% of the subsites counted.

Average percentage area occupancy is defined as the average proportion of the total count area that a species occurred in during low tide counts (based on subsite areas). Although this is a broad calculation across all habitat types it gives some indication of the range of a species across the site as a whole. The most widespread species in terms of area occupied was Great Northern Diver, followed by Common Scoter (Table 5.4) related to the species occurrence within the large subtidal subsites in the outer part of the site. Area occupancy

[13] Note that site totals presented in Cummins and Crowe (2010) include the count subsite Durnesh Lough (0A050) which is not included in this report

was greater for these species during the high tide survey (85% and 66% respectively) due to a larger amount of the site being available to these subtidal species; and lower for the intertidal-feeding wader species Sanderling (18%).

Species richness (total number of species) across the whole site was consistent throughout the survey programme with a total of 38, 35, 36, and 38 species recorded during the four low tide counts respectively, and 37 species recorded during the high tide survey.

Species richness at subsite level varied considerably. Average low tide subsite species richness ranged from six species (0A423 and 0A426) to 19 species (0A432 and 0A496), these latter two subsites also recording the peak number of species during a low tide survey (21). 0A432 supported the peak number (18 species) during the high tide survey. In general species diversity was a greater number of species was recorded during low tide surveys with the exception of one subsite (0A423) that recorded more species during the high tide survey.

Table 5.5 Subsite species richness

Subsite	Subsite Name	Mean (±S.D) LT Survey	HT Survey	Peak Overall
0A407	Legacurry (Inner Bay/Section 5)	8 (1.7)	7	9 (LT)
0A413	Revlin Pt (Inner Bay/Section 1)	10 (3.6)	8	15 (LT)
0A416	Muckros Strand (Inner Bay/Section 2)	9 (1.5)	6	10 (LT)
0A418	Dungally Strand (Inner Bay/Section 4)	12 (3.6)	11	17 (LT)
0A421	Mullanasole (Inner Bay/Section 7	12 (2.6)	14	16 (LT)
0A422	Murvagh E (Inner Bay/Section 8)	8 (2.9)	9	12 (LT)
0A423	Murvagh NE (Inner Bay/Section 9)	6 (1.0)	9	9 (HT)
0A424	St. Ernan's Isl (Inner Bay/Section 3)	11 (0.8)	11	12 (LT)
0A426	Roughan (Inner Bay/Section 6)	6 (2.6)	7	8 (LT)
0A429	Eddrim Estuary (Inner Bay/Section 10)	13 (3.8)	14	15 (LT)
0A432	Doorin Pt. - Salthill Pier (Outer Bay/Section 1)	19 (1.4)	18	21 (LT)
0A464	Rossnowlagh (Outer Bay/Section 5)	12 (2.4)	11	14 (LT)
0A468	Aughrus Pt - Bundoran	14 (4.0)	15	17 (LT)
0A479	Murvagh (Outer Bay/Section 3)	18 (1.3)	17	19 (LT)
0A480	Rossnowlagh - Inishfad (Outer Bay/Section 4)	15 (1.5)	11	17 (LT)
0A496	Erne Estuary	19 (1.3)	15	21 (LT)
0A497	Mountcharles (Outer Bay/Section 2)	14 (3.8)	7	18 (LT)

5.3.4 Waterbird distribution

Data analyses determined the proportional use of subsites by each Special Conservation Interest (SCI) species, relative to the site as a whole during both low tide and high tide surveys. Selected results from these 'subsite assessments' are shown in Tables 5.6 (a–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 that a species was not recorded in that subsite.

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

Tables 5.6 (a-e) are followed by species discussion notes (Page 24 onwards) which provide additional information on the distribution of each SCI species, drawing upon the full extent of the data collected and analysed for Donegal Bay SPA. Waterbird distribution dot-density maps are provided in Appendix 7. Finally, summary roost data are presented in Appendix 8.

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

Species ► Subsites ▼	PB	ND	CX	SS
0A407				
0A413		L		
0A416	L			
0A418		M		
0A421				
0A422				
0A423	L			
0A424	V	L		
0A426				
0A429	V			L
0A432	V	V	H	
0A464	H	V	M	H
0A468	V	H	H	M
0A479	H	V	V	V
0A480	H	H	H	
0A496	L	M		V
0A497	H	H		

Table 5.6 (b) Donegal Bay SPA Subsite assessment – ranked total numbers HT Survey (across all habitats).

Species ► Subsites ▼	PB	ND	CX	SS
0A407		6		
0A413				
0A416				
0A418	6			
0A421				
0A422				
0A423				
0A424		7		
0A426				
0A429	8			3
0A432	2	4	5	
0A464	7	3	2	
0A468	1	4	4	
0A479	5	2	1	2
0A480	3	1	3	
0A496		7		1
0A497	4	7		

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

Species ► Subsites ▼	PB[I]	PB[II]	ND[II]	CX[II]	SS[I]
0A407					
0A413			L		
0A416	M				
0A418		H	M		
0A421					
0A422					
0A423					
0A424	V		L		
0A426					
0A429					L
0A432	L	H	V	M	
0A464	H		V	M	H
0A468	V		H	H	M
0A479	V		V	V	V
0A480	V		V	H	
0A496	L		M		V
0A497	H	V	M		

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

Species ► Subsites ▼	PB[II]	ND[II]	CX[II]	SS[I]
0A407				*not recorded in roosting behaviour*
0A413				
0A416				
0A418		H		
0A421				
0A422				
0A423	V			
0A424				
0A426				
0A429	V			
0A432	V	V	V	
0A464			V	
0A468				
0A479				
0A480				
0A496				
0A497				

Table 5.6 (e) Donegal Bay SPA Subsite assessment – ranked total numbers (roosting/other behaviour) during HT survey (Intertidal[I] and Subtidal[II])

Species ► Subsites ▼	PB[II]	ND[II]	CX[II]	SS[I]
0A407		1		
0A413				
0A416				
0A418				
0A421				
0A422				
0A423				
0A424				
0A426				
0A429				2
0A432			2	
0A464			1	
0A468				
0A479				1
0A480				
0A496				
0A497	1			

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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).

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

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

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

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

Numbers

Brent Geese were recorded in all surveys undertaken. Internationally-important numbers of Brent Geese were recorded during the November and December low tide surveys and during the high tide survey, when the peak count of 358 was made.

Across Donegal Bay, Brent Geese was a relatively widespread species, recorded within 12 subsites overall. However only one subsite (0A479 Murvagh) recorded the species in all surveys, and they were recorded with regularity (three or more surveys) within five subsites only: 0A432, 0A468, 0A479, 0A480 and 0A497.

Different subsites supported peak numbers during the four low tide surveys as follows 0A429, 0A424, 0A468 and 0A432, peak numbers ranging from 35% to 54% of the total numbers present on a survey date.

The subsite peak count of 123 Brent was recorded within 0A468 (Aughrus Pt – Bundoran) on 02/12/09.

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.

Intertidal foraging was recorded within 11 subsites overall (LT and HT surveys) but with regularly (three surveys or more (incl. HT survey)) within five subsites only: 0A432, 0A468, 0A479, 0A480 and 0A497. Peak numbers for the four low tide survey dates were recorded within 0A479 (Murvagh), 0A424 (St. Ernan's Isl.), 0A468 (Aughrus Pt - Bundoran) and 0A480 (Rossnowlagh - Inishfad) for the four dates respectively. 0A479 (Murvagh) was notable for being the only subsite to support foraging individuals in all four low tide surveys, while 0A468 (Aughrus Pt - Bundoran) supported peak numbers on one low tide occasion plus peak numbers (144) foraging during the high tide survey. Subsites 0A479, 0A424, 0A468 and 0A480 are all characterised by a sandy, rather than a muddy, intertidal habitat. The intertidal community of these subsites is classified in NPWS (2011 b) as 'intertidal muddy sand to sand, dominated by polychaetes, bivalves and crustaceans,' and occurs as muddy sand on the upper to mid shore, with sand on the mid to lower shore.

In 0A468 (Aughrus Pt - Bundoran), Brent Geese were usually concentrated within seaweed-covered rocky shore habitat adjacent to Bundoran Town. In 0A480 (Rossnowlagh - Inishfad), the Brent were often associated with the freshwater flow from Durnesh Lough.

Subtidal foraging was recorded less frequently and within 0A418 (Dungally Strand), 0A432 (Doorin Pt. - Salthill Pier) and 0A497 (Mountcharles) only. The latter supported individuals during four surveys with a peak number of 48 foraging subtidally on 04/11/09.

Donegal Bay is surrounded by relatively undisturbed agricultural habitats, and terrestrial foraging within grassland is likely to be commonplace although not recorded during the 2009/10 waterbird survey programme.

The peak low tide intertidal foraging density was recorded for 0A424 (Inner Bay/Section 3: St. Ernan's Isl) which supported 1.62 Brent Geese ha^{-1} on 04/11/09. The second highest foraging density was for 0A468 (Aughrus Pt - Bundoran) (0.82 Brent Geese ha^{-1}) (02/12/09). Thereafter all subsite foraging densities were less than 0.49 Brent Geese ha^{-1}. The whole site average feeding density (intertidal habitat) was 0.10 Brent Geese ha^{-1}.

Roosting Distribution

One-off records of Brent Geese roosting/other subtidally were recorded for 0A423, 0A429, 0A432 and 0A497.

