Cummeen Strand
Special Protection Area

(Site Code 4035)

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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 non-breeding Special Conservation Interests of Cummeen Strand Special Protection Area, designated under Directive 2009/147/EC on the conservation of wild birds (Birds Directive).

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

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

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

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

PART ONE - INTRODUCTION

1.1 Introduction to the designation of Special Protection Areas

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

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

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

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

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

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

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

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

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

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

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

1.2 Introduction to Cummeen Strand Special Protection Area

Cummeen Strand is a large shallow bay stretching from Sligo Town westwards to Coney Island. It is one of three estuarine bays within Sligo Bay and is situated between Drumcliff Bay to the north and Ballysadare Bay to the south. The Garavogue River flows into the bay and forms a permanent channel.

At low tide, extensive areas of intertidal flats are exposed. These support a diverse macro-invertebrate fauna which provides the main food supply for the wintering waterfowl. The estuarine and intertidal habitats are of conservation importance and are designated as part of Cummeen Strand/Drumcliff Bay Special Area of Conservation (SAC Site Code 00627).

Areas of salt marsh fringe the bay in places and provide roosting sites for birds during periods of high tide. Sand dunes occur at Killaspug Point and Coney Island, with a shingle spit at Standalone Point near Sligo Town. Coney Island is accessible by boat from Rosses Point or by driving or walking over the causeway (guided by 14 pillars) at low tide.

Cummeen Strand SPA is of high ornithological importance and in addition to three species of Special Conservation Interest, supports an assemblage of over-wintering waterbirds. The Site Synopsis for Cummeen Strand 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].

Where relevant, conservation objectives are defined for attributes[2] relating to non-breeding waterbird species populations, and for attributes related to the maintenance and protection of habitats that support them. These attributes are:

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

Further guidance is given in Section 3.1 (Conservation Objectives for the Special Conservation Interests of Cummeen Strand 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 Cummeen Strand Special Protection Area

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

The Special Conservation Interests listed for Cummeen Strand SPA are as follows:-

1. During winter the site regularly supports 1% or more of the biogeographic population of Light-bellied Brent Goose (*Branta bernicla hrota*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 223 individuals.

2. During winter the site regularly supports 1% or more of the all-Ireland population of Oystercatcher (*Haematopus ostralegus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 680 individuals.

3. During winter the site regularly supports 1% or more of the all-Ireland population of Redshank (*Tringa totanus*). The mean peak number of this species within the SPA during the baseline period (1995/96 – 1999/00) was 408 individuals.

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

[3] Special Conservation Interest species are listed in taxonomic order.

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

Table 2.1 Site Designation Summary: species listed for Cummeen Strand 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]
Light-bellied Brent Goose (*Branta bernicla hrota*)		223	International importance	21	4
Oystercatcher (*Haematopus ostralegus*)		680	All-Ireland importance	17	5
Redshank (*Tringa totanus*)		408	All-Ireland importance	17	4
Other conservation designations associated with the site[b]	**SAC**	**RAMSAR SITE**	**IMPORTANT BIRD AREA (IBA)**	**WILDFOWL SANCTUARY**	**OTHER**
	000627	Yes	Yes		pNHA

[a] Baseline data are the 4-year mean peak counts for the period 1995/96 – 1999/00 (I-WeBS).
[b] Note that other designations associated with Cummeen Strand 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 and the Sligo Bay wetland complex as a whole, for the non-breeding population of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites in Ireland.
[2]Regional importance rank - the number given relates to the importance of the site and the Sligo Bay wetland complex as a whole, for the non-breeding population of the SCI species during the baseline period (1995/96 – 1999/00) relative to other sites within the Border Region (includes cross-border sites Carlingford Lough and Lough Foyle as well as cross-region site Killala Bay/Moy Estuary).

PART THREE – CONSERVATION OBJECTIVES FOR CUMMEEN STRAND SPA

3.1 Conservation Objectives for the non-breeding Special Conservation Interests of Cummeen Strand SPA

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

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

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

- To be favourable, the long term **population trend** for each waterbird Special Conservation Interest species should be stable or increasing.[5] Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.[6]

- To be favourable, there should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.[7]

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

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

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

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

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

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

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

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

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

- To be favourable, the permanent **area** occupied by the wetland habitat should be stable and not significantly less than the area of **1,732 ha**, other than that occurring from natural patterns of variation.

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

Subtidal areas refer to those areas contained within the SPA that lie below the mean low water mark and are predominantly covered by marine water. Tidal rivers, creeks and channels are included in this category. For Cummeen Strand SPA this broad category is estimated to be **326 ha**. Subtidal areas are continuously available for benthic and surface feeding waterfowl (e.g. Wigeon) and piscivorous/other waterbirds. Various waterbirds roost in subtidal areas (e.g. Brent Goose).

The intertidal area is defined, in this context, as the area contained between the mean high water mark and the mean low water mark. For Cummeen Strand SPA this is estimated to be **1,353 ha**. When exposed or partially exposed by the tide, intertidal habitats provide important foraging areas for many species of waterbirds, especially wading birds, as well as providing roosting/loafing[8] areas. When the intertidal area is inundated by the tide it becomes available for benthic and surface feeding ducks and piscivorous/other waterbirds. During this tidal state this area can be used by various waterbirds as a loafing/roosting resource.

The supratidal category refers to areas that are not frequently inundated by the tide (i.e. occurring above the mean high watermark) but contain shoreline and coastal habitats and can be regarded as an integral part of the shoreline. For Cummeen Strand SPA this is estimated to be **53 ha**. Supratidal areas are used by a range of waterbird species as a roosting resource as well as providing feeding opportunities for some species.

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

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

Table 3.1 Conservation Objectives for the waterbird Special Conservation Interests of Cummeen Strand SPA.

Objective 1: *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Cummeen Strand 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 or intensity of use of areas used by waterbirds, as determined by regular low tide and other waterbird surveys.	There should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest other than that occurring from natural patterns of variation.	Waterbird distribution from the 2010/11 waterbird survey programme is reviewed in Part Five of this document.
Objective 2: *To maintain the favourable conservation condition of the wetland habitat at Cummeen Strand SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:*				
Parameter	**Attribute**	**Measure**	**Target**	**Notes**
Area	Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 1,732 ha, other than that occurring from natural patterns of variation.	The wetland habitat area was estimated as 1,732 ha using OSI data and relevant orthophotographs.

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

4.1 Population data for waterbird SCI species of Cummeen Strand SPA

Non-breeding waterbirds are counted at Cummeen Strand each winter as part of the Irish Wetland Bird Survey (I-WeBS). The dataset spans the period 1995/96 to 2010/11 although counts are missing for some seasons (e.g. 1997/98, 2001/02, 2002/03). I-WeBS counts are undertaken during what is termed the 'core survey period' which covers the main wintering period when many species occur in their largest concentrations, but also the autumn and spring passage periods when total waterbird numbers may be enhanced by staging/stopover birds[9]. Information on I-WeBS and other waterbird surveys is given in Appendix 2. A list of regularly-occurring waterbird species in Ireland is given in Appendix 4 along with their Latin names and species codes.