48 Brent Geese roosted intertidally within 0A432 (Doorin Pt. - Salthill Pier) on 17/02/10.

During the high tide survey, 30 Brent Geese roosted intertidally within 0A479 (Murvagh) and 57 roosted terrestrially (adjacent 0A480 (Rossnowlagh - Inishfad)).

During the roost survey (09/03/10), 164 Brent geese were recorded roosting within five subsites: 0A418, 0A429, 0A432, 0A496 and 0A497. All birds were positioned subtidally. The largest single roost was 46 individuals roosting subtidally within 0A418.

Great Northern Diver - Family (group): Gaviidae (divers)

The Great Northern Diver breeds in Canada, parts of the northern United States, Greenland and Alaska with a smaller breeding population in Iceland. The species winters along coasts of Europe and America. During winter, the waters off Britain and Ireland are thought to support individuals from Iceland, Greenland and possibly Canada (Wernham et al. 2002).

Great Northern Divers occur further offshore than many diver species so obtaining accurate counts and estimating population size is difficult. However, they tend to come closer to shore and into sheltered estuaries during periods of bad weather.

Numbers

Internationally-important numbers of Great Northern Diver were recorded on two survey occasions: 84 individuals on 02/12/09 and 76 individuals on 17/02/10. The species was recorded in all five surveys completed across the site. 43 individuals were recorded during the high tide survey.

Great Northern Divers were recorded within 11 subsites overall. 0A432 (Doorin Pt. - Salthill Pier) and 0A479 (Murvagh) supported the species during all five surveys and both recorded peak subsite numbers. 0A464 (Rossnowlagh) supported joint peak numbers (seven individuals) on 21/10/09. 0A480 (Rossnowlagh - Inishfad) supported good numbers (up to 21 individuals) during the latter three surveys. The subsite peak count of 30 individuals was recorded within 0A432 (Doorin Pt. - Salthill Pier) on 17/02/10.

Foraging Distribution

Great Northern Divers are able to forage successfully in deeper waters and can therefore occur up to 10km offshore. However, onshore winds that bring fish to inshore waters will in turn bring these divers into shallower waters in search of favoured and abundant prey items. Great Northern Divers are primarily fish-eaters although a variety of other prey items can be taken including molluscs and crustaceans.

At Donegal Bay, subtidal foraging was recorded within ten subsites and with regularity (three surveys or more) within eight subsites: 0A424, 0A432, 0A464, 0A468, 0A479, 0A480, 0A496 and 0A497.

0A432 (Doorin Pt. - Salthill Pier) supported peak numbers on three survey occasions (up to 24 individuals). 0A464, 0A479 and 0A480 all supported peak or joint peak numbers also. These aforementioned subsites are all subsites of the outer SPA and dominated by shallow subtidal habitat that is classified as 'subtidal fine sand with polychaetes and bivalves' (NPWS, 2011b). Distinguishing species include the bivalve *Donax vittatus,* the polychaetes *Chaetozone christiei*, *Magelona filiformis* and *Nephtys cirrosa.* The bivalve *Tellina fabula* may also occur.

Roosting Distribution

During low tide surveys the majority of Great Northern Divers were recorded foraging. However nine individuals were recorded roosting/other within 0A432 on 17/02/10, which along with 21 individuals that were foraging, accounted for 38% of all individuals recorded on that survey day. Roosting/other behaviour was also recorded for 0A407, 0A418 and 0A497.

0A432 (Doorin Pt. - Salthill Pier) was the only subsite to support roosting/other individuals during the roost survey on 09/03/10 (five individuals).

Common Scoter *Melanitta nigra* - Family (group): Anatidae (sea ducks)

The Common Scoter is polytypic with a northerly breeding distribution that extends across northwest and northern Europe, Siberia and parts of North America (Wernham et al. 2002). There is a relatively small Irish breeding population that breed at inland lakes. During winter, these birds occur off the coast joined by other wintering individuals from Iceland and Scandinavia (Wernham et al. 2002).

Numbers

Numbers of Common Scoter of all-Ireland importance were recorded in all surveys undertaken with a site peak number of 2,534 recorded during the final low tide survey on 17/02/10. 1,939 Common Scoter were counted during the high tide survey (07/02/10).

This species was recorded within five subsites overall: 0A432, 0A464, 0A468, 0A479 and 0A480. Numbers within 0A479 (Murvagh) were the highest during all surveys; the subsite peak of 1,600 individuals recorded on 17/02/10.

Foraging Distribution

During winter and when feeding, Common Scoters are generally distributed in shallow coastal waters with a depth of no more than 20m (BWPi, 2004). They are most often distributed across areas where there is a sandy substratum, linked to the distribution of their favoured prey of bivalve molluscs. Previous research varies somewhat in the range of dive depths undertaken by scoters; examples include a range 2.2 – 3.7m (BWPi, 2004) and a mean of 6.85m and 11.42m (Kaiser et al. 2006). Water depth is an important parameter and the distribution of foraging scoters is therefore likely to change in relation to the tidal state (Kaiser et al. 2006). As deeper dives are more costly in terms of dive duration and energy expenditure required, it follows that scoters are likely to maximise their energy intake by foraging where prey items are abundant and where the energy required obtaining the prey is minimised.

At Donegal Bay the majority of Common Scoters were recorded foraging. 0A479 (Murvagh) held peak numbers during all five surveys with a peak count of 1,600 (17/02/10). 0A480 (Rossnowlagh - Inishfad) recorded good numbers on four survey occasions with a peak count of 399 on 17/02/10. 0A432 (Doorin Pt. - Salthill Pier) supported 395 foraging individuals on 17/02/10 with smaller numbers on two other survey occasions. 0A464 and 0A468 recorded fewer numbers on one and two occasions respectively. The aforementioned subsites are all subsites of the outer SPA and dominated by shallow subtidal habitat that is classified as 'subtidal fine sand with polychaetes and bivalves' (NPWS, 2011b). Distinguishing species include the bivalve *Donax* vittatus, the polychaetes *Chaetozone christiei*, *Magelona filiformis* and *Nephtys cirrosa.* The bivalve *Tellina fabula* is also present.

Roosting Distribution

Few records of individuals undertaking roosting/other behaviour were made. 0A464 (Rossnowlagh) supported good numbers on two occasions: 296 and 104 on 07/02/10 and 17/02/10 respectively. 0A432 recorded smaller numbers on two survey occasions.

0A480 (Rossnowlagh - Inishfad) supported 1,602 roosting/other individuals during the roost survey on 09/03/10 and a further 20 individuals were recorded within 0A432.

Sanderling *Calidris alba* - Family (group): Scolopacidae (wading birds)
Sanderlings are one of the most northerly of all Arctic-breeding waders with a circumpolar breeding range that includes Alaska, Northern Canada, Greenland and Svalbard. The species is a long-distance migrant with a wide wintering distribution that includes coastlines of much of the tropics and the Southern Hemisphere as well as northwest Europe. There is evidence for two subspecies, with the nominate form *C. a. alba* occurring on passage and during winter in Western Eurasia and Africa. It was thought that most Sanderlings wintering in Ireland and Britain were of Siberian origin, but there is now thought to be considerable overlap in the wintering range of Siberian and Greenland-breeding populations (Delaney et al. 2009).
Numbers
Numbers of all-Ireland importance were recorded on four survey occasions. The peak count of 271 Sanderling was recorded during a low tide count (02/12/09) and during the high tide survey (07/02/10). Sanderling were recorded within five subsites overall: 0A429, 0A464, 0A468, 0A479 and 0A496. 0A479 (Murvagh) was the only subsite to record the species during all four low tide surveys and this subsite supported peak numbers on three survey occasions. The Erne Estuary (0A496) recorded peak numbers (170) during the high tide survey (subsite peak number), peak numbers (160) on 02/12/09, and smaller numbers on one other survey occasion.
Foraging Distribution
Often foraging along the tide line where they rush in and out with the waves searching for small prey such as sandhoppers[14], Sanderlings are shorebirds characteristic of sandy shorelines, indeed significant proportions are found along non-estuarine coastlines (Crowe, 2005) or outer parts of estuaries (Musgrove et al. 2003). The species has a flexible foraging strategy however, with the diet very much related to the local conditions at a site (Reneerkens et al. 2009). At Donegal Bay, Sanderlings appeared to favour 0A479 (Murvagh) when foraging, this subsite supporting peak numbers foraging intertidally on three survey occasions. The Erne Estuary (0A496) supported peak numbers on 02/12/09 and all recorded foraging individuals during the high tide survey. Smaller numbers were recorded foraging within 0A429 (Eddrim Estuary), 0A464 (Rossnowlagh) and 0A468 (Bundoran). 0A479 (Murvagh), 0A464 (Rossnowlagh) and 0A468 (Bundoran) are notable in all having long tide lines at low tide and sandy substrates, whereas the Erne Estuary (0A496) and 0A429 (Eddrim Estuary) are more sheltered with substrates grading from sand to muddy sand/muds in areas of low energy (NPWS, 2011b). Within 0A479 (Murvagh), Sanderlings appeared to favour foraging within an area on the lower shore in the north of the subsite, the birds positioned in roughly the same area in all four low tide counts, usually accompanied by Dunlin, Bar-tailed Godwits and Oystercatchers amongst other species, with flocks often overlapping with subsites 0A497 and 0A432. Sanderlings within the Erne Estuary (0A496) were usually recorded along the southern shore (south of the river) within sandy substrate. The intertidal community of these subsites is classified predominantly as 'intertidal muddy sand to sand, dominated by polychaetes, bivalves and crustaceans,' (NPWS, 2011b) and occurs as muddy sand on the upper to mid shore, with sand on the mid to lower shore. The peak intertidal foraging density was recorded for 0A496 (Erne Estuary) which supported 0.91 Sanderling ha^{-1} on 02/12/09. The second highest foraging density was for 0A479 (Outer Bay/Section 3: Murvagh) (0.64 Sanderling ha^{-1}) on 17/02/10. The whole site average feeding density (intertidal habitat) was 0.08 Sanderling ha^{-1}.
Roosting Distribution
Sanderlings were recorded roosting within two subsites only. 0A479 (Murvagh) supported 66 roosting individuals during the high tide survey (07/02/10) and 0A429 (Eddrim Estuary) supported a further 35 individuals. Only 16 Sanderlings were recorded roosting during the roost survey on 09/03/10 (within 0A464 and 0A468) (a further 172 individuals foraged along the southern shore (south of the river - see above) of the Erne Estuary (0A496).

[14] Small amphipod crustaceans

5.4 Donegal Bay - Activities and Events

5.4.1 Introduction

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve '*favourable conservation status'* and that their long-term survival is secured across their entire natural range within the EU (EU Commission, 2010). In its broadest sense, favourable conservation status means that an ecological feature is in a satisfactory condition, and that this status is likely to continue into the future.

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

Section 5 of the Conservation Advice Notes provides information on activities and events that occur in and around Donegal Bay SPA that may either act upon the habitats within the site, or may interact with the Special Conservation Interest species and other waterbirds using the site.

5.4.2 Assessment Methods

Information on 'activities' and 'events' across the site was collected and categorised based on the standard EU list of pressures and threats as used in Article 17 reporting under the EU Habitats Directive. Only factors likely to directly or indirectly affect waterbirds were included but the resulting list is broad and includes built elements (e.g. man-made structures such as roads and bridges that are adjacent to the site), factors associated with pollution (e.g. industrial discharges and waste water treatment plants), various recreational and non-recreational activities as well as biological factors such as eutrophication and erosion.

Information was collected during a desk-top review which included NPWS site reporting files, Donegal Draft County Development Plan 2012-2018 (Donegal County Council, 2011) and other available documents relevant to the ecology of the site.

In addition, information was collected during the 2009/10 waterbird survey programme (NPWS, 2010) as field workers recorded activities or events that occurred at the site during their survey work. This information, together with results from a 'site activity questionnaire' provides valuable information gained from 30+ hours of coordinated surveyor effort across the SPA site. All activities and events data collected were entered into a database but as the dataset will be subject to change over time, the assessment should be viewed as a working and evolving process.

Data are presented in three ways:-

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

   O observed or known to occur in and around Donegal Bay SPA
   U known to occur but unknown spatial area hence all potential subsites are included (e.g. fisheries activities).
   H historic, known to have occurred in the past.

P potential to occur in the future.

2. Of the activities and events identified to occur across Donegal Bay, those that have the potential to cause disturbance to waterbird species are highlighted.

3. Data from the 2009/10 waterbird survey programme were used to inform an assessment which examined the level of disturbance caused by activities recorded during field surveys. The methodology was adapted from that used for monitoring Important Bird Areas (IBAs) (Birdlife International, 2006) and involved assigning scores which ranged between 0 and 3, to three selected attributes of each disturbance event (1) frequency/duration; (2) intensity and (3) likely response of waterbirds (after Hill et al. 1997) (Table 5.7). The rationale for scoring is provided in Appendix 10.

Table 5.7 Scoring system for disturbance assessment

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

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

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

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

5.4.3 Overview of activities at Donegal Bay

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

Landuse surrounding Donegal Bay is predominantly agricultural, with grazing (cattle & sheep) dominating (DoEHLG, 2009). The main settlement bordering the site is Donegal Town; other settlements are Ballyshannon (at the head of the Erne Estuary) and Bundoran in the outer part of the site.

An area of 12.6km^2 of Donegal Bay is designated as a Shellfish Water under the EU Shellfish Waters Directive[15] (No. 19), this area coinciding with a large part of the inner section of the

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

SPA site. The main species cultivated is the Oyster (*Crassostrea gigas*), together with a smaller amount of clams (DoEHLG, 2009).

The Sea Fisheries Protection Authority is responsible for classifying shellfish production areas and the current classification of the Donegal Bay Bivalve Mollusc Production Area (the area enclosed by a line drawn between Doorin Point and Rossmowlagh Point) is Class B (15th July 2011, www.sfpa.ie). This means that shellfish may be placed on the market for human consumption only after treatment in a purification centre or after relaying, so as to meet the health standards for live bivalve molluscs laid down in EC Regulations on food safety[16].

There is a shellfish processing plant in Legacurry, and tractors are used to carry harvested oysters from plots around the bay to the plant. McCorry & Ryle (2009b) noted a number of tracks and trails that had been created within saltmarsh habitat, and in places, along mud shores.

Various fishing activities occur within and adjacent to the site (detail of spatial scale unknown). Donegal Bay is served by the fishing port of Killybegs which occurs to the west and outside of the area designated as Donegal Bay SPA. Wider Donegal Bay is renowned for its catches of Herring (*Clupea harengus*) and Mackeral (*Scomber scombrus*) amongst others. Static fishing gear activity in the area includes widespread line fishing (lines set on the seabed with baited hooks at intervals); the widespread use of pots (baited traps set on the seabed targeting crustaceans such as Lobster (*Hommarus gammarus*) and Brown Crab (*Cancer pagurus*) and the use of draft nets (curtain of netting hanging from the surface and hauled to shore). Mobile fishing gear activity includes the use of hydraulic and oyster dredges (outer bay) (DoEHLG, 2009). Hand-gathering of edible molluscs (e.g. Periwinkles *Littorina littorea*) is common and was recorded within four subsites during the 2009/10 waterbird survey programme. Bait-digging also occurs and was recorded within seven subsites.

The North Western International River Basin District Transitional and Coastal Waters Action Plan (NWIRBD, 2010b) classifies the waters of Donegal Bay as 'Moderate' with point source pressures identified as WWTPs and combined sewer and treatment plant overflows (WWTP located at Donegal Town and Ballyshannon).

An Irish army base (Finner Camp) is located adjacent to subsite 0A496 (Erne Estuary). This base has a firing range.

Donegal Bay is acknowledged as one of Ireland's most scenic and 'untouched' landscapes and offers a great deal in terms of coastal and marine leisure and tourism. Extensive lengths of sandy shoreline occur in the outer bay and three stretches (Murvagh, Rossnowlagh and Bundoran) are Blue Flag beaches. Ballhill (part of subsite 0A429) is a well used and smaller beach in the inner bay. Caravan parks lie adjacent to several coastlines. Water-based recreational activities are widespread. Surfing is popular and there is a surf school based at Rossnowlagh. Jet skiing, wind surfing, surfing and canoeing, amongst other activities, were recorded during the 2009/10 waterbird survey programme. Walking, dog exercising and horse riding are also widespread activities. Quad and trail bikes were recorded along beaches (e.g. Murvagh, Tullan Strand) although this activity is prohibited at certain beaches listed under Donegal Beach Bye-laws (Donegal County Council, 2009). Leisure fishing is a widespread and popular activity across the site and a focus of much tourism. Small leisure and charter fishing boats launch from quays in Donegal Town and Ballyshannon, while the site offers a variety of options for shore anglers.

[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 Assessment

Of the activities and events known to occur across Donegal Bay (Appendix 9), those that have the potential to cause disturbance to waterbirds are highlighted in grey.[17]

Based on this dataset, 0A464 (Rossnowlagh) and 0A468 (Bundoran) have the highest number of activities that have the potential to cause disturbance to waterbirds, related mostly to human recreation e.g. walking, horse riding, sailing, as well as coastal activities such as bait-digging and hand-gathering of molluscs. Timing (seasonality) is an important factor however and many of the activities identified will be more frequent during summer months and therefore outside of the main period of waterbird presence at the site.

Seven activities were recorded to cause disturbance to waterbirds during the 2009/10 Waterbird Survey Programme. These activities were: walking (incl. dogs), motorised vehicles, horse riding, shooting, bait-digging, powered watercraft, hand-gathering of molluscs and activities associated with intertidal aquaculture. Shooting was recorded adjacent to 0O496 (Erne Estuary) at the army base firing range. Whether this activity caused disturbance or not was not ascertained as the activity was already underway when surveys began and hence any disturbance caused at its onset was not recorded.

A summary of activities is shown in Table 5.8 and full results of the disturbance assessment are shown in Appendix 10. Individual activities/events are scored separately and there has been no attempt to produce cumulative scores for different activities occurring at the same time, although cumulative effects are likely.

Of the activities that were recorded causing disturbance, walking in intertidal areas (including dogs) was the most widespread, recorded within seven subsites overall. This activity was responsible for the peak disturbance score of eight subsites also (Table 5.8), higher scores attained when dogs were present.

Hand gathering of molluscs was the second most widespread activity, recorded within five subsites overall and most frequently within 0A432 (Doorin Pt. - Salthill Pier). Aquaculture activities were reported from two subsites (0A418 and 0A497) and most frequently within 0A418 (Dungally Strand).

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 0A464 where humans walking in intertidal areas might affect Light-bellied Brent Geese or Sanderling but is unlikely to have any disturbance effects on Great Northern Diver or Common Scoter.