During I-WeBS the site is divided into various count subsites. Although the SPA area and the I-WeBS count area are similar, they are not coincident. Table 4.1 presents population[10] data for the non-breeding waterbird SCI species of Cummeen Strand. Annual maxima were identified and used to calculate the five-year mean peak for each species. The baseline period was 1995/96 – 1999/00 (four-year mean; data for 1997/98 missing) while the recent average relates to the five-year period 2006/07 – 2010/11. When examining waterbird data, it is standard practice to use the mean of peak counts generated for each species because it reflects more accurately the importance of a site for a particular species by helping to account for inconsistencies in data gathering (i.e. differing coverage) or extraordinary fluctuations in numbers. However it is important to note that waterbird counts represent a 'snapshot' of bird numbers during a count session, so in general and taking into account all potential sources of error, resulting data are regarded to be underestimates of population size (Underhill & Prŷs-Jones, 1994).

Table 4.1 indicates where the numbers shown surpass the threshold for all-Ireland or international importance. These thresholds are different for the baseline and recent time periods (refer to Crowe et al. (2008) and Wetlands International, 2002 and Wetlands International, 2012 for national and international respectively).

Table 4.1 Population data for non-breeding waterbird Special Conservation Interest Species of Cummeen Strand SPA

Site Special Conservation Interests (SCIs)	Baseline Period[1] (1995/96 – 1999/00)	Recent Site Data[2] (2006/07 – 2010/11)
Light-bellied Brent Goose	223 (i)	481 (i)
Oystercatcher	680 (n)	792 (n)
Redshank	408 (n)	280

[1]Baseline data is the 4-year mean peak for the period 1995/96 – 1999/00;
[2]recent site data is the mean peak for the 5-year period 2006/07 – 2010/11 (I-WeBS).
(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance.
note that thresholds differ for the baseline and recent time periods used (refer to Crowe et al. (2008) and Wetlands International, 2002 and Wetlands International, 2012 for national and international respectively).

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

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

4.2 Waterbird population trends for Cummeen Strand SPA

The calculation and assessment of waterbird population trends at Irish coastal SPA sites follows the UK Wetland Bird Survey 'Alerts System' which provides a standardised technique for monitoring changes in the numbers of non-breeding waterbirds over a range of spatial scales and time periods. A detailed methodology for this trend analysis is provided in Appendix 3. For Cummeen Strand however, incomplete coverage during I-WeBS (as noted above) precludes the use of this analysis process. Therefore an estimation of population change over time was calculated using the 'generic threshold method' (after JNCC, 2004). This compares population size for two different five-year time periods, the change being expressed as a proportion of the initial population, as follows:

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

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

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

Table 4.2 Site Population data for waterbird Special Conservation Interest species of Cummeen Strand SPA: rolling five-year means

Data period	Light-bellied Brent Goose	Oystercatcher	Redshank
1995/96-1999/00 (baseline)	223	680 (n)	408 (n)
2000/01-2004/05*	578 (i)	789 (n)	400 (n)
2003/04-2007/08	534 (i)	862 (n)	313 (n)
2004/05-2008/09	525 (i)	789 (n)	333 (n)
2005/06-2009/10	460 (i)	824 (n)	292
2006/07-2010/11	481 (i)	792 (n)	280

*all 5-year means except 2000/01 – 2004/05 which is a 3-year mean; data for 2001/02 and 2002/03 missing.
(i) denotes numbers of international importance; (n) denotes numbers of all-Ireland importance.
note that thresholds differ for the baseline and recent time periods used (refer to Crowe et al. (2008) and Wetlands International, 2002 and Wetlands International, 2012 for national and international respectively

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

Data period	Light-bellied Brent Goose	Oystercatcher	Redshank
Baseline vs 2000/01-2004/05	+ 159	+ 16	- 2
Baseline vs 2003/04-2007/08	+ 140	+ 27	- 23
Baseline vs 2004/05-2008/09	+ 135	+ 16	- 18
Baseline vs 2005/06-2009/10	+ 106	+ 21	- 29
Baseline vs 2006/07-2010/11	+ 116	+ 17	-31

4.3 Cummeen Strand SPA – site conservation condition of waterbird SCI species

Conservation condition of SCI species was determined using a species estimated site trend based on the comparison of the baseline peak mean with the most recent peak mean. Conservation condition was assigned using the following criteria:

Favourable population = population is stable/increasing.

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

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

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

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

With regards the three waterbird species of Special Conservation Interest listed for Cummeen Strand SPA, and based population trend for the site, it has been determined that (Table 4.4):-

1. 1 species is currently considered as **Unfavourable** (Redshank);

2. 2 species are currently considered as **Favourable** (Light-bellied Brent Goose & Oystercatcher).

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

Table 4.4 SCI species of Cummeen Strand SPA – Current Site Conservation Condition

Special Conservation Interests	BoCCI Category[a]	Site Population Trend[b]	Site Conservation Condition	Current National Trend[c]	Current International Trend[d]
Light-bellied Brent Goose	Amber	+ 116	Favourable	+ 62.3	Increase
Oystercatcher	Amber	+ 17	Favourable	+ 14.5	Decline
Redshank	Red	- 31	Unfavourable	- 4.8	Stable/Increase

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

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

- Green – species whose populations are stable or increasing at both site level and national level.
- Beige – species whose populations are declining at both site level and national level. Therefore there is a potential for factors at a larger spatial scale to be influencing the observed trend at site level.
- Orange - species whose populations are exhibiting a 1.0 – 24.9% decline at site level but are stable or increasing at national level.
- Pink - species whose populations are exhibiting a 25.0 – 49.9% decline at site level but are stable or increasing at national level.

- Red - species whose populations are exhibiting a decline of >50.0% at site level but are stable or increasing at national level.

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

PART FIVE – SUPPORTING INFORMATION

5.1 Introduction

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

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

The information provided is intended to:-

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

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

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

Waterbirds, defined as *''birds that are ecologically dependent on wetlands"* (Ramsar Convention, 1971), are a diverse group that includes divers, grebes, swans, geese and ducks, gulls, terns and wading birds. During the data period 1995/96 – 2010/11 the I-WeBS database shows a total of 53 waterbird species that have been recorded at Cummeen Strand. These species represent eleven waterbird families: *Gaviidae* (divers), *Podicipedidae* (grebes), *Anatidae* (swans, geese and ducks), *Rallidae* (Water Rail, Moorhen and Coot), *Haematopodidae* (oystercatchers), *Charadriidae* (plovers and lapwings), *Scolopacidae* (sandpipers and allies) and *Laridae* (gulls and terns) plus *Phalacrocoracidae* (Cormorants), *Ardeidae* (Herons) and *Alcedinidae* (Kingfisher).

As described in Section 1.1, the wetland habitats contained within this SPA are considered to be a Special Conservation Interest in their own right. The wetland habitat is an important resource for listed SCI species and for other waterbird species included in the total waterbird assemblage. These species may include those that utilise the site during passage, those that are present in months of the year outside of the non-breeding season[11] or species that use the site at certain times only (e.g. as a cold weather refuge).

25 waterbird species occurred on a regular basis within Cummeen Strand during the I-WeBS period 1995/96 – 2010/11.[12] In addition to the three SCI species a further 22 waterbird species occurred regularly, and these are listed in Table 5.1.

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

[12] Regular is defined as a species that has occurred in 11 out of the 14-year data period.

Table 5.1 Regularly-occurring non SCI waterbird species that occur at Cummeen Strand during the non-breeding season

Species	Baseline Data Period[1] (1995/96 – 1999/00)	Recent Site Average[2] (2006/07 – 2010/11)
Mute Swan (*Cygnus olor*)	17	25
Shelduck (*Tadorna tadorna*)	86	105
Wigeon (*Anas penelope*)	149	150
Mallard (*Anas platyrhynchos*)	157	197
Goldeneye (*Bucephala clangula*)	7	7
Red-breasted Merganser (*Mergus serrator*)	22	25
Great Northern Diver (*Gavia immer*)	7	10
Great Crested Grebe (*Podiceps cristatus*)	1	7
Cormorant (*Phalacrocorax carbo*)	21	17
Grey Heron (*Ardea cinerea*)	12	18
Ringed Plover (*Charadrius hiaticula*)	32	122
Lapwing (*Vanellus vanellus*)	743	271
Knot (*Calidris canutus*)	165	748 (n)
Dunlin (*Calidris alpina*)	539	963 (n)
Bar-tailed Godwit (*Limosa lapponica*)	114	281 (n)
Curlew (*Numenius arquata*)	436	391
Greenshank (*Tringa nebularia*)	20 (n)	11
Turnstone (*Arenaria interpres*)	64	85
Black-headed Gull (*Chroicocephalus ridibundus*)	289	475
Common Gull (*Larus canus*)	48	260
Herring Gull (*Larus argentatus*)	29	160
Great Black-backed Gull (*Larus marinus*)	8	16

Grey shading denotes an Annex I species; (n) = numbers of all-Ireland importance (as per Crowe et al. (2008).
[1] Baseline data is the 4-year mean peak for the period 1995/96 – 1999/00 (I-WeBS); [2]recent site average is for the 5-year period 2006/07 – 2010/11 (I-WeBS).

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

Table 5.2 provides selected ecological information for waterbird SCI species of Cummeen Strand SPA. Information is provided for the following categories[13]:-

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

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

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

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

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

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

Table 5.2 Waterbirds – Ecological characteristics, requirements & specialities

Special Conservation Interests	Family (group)	Winter distribution[A]	Trophic Guild[B]	Food/Prey Requirements[C]	Principal supporting habitat within site[D]	Ability to utilise other/alternative habitats[E]	Site Fidelity[F]
Light-bellied Brent Goose *Branta bernicla hrota*	Anatidae (geese)	Localised	1, 5	Highly specialised	Intertidal mud and sand flats	2	High
Oystercatcher *Haematopus ostralegus*	Haematopodidae (wading birds)	Intermediate	4	Narrower	Intertidal mud and sand flats	2	High
Redshank *Tringa totanus*	Scolopacidae (wading birds)	Intermediate	4	Wide	Intertidal mud and sand flats	2	Moderate

[A] Winter distribution: Very widespread (>300 sites); Widespread (200 – 300 sites); Intermediate (100 – 200 sites); Localised (50-100 sites); Highly restricted (<50 sites) (based on Boland & Crowe, 2012).
[B] Waterbird foraging guilds. 1 = Surface swimmer, 2 = water column diver (shallow), 3 = water column diver (deeper), 4/5 = intertidal walker (out of water), 6 = intertidal walker (in water), 7 = terrestrial walker. Further details are given within Appendix 5.
[C] Food/prey requirements - species with a wide prey/food range; species with a narrower prey range (e.g. species that forage upon a few species/taxa only), and species with highly specialised foraging requirements (e.g. piscivores).
[D] Principal supporting habitat present within Cummeen Strand. Note that this is the main habitat used when foraging.
[E] Ability to utilise alternative habitats refers to the species ability to utilise other habitats adjacent to the site. 1 = wide-ranging species with requirement to utilise the site as and when required; 2 = reliant on site but highly likely to utilise alternative habitats at certain times (e.g. high tide); 3 = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements.
[F] Site fidelity on non-breeding grounds: Unknown; Weak; Moderate; or High (based on published literature).

5.3 The 2010/11 waterbird survey programme

5.3.1 Introduction

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

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

At Cummeen Strand, a standard survey programme of four low tide counts (October, November and December 2010 and February 2011) and two high tide counts (January and February 2011) were undertaken.[14] Waterbirds were counted within a series of ten count subsites (refer to Appendix 6). It should be noted that the count boundaries and SPA boundaries are not coincident.

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

Table 5.3 Definition of broad habitat types used

Broad Habitat Type	Broad Habitat Description
Intertidal (area between mean high water and mean low water)	Refers to the area uncovered by the tide and most likely dominated by mudflats and sandflats. It may also include areas of rocky shoreline, areas of mixed sediment and grave/pebbles or shingle and gravel shores.
Subtidal (area that lies below mean low water)	Refers to areas that are covered by seawater during counts. During low-tide counts it will include offshore water, tidal channels and creeks as well as tidal rivers.
Supratidal	This category pertains to the shore area and habitats immediately marginal to and above the mean high-water mark. The supratidal section is an integral part of the shoreline. This broad habitat also includes areas of saltmarsh where the saltmarsh is contiguous with coastal habitats lying above. Note that patches of lower saltmarsh (e.g. *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 30/11/10. During this survey waterbird roost sites were located, species and numbers of waterbirds counted and the position of roosts marked onto field maps.

5.3.2 Waterbird data, analyses and presentation

The aim of data analyses was to understand how waterbirds are distributed across the site of Cummeen Strand 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

[14] Low tide counts on 21/10/10, 22/11/10, 21/12/10 & 02/02/11 plus high tide counts on 27/01/11 and 11/02/11.

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

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

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

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

Subsite Rank Position - Categories

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

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

Waterbird count data for low tide surveys are also presented as species distribution maps ('dot density maps'). Dot-density maps show waterbird species distribution within intertidal or subtidal habitat[15] divided into 'foraging' birds and 'roosting/other' birds. These maps show the number of birds represented by dots; each dot representing one, or a pre-determined number of birds. As the dots are placed in the appropriate subsites and broad habitat types for the birds counted, the resulting map is equivalent to presenting numbers and densities and provides a relatively quick way of assessing species distribution.

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

Notes on data interpretation and methodological limitations

Waterbirds are thought to range across the three component sites of Sligo Bay (Cummeen Strand, Drumcliff Bay and Ballysadare Bay) although the extent to which they do this is largely unknown. Every effort was made to record bird movements during surveys and the

[15] Note that birds within supratidal or terrestrial habitat are not included within these maps.

two adjoining sites, Drumcliff Bay and Ballysadare Bay were surveyed on the same day or on nearby dates. However, these features and the possibility of bird movements, double-counting etc should be borne in mind when examining count data.

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

One subsite (0C447 Inner Port) was affected during the December low tide survey by a sudden descent of smog from Sligo Town. No birds in this subsite could be counted.

Subsite rankings and dot-density maps relate to the distribution of waterbirds at subsite level as recorded within the survey area during the 2010/11 waterbird survey programme. Care must be taken in the interpretation of these data, and subsite rankings in isolation should not be used to infer a higher level of conservation importance to one area over another without a detailed examination of data and understanding of each species' ecology. For instance, while some species are known to be highly site-faithful, both at site level and within-site level (e.g. Dunlin), other species may range more widely across a site(s). While some species by their nature may aggregate in high numbers, other species such as Greenshank or Grey Heron may not. It is also important to consider that distribution maps and data refer to a single season of low tide surveys. Although important patterns of distribution will emerge, these distributions should not be considered absolute; waterbirds by their nature are highly mobile and various factors including tide (e.g. spring/neap), temperature, direction of prevailing winds, changing prey densities/availabilities and degree of human activity across the site, could lead to patterns that may change in different months and years.