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

Table 5.8 Disturbance Assessment – Summary Table
Number of activities recorded to cause disturbance to waterbirds during field surveys (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

Subsite Code	Subsite Name	Number Activities causing disturbance	Peak Disturbance Score	Activity Responsible
0A407	Legacurry	0		
0A413	Revlin Pt.	0		
0A416	Muckros Strand	1		• Bait digging
0A418	Dungally Strand	1		• Aquaculture activities
0A421	Mullanasole	0		
0A422	Murvagh E	0		
0A423	Murvagh NE	0		• Walking (incl. dogs) • Motorised vehicles
0A424	St. Ernan's Isl.	0		• Walking (incl. dogs)
0A426	Roughan	1		• Bait digging
0A429	Eddrim Estuary	2		• Walking (incl. dogs)
0A432	Doorin Pt. - Salthill Pier	2		• Hand gathering - molluscs
0A464	Rossnowlagh	4		• Walking (incl. dogs)
0A468	Aughrus Pt - Bundoran	2		• Walking (incl. dogs)
0A479	Murvagh	3		• Walking (incl. dogs)
0A480	Rossnowlagh - Inishfad	2		• Walking (incl. dogs)
0A496	Erne Estuary	1		• Walking (incl. dogs)
0A497	Mountcharles	2		• Aquaculture activities • Motorised vehicles

Table 5.9 Donegal Bay SPA - subsite rankings based on total numbers (LT surveys) and the peak disturbance score attained

Species ► Subsites ▼	PB	ND	CX	SS
0A407				
0A413		L		
0A416	L			
0A418		M		
0A421				
0A422				
0A423	L			
0A424	V	L		
0A426				
0A429	V			L
0A432	V	V	H	
0A464	H	V	M	H
0A468	V	H	H	M
0A479	H	V	V	V
0A480	H	H	H	
0A496	L	M		V
0A497	H	H		

5.4.5 Discussion

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

Many of the 'activities' identified may act so as to modify wetland habitats of the site. While physical loss might be considered more historic in nature (e.g. the construction of piers, slipways etc.), 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, motorised vehicles). The grazing of salt marsh areas can modify waterbird roosting areas. Bait-digging and the hand-gathering of molluscs may cause some physical damage while at the same time removing waterbird prey resources. Fisheries and aquaculture interact with waterbirds in a variety of ways including the direct removal of waterbird prey (e.g. fish species, bivalves), habitat loss/modification (e.g. due to the physical presence of oyster trestles within intertidal habitat), habitat damage (e.g. from machinery, vehicles) and indirect effects upon invertebrate distribution and abundance.

Activities that cause disturbance can lead to the displacement of waterbirds. The significance of the impact that results from even a short-term displacement should not be underestimated. In terms of foraging habitat, displacement from feeding opportunities not only reduces a bird's energy intake but also leads to an increase in energy expenditure as a result of the energetic costs of flying to an alternative foraging area. Displacement also has knock-on ecological effects such as increased competition within and/or between different species for a common food source. In areas subject to heavy or on-going disturbance, waterbirds may be disturbed so frequently that their displacement is equivalent to habitat loss. When disturbance effects reduce species fitness[18] (reduced survival or reproductive success) consequences at population level may result.

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

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

and be influenced by:-

- Temporal availability – whether waterbirds have the opportunity to exploit the food resources in a disturbed area at times when the disturbance does not occur;
- Availability of compensatory habitat - whether there is suitable alternative habitat to move to during disturbance events;
- Behavioural changes as a result of a disturbance - e.g. degree of habituation;
- Time available for acclimatisation - whether there is time available for habituation to the disturbance. (NB there may be a lack of time for waterbirds during the staging period);
- Age - for example when feeding, immature (1st winter birds) may be marginalised by older more dominant flocks so that their access to the optimal prey resources is limited. These individuals may already therefore be under pressure to gain their required daily energy intake before the effects of any disturbance event are taken into account;

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

- 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: DONEGAL BAY SPA

SITE CODE: 004151

Donegal Bay SPA is a very large, marine-dominated, site. It extends from Doorin Point, to the west of Donegal Town, to Tullaghan Point in County Leitrim, a distance of approximately 15 km along its north-east/south-west axis. It varies in width from about 3 km to over 8 km. The site includes the estuary of the River Eske, which flows through Donegal Town, and the estuary of the River Erne, which flows through Ballyshannon. Much of the shoreline is rocky or stony, with well-developed littoral reefs in places. There are also extensive stretches of sandy beaches, especially from the Murvagh peninsula southwards to Rossnowlagh and at the outer part of the estuary of the River Erne. Shingle or cobble beaches are also represented. There are extensive areas of intertidal flats associated with the estuary of the River Eske, reflecting the very sheltered conditions in this part of the bay. These have been shown to be biotope rich, and supporting a range of macro-invertebrates, including polychaete worms (*Hediste diversicolor*, *Arenicola marina* and *Nephtys hombergii*) and bivalves (*Scrobicularia plana*, *Cerastoderma edule* and *Macoma balthica*). Elsewhere, a narrow fringe of intertidal flats is exposed at low tides. Salt marshes are found in the sheltered conditions of the innermost part of the bay. A number of small, grassy, islands occur in the innermost part of the bay. The waters of the shallow bay overlie mostly sandy substrates, though reefs occur in places.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Great Northern Diver, Light-bellied Brent Goose, Common Scoter and Sanderling. 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.

Donegal Bay supports an excellent diversity of wintering waterbirds, especially species associated with shallow bays (all figures are mean peak counts for four of the five winters between 1995/96 and 1999/2000). It has an internationally important wintering population of Great Northern Diver (138) and is consistently one of the top sites in the country for this species. It also has one of the few regular populations of Black-throated Diver in the country (11), and Red-throated Diver (21). It supports an internationally important population of Light-bellied Brent Goose (207) and nationally important populations of Common Scoter (860) and Sanderling (68). A range of other species associated with estuarine and shoreline habitats occurs at the site, including Cormorant (29), Shelduck (24), Wigeon (224), Mallard (100), Long-tailed Duck (14), Red-breasted Merganser (38), Oystercatcher (581), Ringed Plover (99), Golden Plover (103), Lapwing (122), Dunlin (269), Bar-tailed Godwit (49), Curlew (359), Redshank (93), Greenshank (12) and Turnstone (53). Gulls are regular in autumn and winter, especially Black-headed Gull (239) and Common Gull (297).

This large coastal site is of high ornithological importance, with two species having populations of international importance (Great Northern Diver and Light-bellied Brent Goose) and a further two species having populations of national importance (Common Scoter and Sanderling). Also of note is that five of the regularly occurring species are listed on Annex I of the E.U. Birds Directive, i.e. Great Northern Diver, Black-throated Diver, Red-throated Diver, Golden Plover and Bar-tailed Godwit.


INVER BAY
Bá Inbhir
INVER BAY
DONEGAL BAY
Bá Dhún na nGall
Rooney's Island
Ballyboyle Island
Mountcharles
Ballintra
Durnesh Lake
River Erne
An Éirne
BUNDORAN
Legend
SPA 004151
Buncrana
Letterkenny
Lifford
CO. DONEGAL
Donegal
SPA 004151
Ballyshannon
Bundoran
An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht
DONEGAL BAY
SPA 004151
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
SITE CODE:
SPA 004151 Version 2.01
0 1 2 3 km
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordanáis le chead ón Rialtas (Ceadunas Uimh. EN 0059208)
N
Map Version 1
Date: Jan 2012

APPENDIX 2

Waterbird data sources

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

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

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

- Swan Surveys

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

- Greenland White-fronted Goose

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

- Greylag Geese

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

- Barnacle Goose (*Branta leucopsis*)

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

- Light-bellied Brent Geese

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

APPENDIX 3

Analysing population trends: a synopsis

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

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

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

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

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

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

Un-smoothed indices are also calculated and provide a means of examining ('eye-balling') the variation across time and can also be used to provide a measure of the mean annual change over the entire period. However, the GAM extension to the methodology and resultant smoothed indices allows for the calculation of proportional change in population size between one season and another. This latter calculation is used in Section 4.2 whereby trends are calculated for the 'long-term' 12-year period (1995–2007) and the recent five-year period (2002-2007). The values given represent the percentage change in index (population) values across the specified time period, calculated by subtracting the smoothed index value at the start of the time-frame (1995) from the smoothed index value in the reference year (2007):-

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

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

The reference year is the penultimate year in the time series because, when smoothing, the GAM takes into account values from both the preceding and following year. The last value in the smoothed dataset (2008) is therefore likely to be the least robust because it has no following year.