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

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

5.3.3 Summary Results

A total of 39 waterbird species were recorded during the 2010/11 survey programme at Cummeen Strand. Cummins and Crowe (2011) provide a summary of waterbird data collected. Note that the total count area and SPA area are not exactly coincident; a map showing count subsites is provided in Appendix 6.

All SCI species were recorded within all counts of the main survey programme. Table 5.4 shows peak numbers (whole site) for SCI species recorded during the low tide (LT) and high tide (HT) surveys.

Average subsite occupancy, the average proportion of subsites in which a species occurred during low tide counts, ranged from 65% (Light-bellied Brent Goose) to 85% (Oystercatcher); all SCI species reasonably widespread across the site.

Average percentage area occupancy is defined as the average proportion of the whole site area that a species occurred in during low tide counts. Although this is a broad calculation

across all habitat zones it presents some indication of the range of a species across the site as a whole. Because of the relatively widespread distribution of SCI species, average percentage area occupancy was relatively high for all three species (range 87% to 96%) (Table 5.4).

Table 5.4 Cummeen Strand 2010/2011 waterbird surveys – summary data

Site Special Conservation Interests (SCIs)	Peak number - LT surveys[I]	Peak number - HT survey[II]	Average subsite % occupancy [III]	Average % area occupancy [III]
Light-bellied Brent Geese	774 (i)	786 (i)	65 (17)	90 (10)
Oystercatcher	940 (n)	1,524 (n)	85 (6)	96 (4)
Redshank	452 (n)	296	78 (5)	87 (9)

(i) denotes numbers of international importance (after Wetlands International, 2012); (n) denotes numbers of all-Ireland importance (1% thresholds; 1999/00 – 2003/04 Crowe et al. 2008); [I] 4 low-tide counts undertaken on 21/10/10, 22/11/10, 21/12/10 & 02/02/11; [II] High-tide counts undertaken on 27/01/11 and 11/02/11; [III] Mean (± s.d.) averaged across the four low tide surveys.

Whole site species richness (total number of species) ranged between 28 species and 34 species (21/12/10) during low tide surveys. 37 species were recorded during the high tide survey on 27/01/11 with 31 species recorded in the second high tide count on 11/02/11.

During low tide surveys, average subsite species richness ranged from five species (0C479 Martin's Quay) to 20 species (0C466 Cummeen Strand). 70% of subsites supported on average, ten or more species during low tide surveys.

Seven out of ten subsites recorded a greater number of species during the January 2011 high tide survey in contrast to the February high tide survey. Five subsites supported the peak number of species during a high tide survey, or during both high and low tide surveys (Table 5.5).

Table 5.5 Subsite species richness

Subsite Code	Subsite name	Mean (±S.D) LT Survey	HT Survey 1/2*	Peak Overall (H/L)
0C445	Ballincar - Ballyweelin	19 (1.8)	17/12	21 (L)
0C446	Cartron to Standalone Pt.	12 (1.9)	11/17	17 (H)
0C447	Inner Port	9 (1.6)	9/10	11 (L)
0C462	Coney Island Rd. - Dorrins Strand East	9 (3.7)	14/7	14 (L/H)
0C463	Killaspug Pt - Dorrins Strand West	17 (4.7)	16/13	24 (L)
0C466	Cummeen Strand	20 (3)	21/15	24 (L)
0C478	Cummeen west from Coney Island Road	16 (1.3)	21/15	21 (H)
0C479	Martin's Quay	5 (0.5)	5/4	6 (L)
0C482	Coney Island	19 (3)	22/21	22 (L/H)
0C485	Rosses Point Harbour	11 (3.6)	15/15	15 (H)

* refers to two high tide surveys undertaken on 27/01/11 and 11/02/11.

5.3.4 Waterbird distribution

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

Ranked assessments relate to the broad habitat that birds were observed in. In some cases, data for different broad habitats have been combined, for example, in the case of wading birds and intertidal/subtidal habitat which were combined in order to include those individuals that had their feet in water and were recorded as subtidal.

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

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

Table 5.6 (a) Cummeen Strand 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	OC	RK
0C445	H	H	H
0C446	M	M	V
0C447		L	M
0C462	L	L	H
0C463	V	M	M
0C466	V	V	V
0C478	H	H	M
0C479		L	
0C482	V	M	M
0C485	H	M	M

Table 5.6 (b) Cummeen Strand Subsite assessment – highest rank obtained during either one of the high tide surveys

Species ► Subsites ▼	PB	OC	RK
0C445	4	4	4
0C446	3	2	3
0C447			6
0C462	1	1	6
0C463	2	6	5
0C466	7	1	1
0C478	3	3	2
0C479			
0C482	1	3	7
0C485	6	7	4

Table 5.6 (c) Cummeen Strand Subsite assessment – total numbers foraging intertidally[I] and subtidally[II] (L Low, M Moderate; H High V Very high; please see Section 5.3.2 for methods)

Species ► Subsites ▼	PB[I]	PB[II]	OC[I]	RK[I]
0C445	H	H	V	H
0C446	L	M	M	V
0C447			M	M
0C462			M	H
0C463	H	V	M	M
0C466	V	V	V	V
0C478	H	L	H	M
0C479			L	
0C482	V	L	H	L
0C485	H	V	M	M

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

Species ► Subsites ▼	PB	OC	RK
0C445	2	1	2
0C446		9	1
0C447		2	5
0C462	7	10	6
0C463	5	8	7
0C466	4	5	4
0C478	6	7	8
0C479		3	
0C482	3	6	9
0C485	1	4	3

Table 5.6 (e) Cummeen Strand 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[I]	PB[II]	OC	RK
0C445			V	V
0C446	V			
0C447				
0C462			L	
0C463	V	H	M	V
0C466	H	V	V	
0C478	H		V	
0C479				
0C482	V	V	H	V
0C485		V	L	

Table 5.6 (f) Cummeen Strand Subsite assessment – highest rank obtained (roosting/other behaviour) during either HT survey (Intertidal[I], Subtidal[II])

Species ► Subsites ▼	PB[I]	PB[II]	OC	RK
0C445			3	4
0C446			1	3
0C447				
0C462		1	5	
0C463		2	6	
0C466	2		1	1
0C478	1		2	2
0C479				
0C482	1	2	2	
0C485			6	1

Cummeen Strand - Waterbird Survey Programme 2010/11

Waterbird distribution - discussion notes

Where mentioned, information on benthic communities or sediment is from the intertidal and subtidal sampling programme commissioned by the National Parks & Wildlife Service (NPWS) and Marine Institute and reported in ASU (2007, 2012) and NPWS (2013).

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

Information relating to the NPWS Waterbird Survey Programme undertaken at Drumcliff Bay and Ballysadare Bay can be found in NPWS (2013b) and NPWS (2013c) respectively.

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

Whole-site numbers of Brent Geese reached 722 in October 2010 and then dropped to 485 and 229 for the subsequent low tide surveys before rising to a low tide peak of 774 on 02/02/11. The peak high tide count was 786 (27/01/11). All counts bar that on 21/12/10 surpassed the threshold of international importance.

The peak count recorded during I-WeBS at Sligo Harbour during the 2010/11 season was 435 Brent Geese, recorded in February 2011.

Brent Geese were recorded in eight subsites across the survey period (0C445, 0C446, 0C462, 0C463, 0C466, 0C478, 0C482 and 0C485) and most regularly (all LT surveys) in four of these: 0C445, 0C466, 0C478 and 0C482.

Peak numbers were held by 0C466 (Cummeen Strand), 0C482 (Coney Island), 0C463 (Killaspug Pt - Dorrins Strand West) and 0C466 for the four low tide survey dates respectively. The subsite peak count of 557 Brent Geese was recorded for 0C466 (Cummeen Strand) on 21/10/10.

Foraging Distribution

Brent Geese are grazers and are known for their preference for foraging in intertidal areas with the Eelgrass *Zostera* sp. (Robinson et al. 2004). Where this food source is absent or becomes depleted, the birds feed upon algae species, saltmarsh plants and may also undertake terrestrial grazing. *Zostera* sp. is not currently known at Cummeen Strand; a previously known bed along the southern shore of Cummeen Strand was not recorded during recent sampling (ASU, 2012). Green algae (*Ulvae* spp.) are widespread across tidal flats and are likely to form a major part of the Brent Goose diet.

Across the survey period Brent Geese were recorded foraging intertidally across a total of seven subsites and most regularly (three LT surveys or more) within four subsites: 0C466 (Cummeen Strand), 0C478 (Cummeen west from Coney Island Road), 0C482 (Coney Island) and 0C485 (Rosses Point Harbour).

0C482 (Coney Island) held peak intertidal numbers in the latter three low tide surveys with a maximum number of 90 individuals on 22/11/10. 0C466 (Cummeen Strand) held peak numbers on 21/10/10 (306) that included a flock of 243 individuals that foraged along the southern shore of the subsite and several other smaller flocks. A further 239 individuals foraged subtidally

0C466 (Cummeen Strand) was notable for supporting numbers ranked in the top four in all low tide surveys. 0C485 (Rosses Point Harbour) held good numbers on three occasions.

Subtidal foraging was widespread (eight subsites). Peak numbers were held by 0C466 (Cummeen Strand), 0C485 (Rosses Point Harbour) and 0C463 (Killaspug Pt - Dorrins Strand West). 0C445 (Ballincar – Ballyweelin) held good numbers regularly.

Intertidal foraging was recorded during the January 2011 high tide survey; 244 individuals across five subsites. 57% were within 0C462 (Coney Island Rd. - Dorrins Strand East). A further 175 foraged subtidally in 0C462, while 195 foraged subtidally just to the west in 0C463 (Killaspug Pt - Dorrins Strand West). These two outer bay subsites were clearly favoured at this time.

Terrestrial foraging was recorded in areas adjacent to the SPA and this is likely to occur regularly. 52 Brent foraged in grassland adjacent 0C463 (Killaspug Pt - Dorrins Strand West) on 02/02/11. Areas adjacent (east) of 0C446 (Cartron to Standalone Pt.) held good numbers foraging terrestrially during both high tide surveys (maximum number 111).

The highest intertidal foraging density within a single subsite was recorded for 0C485 (Rosses Point Harbour) (2 Brent Geese ha^{-1}). The average whole site foraging density was 0.2 individuals ha^{-1}.

Roosting Distribution

Roosting/other behaviour was recorded irregularly in intertidal habitat during low tide surveys, the following subsites recording flocks on irregular occasions: 0C446, 0C463, 0C466, 0C478 and 0C482. Of note was a flock of 119 Brent that flew in and rested in 0C446 on 02/02/11 for a short time. 109 Brent roosted intertidally along the southern shore of 0C478 on the same date.

0C478 (Cummeen west from Coney Island Road) held good numbers (52) roosting intertidally during the January high tide survey, positioned to the east of Coney island as part of a larger mixed-species roost that included 120 Lapwing and 143 Golden Plover.

0C482 (Coney Island) supported 192 Brent roosting intertidally during the February high tide survey although these birds moved around the subsite and were recorded in various positions, both roosting and foraging. A further 131 Brent roosted subtidally.

Subtidal roosting/other behaviour was recorded rarely, often one-off records made for 0C462, 0C463, 0C466, 0C482 and 0C485. Of note (and noted above) was a count of 131 Brent that roosted subtidally in 0C482 (Coney Island) during the February 2011 high tide survey.

15 and 75 Brent Geese roosted terrestrially adjacent to 0C478 and 0C482 during the low tide survey on 02/02/11. 152 Brent roosted terrestrially adjacent to 0C482 (Coney Island) during the February 2011 high tide survey.

The roost survey on 30/11/10 recorded roosting Brent Geese at 12 locations but roosting behaviour was concentrated in the outer part of the bay. Indeed, apart from a relatively small number of Brent within 0C466 (Cummeen Strand), all other individuals were located in the outer site around Coney Island (0C462, 0C463 and 0C482). 0C463 (Killaspug Pt - Dorrins Strand West) (south of Coney island) recorded the greatest number of individual roost positions (seven) and the largest single roost (57 individuals), most birds positioned along the southern shoreline of the subsite. The adjacent subsite 0C462 recorded the second largest single roost of 54 individuals; again along the southern shoreline.

0C482 held very few individuals roosting (maximum number of two) although 45 were recorded foraging.

The roost survey at Drumcliff Bay was held on the same date as Cummeen Strand. Brent Geese were observed roosting at six positions during this survey (one flock recorded in two positions) and the maximum flock size was 29 individuals.

Oystercatcher *Haematopus ostralegus* - Family (group): Haematopodidae (wading birds)

Haematopus ostralegus is polytypic; four subspecies are recognised of which only two occur within western Europe and Africa (Delaney et al. 2009). The nominate race breeds in western and northern Europe as far as Iceland, Norway and Finland and includes those birds that breed within Ireland. Irish-breeding birds are partial migrants, some moving south during winter while others remain on the Irish coast. Wintering birds are supplemented by breeding birds from Iceland and the Faeroe Islands (Wernham et al. 2002).

Numbers

Whole-site numbers ranged from 559 (21/10/10) to 940 (02/02/11) during low tide surveys and a high tide peak count of 1,524 was recorded during the January 2011 high tide survey. With the exception of 21/10/10 and 21/12/10, all counts surpassed the threshold of all-Ireland importance.

The peak count recorded during I-WeBS at Sligo Harbour during the 2010/11 season was 601 Oystercatchers, recorded in February 2011. A peak count of 719 Oystercatchers was recorded at Drumcliff Bay (November 2010).

Oystercatchers were widespread and occurred in all ten subsites overall (although 0C479 only recorded a single individual). Six subsites recorded Oystercatchers during all surveys: 0C445, 0C463, 0C466, 0C478, 0C482 and 0C485.

0C466 (Cummeen Strand) was notable in recording peak numbers in all four low tide surveys plus the January 2011 high tide survey. 0C445 (Ballincar – Ballyweelin) that lies directly north of 0C466 recorded numbers ranked in the top three in all four low tide surveys. 0C478 (Cummeen west from Coney Island Road) recorded numbers always ranked in the top three.

The subsite peak count was 649 Oystercatchers recorded for 0C466 (Cummeen Strand) on 27/01/11 (high tide).