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

Worked example

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

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

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

Generic threshold method

This method (after JNCC, 2004) is used where an incomplete dataset precludes the use of the trend analysis described above. It compares population size for two different five-year time periods, the change being expressed as a proportion of the initial population, as follows:

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

where: I_y = current population and I_x = baseline population

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

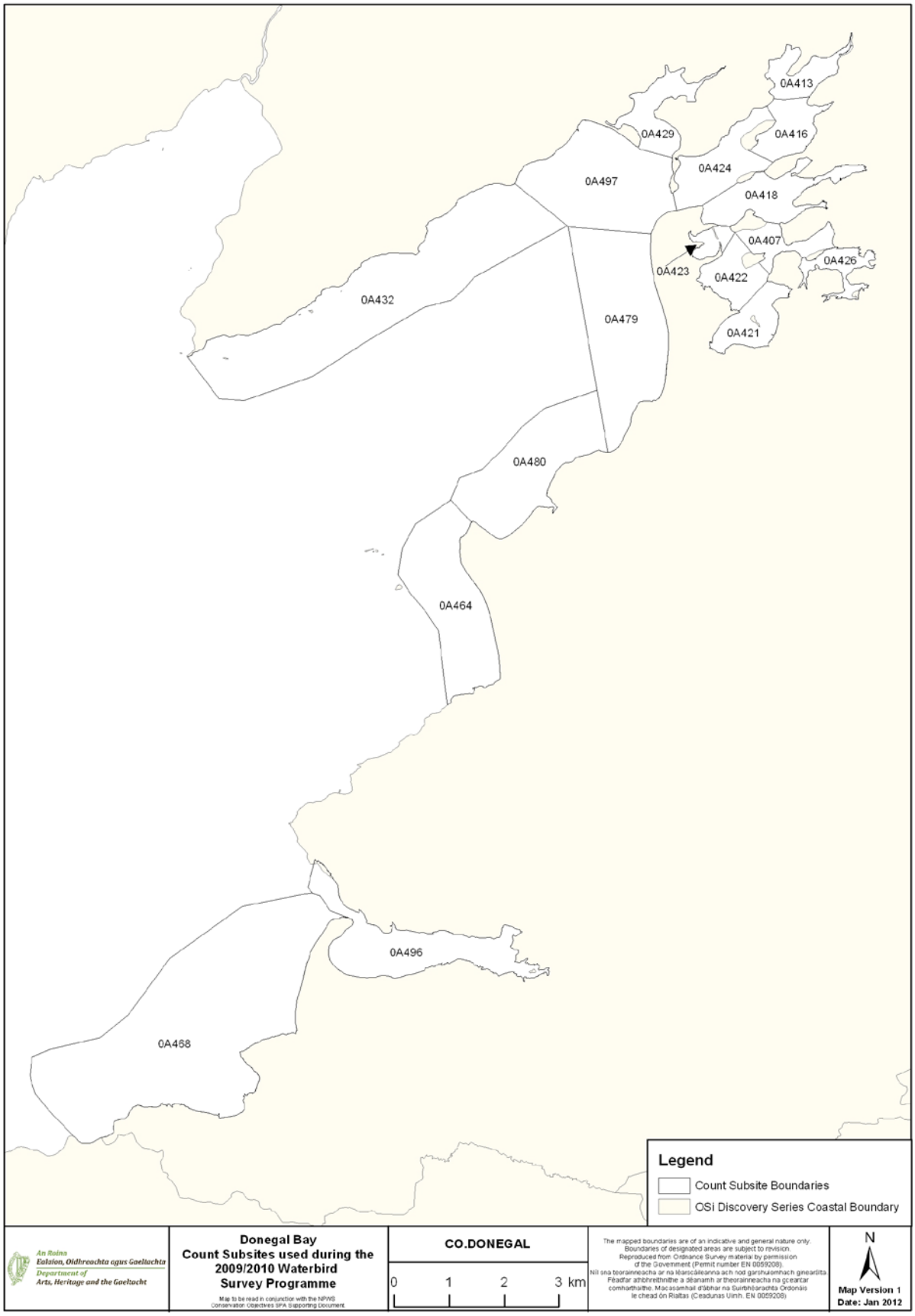
[a] dives <3m.

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

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

Subsite	Subsite Name	Notes
0A407	Legacurry	Inner Bay/Section 5
0A413	Revlin Pt.	Inner Bay/Section 1
0A416	Muckros Strand	Inner Bay/Section 2
0A418	Dungally Strand	Inner Bay/Section 4
0A421	Mullanasole	Inner Bay/Section 7
0A422	Murvagh E	Inner Bay/Section 8
0A423	Murvagh NE	Inner Bay/Section 9
0A424	St. Ernan's Isl.	Inner Bay/Section 3
0A426	Roughan	Inner Bay/Section 6
0A429	Eddrim Estuary	Inner Bay/Section 10
0A432	Doorin Pt. - Salthill Pier	Outer Bay/Section 1
0A464	Rossnowlagh	Outer Bay/Section 5
0A468	Aughrus Pt - Bundoran	
0A479	Murvagh	Outer Bay/Section 3
0A480	Rossnowlagh - Inishfad	Outer Bay/Section 4
0A496	Erne Estuary	
0A497	Mountcharles	Outer Bay/Section 2
0A050	Durnesh Lough	Refers to a separate SPA site Durnesh Lough SPA (Site Code 4145) and is not included within data analyses for Donegal bay SPA.


0A413
0A429
0A416
0A424
0A497
0A418
0A407
0A426
0A423
0A422
0A432
0A479
0A421
0A480
0A464
0A496
0A468
Legend
Count Subsite Boundaries
OSi Discovery Series Coastal Boundary
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Donegal Bay
Count Subsites used during the 2009/2010 Waterbird Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
CO.DONEGAL
0 1 2 3 km
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N
Map Version 1
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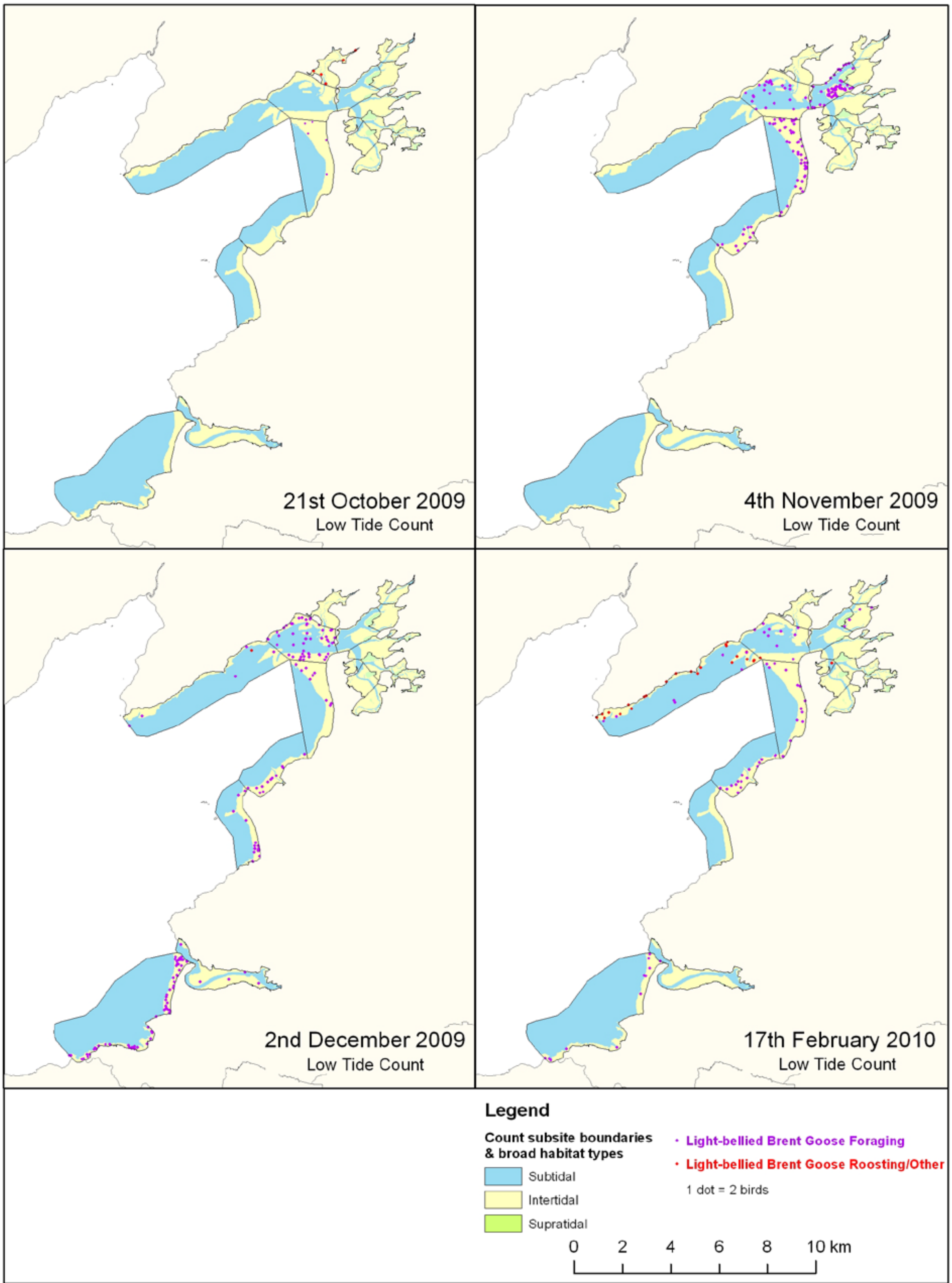
APPENDIX 7

Donegal Bay

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

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



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DONEGAL BAY SPA
CONSERVATION OBJECTIVES
LIGHT-BELLIED BRENT GOOSE
DISTRIBUTION DOT DENSITY DIAGRAMS