Foraging Distribution

Oystercatchers are large wading birds that forage primarily on tidal flats although the species can be found foraging along non-estuarine coastline or terrestrially for earthworms. On tidal flats their food consists of Cockles (*Cerastoderma edule*), Mussels (*Mytilus edulis*) and to a lesser degree other bivalve molluscs such as *Macoma balthica*, *Scrobicularia plana* and *Mya arenaria* as well as larger polychaetes such as *Arenicola marina* and *Hediste diversicolor.* Cockles and Mussels are favoured prey items and '*universally important during winter*' (Zwarts et al. 1996) because these bivalves live in the upper sediment and are nearly always accessible, although it is known that individual birds are specialised by way of their morphology with regards choosing one or the other of these prey items, and their means of handling them.

Oystercatchers foraged across all ten subsites. 0C466 (Cummeen Strand) recorded peak numbers in the latter three low tide surveys plus second highest numbers on 21/10/10. The largest number foraging there however was recorded during the January high tide survey (375). This subsite is dominated by the intertidal benthic broad community 'intertidal fine sand with *Peringia* (*Hydrobia*) *ulvae* and *Pygospio elegans*.' The Cockle (*Cerastoderma edule*) is a characterising species of this community. Of interest is a large bed of Mussels (*Mytilus edulis*) that occurs mid shore from Finisklin to Cummeen (NPWS, 2013) that likely explained a concentration of Oystercatchers in the south-east of the subsite on some occasions (e.g. February 2011).

Peak numbers on 21/10/10 were recorded for 0C445 (Ballincar - Ballyweelin) (177) one flock comprising 170 individuals that foraged alongside the channel; smaller numbers present in all other low tide surveys. The intertidal habitat of this habitat is similar to that described above although it gives way to a sandy mud/mixed sediment community along the northern shoreline.

Of further note was 0C478 (Cummeen west from Coney Island Road) that always recorded numbers ranked in the top three. This subsite is dominated by the intertidal benthic broad community 'intertidal fine sand with *Peringia* (*Hydrobia*) *ulvae* and *Pygospio elegans* but also supports Cockles; classified as the biotope '*Cerastoderma edule* and polychaetes in littoral muddy sand' by ASU (2012).

Oystercatchers forage terrestrially for prey such as earthworms, and although not recorded widely during the 2010/11 surveys this activity is likely to take place around the site (and outside of the SPA boundary) regularly.

Good numbers of Oystercatcher were recorded foraging across Drumcliff Bay during low tide surveys. While the frequency is largely unknown it is reasonable to assume that some movement of Oystercatchers between these sites occurs.

The highest average intertidal foraging density within a single subsite was recorded for 0C445 (Ballincar - Ballyweelin) (1.9 Oystercatcher ha^{-1}). The second highest foraging density was 1.5 Oystercatchers ha^{-1} recorded for 0C447 (inner Port). The average whole site foraging density was 0.3 individuals ha^{-1}.

Roosting Distribution

Good numbers of Oystercatchers were recorded roosting/other in intertidal habitat during low tide surveys; this activity recorded for eight subsites: 0C445, 0C446, 0C462, 0C463, 0C466, 0C478, 0C482 and 0C485. Notable subsites that recorded peak or highly ranked numbers were 0C445 (Ballincar - Ballyweelin), 0C466 (Cummeen Strand), 0C478 (Cummeen west from Coney Island Road) and 0C482 (Coney Island).

378 Oystercatchers roosted in intertidal habitat during the high tide survey on 27/01/11; nearly 60% of these in 0C466 (Cummeen Strand). A further 32 individuals roosted supratidally in 0C466 but as intertidal habitat was available, many Oystercatchers also foraged (total number foraging was 375 individuals). 0C478 (Cummeen west from Coney Island Road) supported a further 72 individuals roosting intertidally and 220 foraging intertidally. Smaller numbers roosted across a further five subsites (0C445, 0C462, 0C466, 0C482, 0C485). The concurrent high tide survey at Drumcliff Bay recorded good numbers of Oystercatcher (198) roosting intertidally in the inner bay (Kintogher).

The February 2011 high tide survey recorded a total 435 Oystercatchers roosting intertidally. 165 individuals were in 0C446 (Cartron to Standalone Pt.), positioned close to Standalone Point, a roost that also comprised 236 Knot, amongst other species. A further 108 Oystercatchers roosted within 0C482 (Coney Island) and 89 roosted at two positions along the southern shore of 0C478 (Cummeen west from Coney Island Road). Four subsites (0C445, 0C463, 0C466 and 0C485) held smaller numbers. The high tide survey at Drumcliff Bay again recorded good numbers of Oystercatcher (368) roosting intertidally in the inner bay (Kintogher).

During the roost survey (30/11/10) Oystercatchers were recorded roosting within eight subsites (0C445, 0C446, 0C462, 0C463, 0C466,

0C478, 0C482 and 0C485). The peak number at a single roost was 340 individuals recorded for 0C445 (Ballincar - Ballyweelin) these birds roosting supratidally near Standalone Point in the east of the subsite. 0C466 (Cummeen Strand) recorded four roosts, the largest of 288 individuals, recorded along the shore in the SE of the subsite (near Barrow). All other roosts comprised 40 or less individuals. 0C463 was notable for recording seven different roost positions.

The roost survey at Drumcliff Bay undertaken also on 30/11/10 recorded a large roost (330 individuals) in the inner bay (Kintogher). A further 166 roosted on Ballygilgan Strand and a total of 604 roosting Oystercatchers were counted across this bay, in comparison to the total of 833 that were counted roosting across the Cummeen Strand survey area. Note, totals should be treated with caution as the movement of birds during the survey could lead to double-counting.

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

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

Numbers

Whole site numbers of Redshanks ranged from 198 (02/02/11) to a peak of 452 on 22/11/10. All low tide counts except the count of 198 surpassed the threshold of all-Ireland importance. The peak high tide count was 296 (27/01/11).

The peak count recorded during I-WeBS at Sligo Harbour during the 2010/11 season was 131 Redshank, recorded in February 2011.

Redshanks were widespread and recorded within nine subsites overall (not in 0C479). Five subsites recorded Redshank in all four low tide surveys: 0C445, 0C446, 0C463, 0C466 and 0C482. 0C466 (Cummeen Strand) recorded peak numbers in the first three low tide surveys and second highest numbers in the final survey in February 2011. 0C446 (Cartron to Standalone Pt.) held peak numbers on 02/02/11 and good numbers during all other low tide surveys (ranked in top three).
0C466 (Cummeen Strand) recorded the subsite peak count of 344 Redshank (21/12/10).

Foraging Distribution

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

Redshanks foraged intertidally across eight subsites (0C445, 0C446, 0C447, 0C463, 0C466, 0C478, 0C482 and 0C485). Four subsites held foraging individuals in all four low tide surveys (0C445, 0C446, 0C463 and 0C466).

0C466 (Cummeen Strand) recorded peak numbers in the first three low tide surveys and second highest numbers in the final survey in February 2011. This subsite is dominated by the intertidal benthic broad community 'intertidal fine sand with *Peringia* (*Hydrobia*) *ulvae* and *Pygospio elegans*. The sediment of this community complex is largely fine sand (70% - 97%) but localised areas of more muddy sediment do occur; for example within inner reaches near Finisklin and at Cartron and Cregg (northern shore) where the silt-clay fraction accounts for 77% to 84%. On 21/10/10, the largest flock of Redshank foraged in the south-east of the subsite (spanning 0C447) and on balance, this species tended to forage mostly in this inner muddier part of the subsite, or in the north of the subsite close to the channel, often with feet in water.

The inner bay subsite 0C446 (Cartron to Standalone Pt.) held peak numbers on 02/02/11 and good numbers during all other low tide surveys (ranked in top three). This subsite has a muddier sediment classified as 'estuarine mixed sediment to muddy sand with *Hediste diversicolor* and oligochaetes.' ASU (2012) assigned the typical estuary biotope '*Hediste diversicolor*, *Macoma balthica* and *Scrobicularia plana* in littoral sandy mud.'

0C445 (Ballincar – Ballyweelin) also held good numbers in all surveys (peak number 145). This subsite comprises both intertidal benthic community types described above.

The peak intertidal foraging density was 1.8 Redshanks ha^{-1} recorded for 0C446 (Cartron to Standalone Pt.); this subsite recording an average foraging density of 1.0 Redshank ha^{-1} throughout the survey programme. 0C445 (Ballincar – Ballyweelin) recorded a density of 1.6 Redshanks ha^{-1} on one occasion. The whole site average intertidal foraging density was 0.2 Redshanks ha^{-1}.

Roosting Distribution

Almost all Redshanks recorded during low tide surveys were foraging, irregular records of small numbers of Redshank were recorded roosting/other. The one exception was 95 Redshanks that roosted intertidally within 0C445 (Ballincar – Ballyweelin) on 21/10/10.

With intertidal habitat available, most Redshanks were recorded foraging during the January 2011 high tide survey although numbers during this survey and the early February 2011 low tide survey were down on previous months, possibly due to the cold weather conditions experienced that winter. The largest number roosting intertidally (21) were located within 0C485 (Rosses Point Harbour). 26 Redshanks roosted supratidally in 0C446 (Cartron to Standalone Pt.), a mixed-species roost on Horse Island. A further 92 Redshanks roosted terrestrially (part of a larger mixed-species roost) along the training wall that marks the eastern boundary of the subsite.

The February 2011 high tide survey recorded 150 roosting Redshanks, 81 of these within 0C466 (Cummeen Strand). The largest flock was 75 individuals that roosted intertidally in the south-eastern corner of the subsite. A further 90 Redshanks roosted terrestrially along the training wall that marks the eastern boundary of the subsite. Other roost records were obtained for 0C445 (4 intertidal), 0C446 (25 intertidal), 0C463 (13 supratidal), 0C478 (40 intertidal) and 0C482 (Coney Island, one terrestrial). Of note was a flock of 58 Redshanks that roosted supratidally in outer Drumcliff Bay (on Raghly Point) on the same day.

The roost survey (30/11/10) recorded roosting Redshanks across seven subsites (0C445, 0C446, 0C462, 0C463, 0C466, 0C482 and 0C485). The largest single roost was recorded in 0C466 (Cummeen Strand) where 155 individuals roosted intertidally near Barrow. Slightly further west (off Gibraltar Point), a flock of 101 roosted intertidally, a large mixed-species roost that included 73 Common Gull and 47 Dunlin amongst other species. A flock of 135 Redshanks roosted intertidally within 0C485 (Rosses Point Harbour). Smaller numbers roosted across a further 12 positions. The concurrent roost survey at Drumcliff Bay recorded relatively few roosting Redshanks, 27 individuals recorded from six positions.

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

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

5.4.2 Assessment Methods

Information on 'activities' and 'events' across the site was collected during a desk-top review which included NPWS site reporting files, County Development and other plans (e.g. Sligo County Council, 2010, 2011), Western River Basin District documents (e.g. WRBD, 2009) and other available documents relevant to the ecology of the site.

In addition, information was collected during the 2010/11 waterbird survey programme (NPWS, 2011) as field workers recorded activities or events that occurred at the site during their survey work. This information, together with results from a 'site activity questionnaire' provides valuable information gained from 90+ hours of surveyor effort across the site. All data collected were entered into a database but as the dataset will be subject to change over time, the assessment should be viewed as a working and evolving process.

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

Data are presented in three ways:-

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

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

2. Of the activities and events identified to occur in and around Cummeen Strand, those that have the potential to cause disturbance to waterbird species are highlighted.

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

Table 5.7 Scoring system for disturbance assessment

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

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

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

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

5.4.3 Overview of activities at Cummeen Strand

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

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

Habitat loss, modification and adjacent landuse

Cummeen Strand (also known as Sligo Harbour) is a large shallow bay stretching from Sligo Town westwards to Coney Island. It is the estuary of the Garavogue River. The inner bay is dominated by the presence of Sligo Harbour, the most northerly commercial port on the west coast of Ireland, the channel lined by training walls (along subsite 0C445) and dredged

regularly to maintain navigation. A fishing harbour and a separate pier for yacht mooring are located at Rosses Point and small piers are found at Raghly Point and on Coney Island.

The main residential and industrial developments occur at Sligo Town. Strandhill and Rosses Point are popular seaside resorts. Sligo Airport is located within dune habitat and adjacent to saltmarsh at Strandhill (subsite 0C463). There have been previous proposals to expand this airport.

Outside of villages and towns, rural dwellings and ribbon development of housing along main roads are common e.g. along the road from Sligo to Rosses Point. However, the surrounding landscape is largely agricultural with intensively managed grassland predominating. The landscape rises steeply along the southern side of the site.

A golf course has encroached onto the dune system at Rosses Point and a small forestry plantation also occurs in dune habitat there (NPWS, 2000).

Coney Island is accessible by boat from Rosses Point or by driving or walking over the causeway across Dorrin's Strand (guided by 14 pillars) at low tide.

Saltmarsh that lies above the sand flats in subsites 0C462 and 0C478 is grazed by livestock and is fenced off from the sandflats to prevent livestock wandering along the shoreline. Some sections are overgrazed and there are signs of poaching and damage (McCorry & Ryle, 2009). There has been some dumping of old machinery in the past along the seaward edge of the saltmarsh for coastal protection. Tracks are present along the upper saltmarsh boundary along one section and a track bisects the saltmarsh at the Coney Island causeway. There has also been some dumping and infilling of spoil on the saltmarsh in the past at several access points onto the saltmarsh.

In the west of the site (subsite 0C463) former saltmarsh habitat was reclaimed in the past for the construction of the airport runway. This was facilitated by the building of a seawall along the shoreline adjacent to the runway; saltmarsh behind this area was infilled (McCorry & Ryle, 2009).

A low ridge is present along some of the saltmarsh at the eastern side of the site. There are indications that this ridge was a former embankment related to attempted reclamation of this saltmarsh (McCorry & Ryle, 2009).

Macroalgal mats are present within the inner estuary during summer months. Although a natural component of shallow estuarine communities, macroalgal mats of species such as *Ulva* spp[16] are considered a consequence of organic enrichment when they occur in excessive amounts.

Water quality

The Western River Basin District (WRBD) River Basin Management Plan 2011 – 2015 covers the implementation of the Water Framework Directive (WFD) (2000/60/EEC) for the west coast of Ireland and covers Sligo Harbour and its inflowing rivers. The main rivers in the catchment are the Bonet River and tributaries and the Garavogue River. Many smaller rivers, including Willsborough Stream, discharge directly to the Harbour (DoEHLG, 2009).

The current water quality status of Sligo Harbour is 'high' according to the Western River Basin Transitional and Coastal Waters Action Programme (WRBD, 2009).

[16] includes species formerly classified as *Enteromoropha* (Hayden et al. 2003).