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

N
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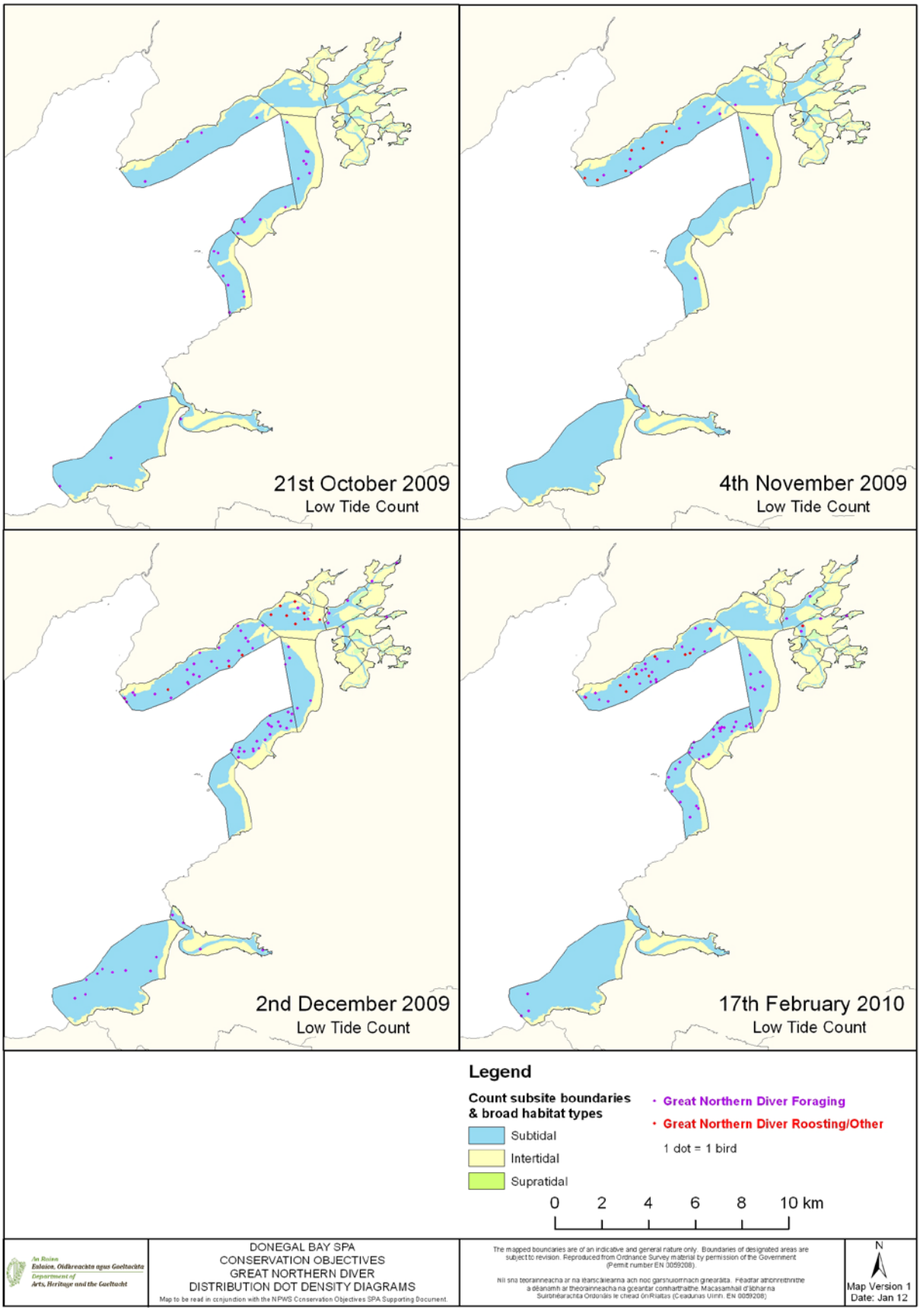
Date: Jan 12


21st October 2009
Low Tide Count
4th November 2009
Low Tide Count
2nd December 2009
Low Tide Count
17th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Great Northern Diver Foraging
Great Northern Diver Roosting/Other
1 dot = 1 bird
0 2 4 6 8 10 km
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Department of Arts, Heritage and the Gaeltacht
DONEGAL BAY SPA
CONSERVATION OBJECTIVES
GREAT NORTHERN DIVER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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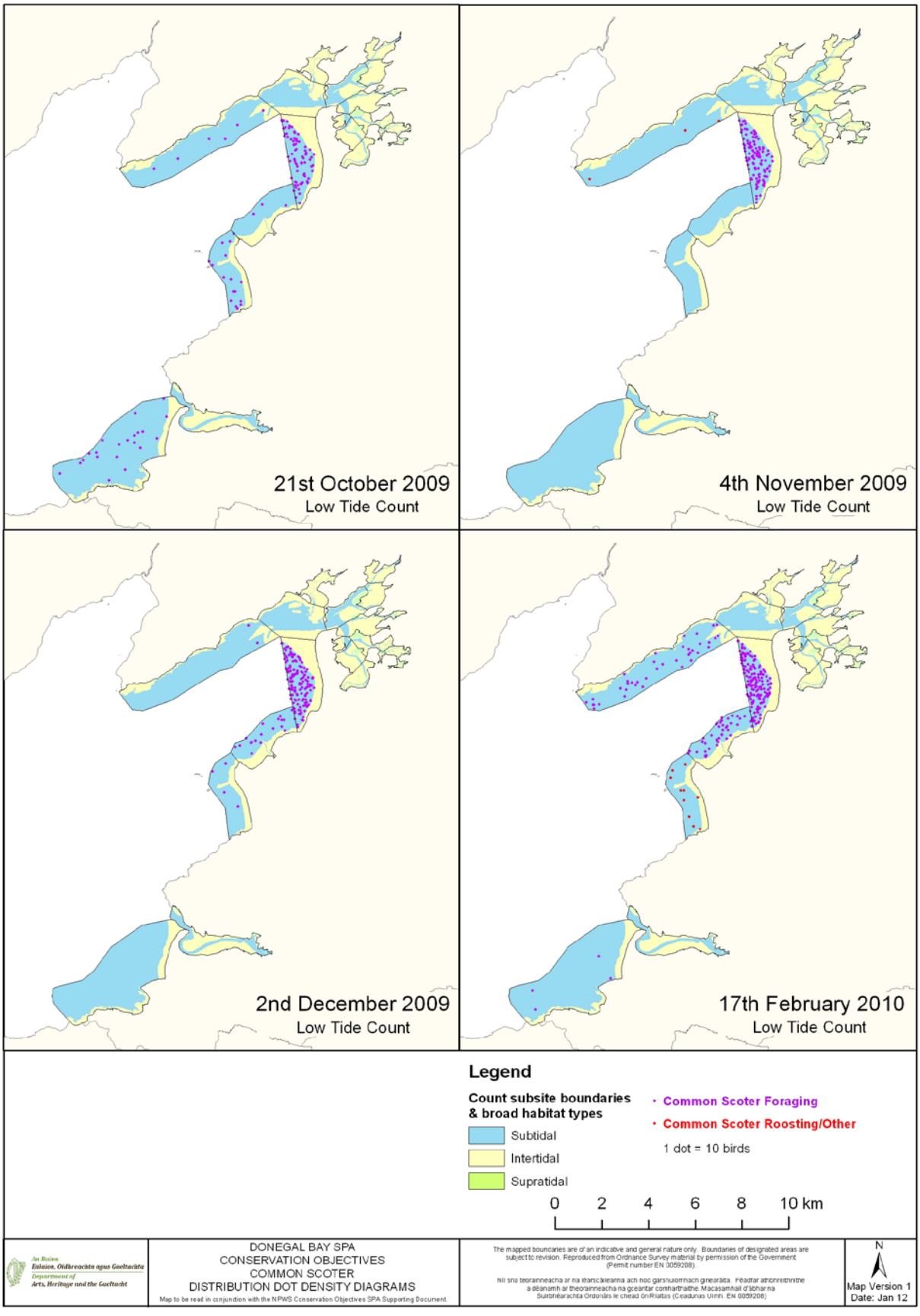
N
Map Version 1
Date: Jan 12


21st October 2009
Low Tide Count
4th November 2009
Low Tide Count
2nd December 2009
Low Tide Count
17th February 2010
Low Tide Count
Legend
Count subsite boundaries & broad habitat types
Subtidal
Intertidal
Supratidal
Common Scoter Foraging
Common Scoter Roosting/Other
1 dot = 10 birds
0 2 4 6 8 10 km
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Department of Arts, Heritage and the Gaeltacht
DONEGAL BAY SPA
CONSERVATION OBJECTIVES
COMMON SCOTER
DISTRIBUTION DOT DENSITY DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
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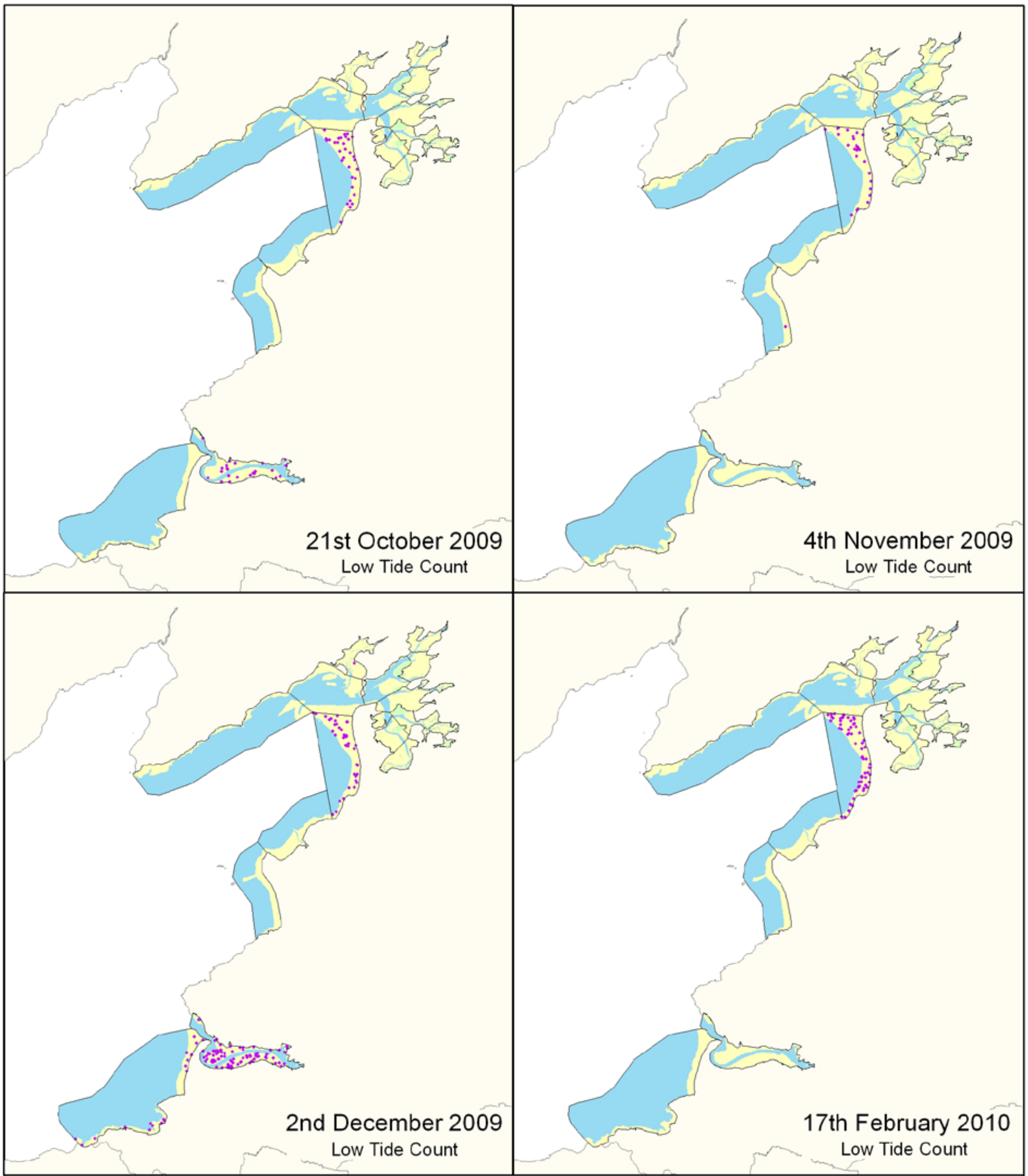
N
Map Version 1
Date: Jan 12



Legend

Count subsite boundaries & broad habitat types

- Subtidal
- Intertidal
- Supratidal

• Sanderling Foraging
• Sanderling Roosting/Other

1 dot = 2 birds

0 2 4 6 8 10 km

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DONEGAL BAY SPA
CONSERVATION OBJECTIVES
SANDERLING
DISTRIBUTION DOT DENSITY DIAGRAMS

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

N

Map Version 1
Date: Jan 12

APPENDIX 8

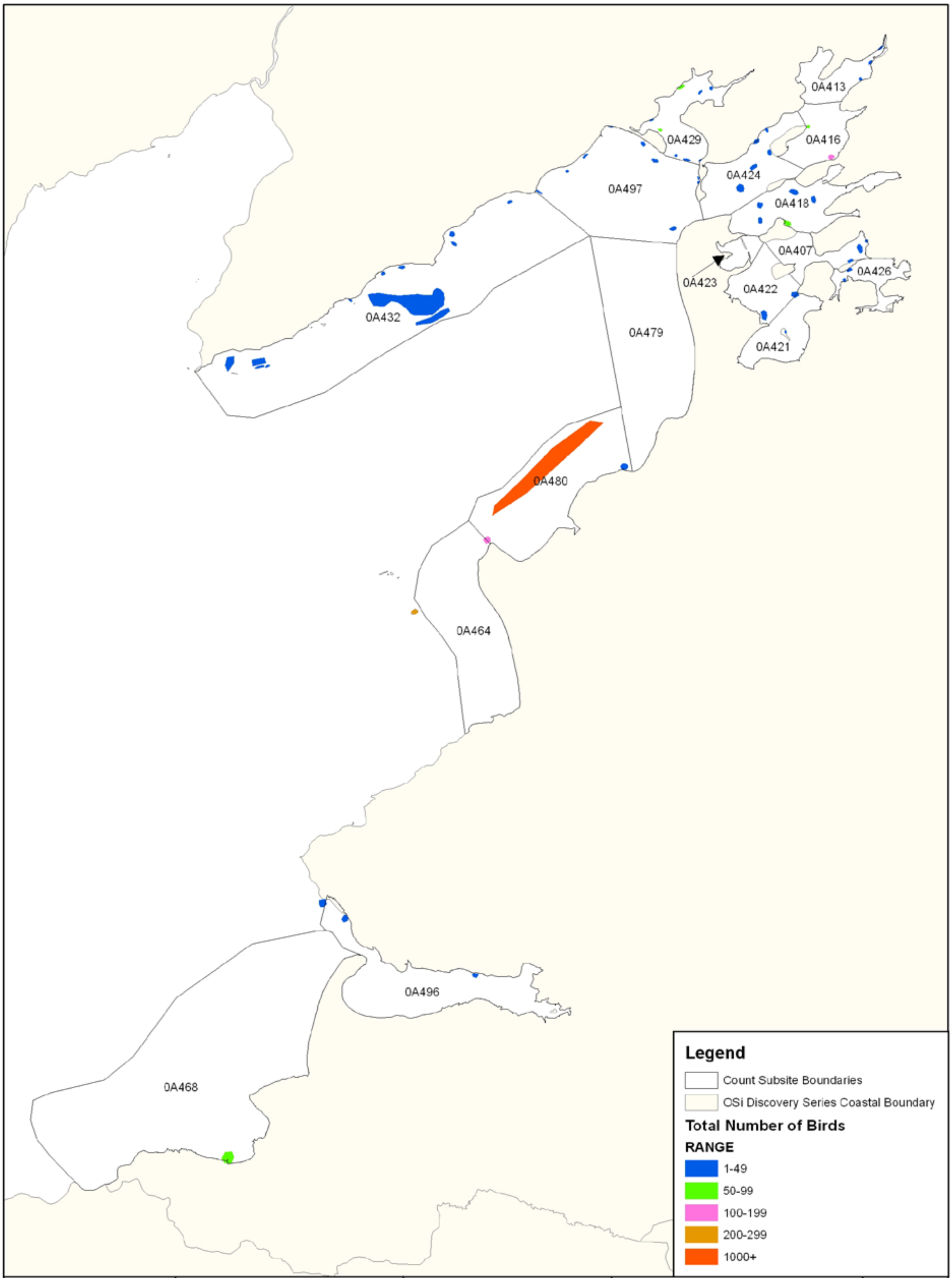
Donegal Bay

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

This table summarises the data collected from the coordinated roost survey undertaken on 9th March 2010. (Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations)

Donegal Bay - Roost Summary Table

Subsite Code	Subsite Name	Number individual roost locations	No. Species	Total No. birds	Species (alphabetical order)
0A407	Legacurry	3	4	64	BH, CM, CU, RK
0A413	Revlin Pt.	3	4	64	BH, CM, CU, WN
0A416	Muckros Strand	2	6	187	CU, MA, OC, RK, SU, WN
0A418	Dungally Strand	5	4	188	CH, CM, OC, PB
0A421	Mullanasole	1	1	22	CU
0A422	Murvagh E	2	2	18	CU, OC
0A423	Murvagh NE	-	-	-	
0A424	St. Ernan's Isl.	5	4	114	CU, OC, T., WN
0A426	Roughan	2	3	16	GK, MA, T.
0A429	Eddrim Estuary	8	5	216	BH, CU, OC, MA, PB
0A432	Doorin Pt. - Salthill Pier	12	10	119	CA, CU, CX, GB, H., OC, ND, RM, PB, SA
0A464	Rossnowlagh	2	7	386	BA, CA, DN, OC, SA, SS, TT
0A468	Aughrus Pt - Bundoran	1	3	55	DN, RP, SS
0A479	Murvagh	-	-	-	
0A480	Rossnowlagh - Inishfad	2	4	1,626	CX, OC, RK, TT
0A496	Erne Estuary	3	6	80	CU, GK, OC, PB, RK, TT
0A497	Mountcharles	9	10	119	CM, CU, DN, GB, H., LN, OC, PB, RM, RP



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Donegal Bay
Roost Location Map
Data collected during
the roost survey on 09/03/2010

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

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0 1 2 3 km

The mapped boundaries are of an indicative and general nature only.
Boundaries of designated areas are subject to revision.
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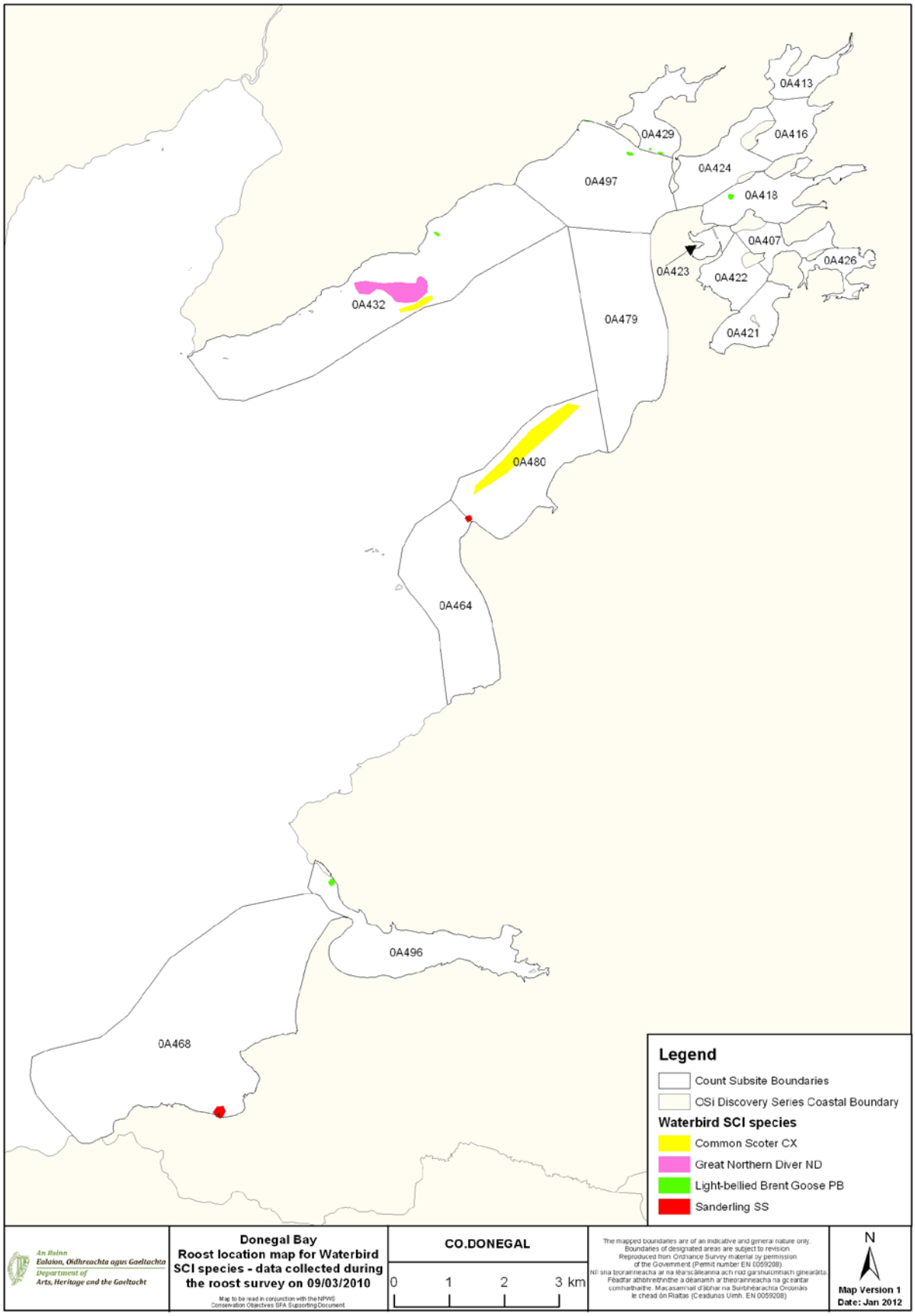
Ní sna teorainneacha ar na léarscáileanna ach rod garshuíomhach ginearálta.
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

Map Version 1
Date: Jan 2012


0A413
0A429
0A416
0A424
0A497
0A418
0A407
0A423
0A426
0A422
0A432
0A479
0A421
0A480
0A464
0A496
0A468
Legend
Count Subsite Boundaries
CSi Discovery Series Coastal Boundary
Waterbird SCI species
Common Scoter CX
Great Northern Diver ND
Light-bellied Brent Goose PB
Sanderling SS
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Donegal Bay
Roost location map for Waterbird SCI species - data collected during the roost survey on 09/03/2010
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
CO.DONEGAL
0 1 2 3 km
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).
Ní sna teorainneacha ar na léarscáileanna ach rud garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comhaltaithe. Macasamhail dílsithe na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059208)
N
Map Version 1
Date: Jan 2012

APPENDIX 9

Donegal Bay - Activities & Events

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

Legend:	
O	observed or known to occur in and around Donegal Bay SPA
U	known to occur but unknown area (subsites)/spatial extent; hence all potential subsites are included (e.g. fisheries activities).
H	historic, known to have occurred in the past.
P	potential to occur in the future.
	Grey highlighting refers to activities that have the potential to cause disturbance to waterbirds.

	0A407	0A413	0A416	0A418	0A421	0A422	0A423	0A424	0A426	0A429	0A432	0A464	0A468	0A479	0A480	0A496	0A497
1. Coastal protection, sea defences & stabilisation																	
1.1 Linear defences	O												O				O
1.2 Training walls																P	
1.6 Other modifications				O	O		O										
2. Barrage schemes/drainage																	
2.2 Altered drainage/river channel				H													
4. Industrial, port & related development																	
4.2 Fishing harbour		O								O							O
4.3 Slipway	O	O			O			O			O	O	O			O	
4.4 Pier		O		O	O					O	O		O			O	O
4.8 Other		O															
5. Military activities																	
5.1 Over flying of military aircraft																O	
5.2 Firing range																O	
6. Pollution																	
6.1 Domestic & urban waste water		O			O											O	
6.4 Agricultural & forestry effluents					O					H	O			O			
6.7 Solid waste incl. fly-tipping																O	
7. Sediment extraction																	
7.1 Channel dredging (maintenance & navigation)																H/P	
7.3 Sand and gravel extraction										H		H	H		O		
7.4 Removal of beach materials												O	O		O		

	0A407	0A413	0A416	0A418	0A421	0A422	0A423	0A424	0A426	0A429	0A432	0A464	0A468	0A479	0A480	0A496	0A497
8. Transport & communications																	
8.5 Road schemes				O				O					O				
8.6 Car parks (adjacent)		O			O					O				O			O
9. Urbanisation																	
9.1 Urbanised areas, housing		O	O					O									P
9.3 Hotel & leisure complex												O	O				
12. Tourism & recreation																	
12.1 Marinas																P	
12.2 Non-marina moorings		O			O											O	
12.4 Caravan parks & chalets												O	O		O		
12.5 Leisure centres, sports ground										O							
12.6 Power boating & water-skiing											O						
12.7 Jet-skiing												O	O				
12.8 Sailing										O	O		O				O
12.9 Sailboarding & wind-surfing												O	O				
12.11 Canoeing												O	O				
12.12 Surfing												O	O				
12.14 Tourist boat trips		O															P
12.15 Angling		O	O					O				O	O			O	
12.17 Bathing & general beach recreation										O		O	O	O			O
12.18 Walking, incl. dog walking	O	O	O					O		O		O	O	O	O	O	O
12.19 Birdwatching		O	O	O				O		O	O	O	O	O			O
12.20 Sand-yachting													O				

	0A407	0A413	0A416	0A418	0A421	0A422	0A423	0A424	0A426	0A429	0A432	0A464	0A468	0A479	0A480	0A496	0A497
12.21 4WD, trial & quad bikes												O	O	O			
12.22 Motorised vehicles										O		O	O	O		O	O
12.23 Horse-riding												O	O	O			
12.25 Golf courses														O			
12.26 Clay-pigeon shooting		O						O									
13. Wildfowl & hunting																	
13.2 Other hunting-related activities																O	
14. Bait-collecting																	
14.1 Digging for lugworms/ragworms	O	O	O	O					O			O				O	
15. Fisheries & Aquaculture																	
15.1 Professional passive fishing (e.g. longlining)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
15.2 Professional active fishing											U	U		U	U		U
15.3 Bottom (benthic) dredging											U			U			U
15.4 Fish traps & other fixed devices & nets											U	U		U	U		U
15.6 Molluscs - hand-gathering										O	O	O	O	O	O		O
15.9 Intertidal aquaculture e.g trestles	O		O	O	O	O	O	O	O		O						O
16. Agriculture & forestry																	
16.1 Saltmarsh grazing/harvesting				O													
16.3 Grazing: non-intensive (terrestrial)				O	O	O			O					O			
16.4 Sand dune grazing												O	H			O	

	0A407	0A413	0A416	0A418	0A421	0A422	0A423	0A424	0A426	0A429	0A432	0A464	0A468	0A479	0A480	0A496	0A497
16.14 In-filling of ditches, ponds, pools, marshes and pits				H								H					
16.17 Forest planting on open ground					H						H			O			
16.18 Forest and plantation management & use											H			H			
19. Natural events																	
19.1 Storms, floods and storm surges										O	O						O
19.2 Severe cold weather										O	O						O

APPENDIX 10

Disturbance Assessment

Scoring system - definitions & rationale

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

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

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

Scoring system – worked example

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

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

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

	0A407	0A413	0A416	0A418	0A421	0A422	0A423	0A424	0A426	0A429	0A432	0A464	0A468	0A479	0A480	0A496	0A497
12. Tourism & recreation																	
12.6 Power boating & water-skiing											6						
12.18 Walking, incl. dog walking										5		7	7	7	6	6	5
12.22 Motorised vehicles												6	5	5			6
12.23 Horse-riding														5			
14. Bait-collecting																	
14.1 Digging for lugworms/ragworms			4						4			3					
15. Fisheries & Aquaculture																	
15.6 Molluscs - hand-gathering										4	5	3			5		4
15.9 Intertidal aquaculture (associated activities)				7													6