The Environmental Protection Agency (EPA) monitors the status of estuarine and coastal water bodies using their Trophic Status Assessment Scheme (TSAS), a requirement under the Urban Waste Water Treatment Directive (UWWT) (91/271/EEC)[17] and Nitrates Directive (91/676/EEC). Following assessment waterbodies are classified as eutrophic, potentially eutrophic, intermediate, or unpolluted (O'Boyle et al. 2010). The most recent assessment (2007-2009) shows an improved status for Sligo Harbour and the Garavogue estuary, from 'intermediate' to 'unpolluted.' This is attributed to improvements in waste water treatment.

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

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

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

Agricultural discharges are a second type of diffuse pollution to Sligo Harbour and could potentially be affecting water quality (DoEHLG, 2009).

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

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

[17] Transposed by the Urban Waste Water Treatment Regulations S. I. No 254 of 2001, as amended by S.I. No 48 of 2010.

Fisheries & aquaculture

An area of 8.6 km^2 in Sligo Harbour is designated as the Sligo Bay Shellfish Area under the EU Shellfish Waters Directive[18] (No. 17) (DoEHLG, 2009). The designated area covers a large area of intertidal flats extending from Ballincar in the east to Maguins Island in the west. The designation relates to the cultivation of Clams (*Tapes semidecussatus*) and Oysters (*Crassostrea gigas*). Oysters are grown intertidally upon trestles; clams are bottom-grown within the sediment. Initially, clam seed is grown off-bottom between mesh in flat wooden frames. When they reach a size of 8-10 mm (approximately one year) they are re-layed for on-growing which involves rotovating the site to remove predators (e.g. crabs), ploughing the sand and sowing the juvenile clams within the sediment (Heffernan, 1999). The clam lays are protected with netting.

Aquaculture occurs within subsites 0C466, 0C478 and 0C482 on the southern side of the channel. There is an agreed access route to the mid-bay plots from the Coney Island causeway which runs from the southern shore (NPWS, 2011).

The Sea Fisheries Protection Authority (SFPA) is responsible for classifying shellfish production areas and the current classification of the Sligo Harbour Bivalve Mollusc Production Area is Class B (clams and oysters) as of 20th July 2012 (www.sfpa.ie).

Various commercial inshore fishing activities are likely to occur adjacent to the site (detail and spatial scale unknown). Line fishing and other static methods (e.g. pots) are widespread within the bay (DoEHLG, 2009).

Native Oyster (*Ostrea edulis*) beds were present in the bay historically and can be seen on 6'' Ordnance Survey maps (e.g. near Oyster Island). These beds disappeared over time, likely due to a combination of increased human and industrial pollution at the turn of the 19th century, plus over-harvesting.

Recreational activities

Walking is a popular recreational activity and coastal walking routes in the area are centred upon Rosses Point, Strandhill and Lissadell (Drumcliff Bay) (www.sligowalks.ie). Car parks and paths at Rosses Point provide public access to the coast; the beach in this area is used for general leisure purposes. Rosses Point beach was awarded blue flag status in 2012. Outdoor benches are located at Deadman's Point and along the embankment in Rosses Point. Diving platforms have been constructed at Deadman's Point. At Cartron, a lay-by with parking for a number of cars provides good views over Sligo Harbour (NPWS, 2000). At Strandhill, car parks and paths provide coastal access and the dunes and strand are used for amenity purposes (largely outside of the SPA). Swimming is not allowed at Strandhill due to strong currents. Strandhill beach is a well known surfing beach and several surf clubs/schools are based there. Kite boarding occurs at Rosses Point.

Recreational shore angling is a popular pursuit at a number of locations around Sligo Bay. A guide to sea angling in the north-west (Dunlop, 2009) describes two suitable locations within the site: Coney Island ("some fishing in the main channel for Sea Trout, Mackerel and Bass"), and Rosses Point to Deadman's Point ("spinning for Mackerel and Sea Trout in summer, occasional Bass"). Sea angling and charter boats are based at Rosses Point.

Others

Wildfowling was not recorded at the site during the 2010/11 Waterbird Survey Programme. In response to the freezing conditions experienced in the winter of 2010, the Department of the

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

Environment, Heritage and Local Government extended a temporary closure of the hunting season for wild birds (8th – 30th December 2010 inclusive).

5.4.4 Disturbance Assessment

During 2010/11 survey work four activities/events were recorded that had the potential to cause disturbance to waterbirds. These were aircraft, aquaculture machinery (and activities associated with intertidal aquaculture), horse riding, and walking (including with dogs) (Table 5.8). Fieldworkers themselves often caused disturbance to waterbirds as they took up observation positions; these disturbances, although recorded are not included in this current assessment.

Walking (including with dogs) was the most widespread activity occurring in six subsites overall and accounted for the peak disturbance scores in four of these. Aircraft (small planes and helicopters) affected birds in four subsites; the response greatest in 0C463 and 0C482.

Aquaculture activities and in particular machinery (e.g. tractors) caused a noticeable disturbance in all events recorded and together with a regular frequency of occurrence resulted in the peak disturbance score overall, although this was confined to just one subsite (0C466 Cummeen Strand). A moderate response was noted in all cases; i.e. the birds flew off to another part of the subsite.

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

Table 5.8 Disturbance Assessment Summary Table
Number of activities recorded during field surveys (2010/11 waterbird survey programme) observed to cause disturbance to waterbirds. The calculated peak disturbance score is shown (see text for explanation).
Scores 0 – 3 = Low Scores 4 – 6 = Moderate Scores 7 – 9 = High. Grey shading = no activity recorded.

Subsite Code	Subsite Name	Number Activities	Peak Disturbance Score	Activity Responsible
0C445	Ballincar - Ballyweelin	1	5	- Walking (incl. with dogs)
0C446	Cartron to Standalone Pt.	-	-	
0C447	Inner Port	-	-	
0C462	Coney Island Rd. - Dorrins Strand East	4	6	- Walking (incl. with dogs)
0C463	Killaspug Pt - Dorrins Strand West	2	6	- Aircraft
0C466	Cummeen Strand	3	7	- Intertidal aquaculture
0C478	Cummeen west from Coney Island Road	2	5 5	- Walking (incl. with dogs) - Aircraft
0C479	Martin's Quay	-	-	
0C482	Coney Island	2	6	- Walking (incl. with dogs) - Aircraft
0C485	Rosses Point Harbour	-	-	

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

Species ► Subsites ▼	PB	OC	RK
0C445	H	H	H
0C446	M	M	V
0C447		L	M
0C462	L	L	H
0C463	V	M	M
0C466	V	V	V
0C478	H	H	M
0C479		L	
0C482	V	M	M
0C485	H	M	M

5.4.5 Discussion

Many of the 'activities' identified at the Cummeen Strand may act so as to modify the wetland habitats. While physical loss might be considered more historic in nature (e.g. land claim for the airport), on-going modifications to intertidal and coastal habitats may occur due to changes in natural processes (e.g. sedimentation or erosion rates) as a result of former physical events.

Human recreational activities at coastal sites occur less frequently during winter months and the range of activities is much reduced. Nevertheless, recreational activity in the form of walkers (with/without dogs) occurred in over half of the count subsites and was a regular activity in several (e.g. 0C462, 0C482).

Any activity that causes disturbance can lead to the displacement of waterbirds. The significance of the impact that results from even a short-term displacement should not be underestimated. In terms of foraging habitat, displacement from feeding opportunities not only reduces a bird's energy intake but also leads to an increase in energy expenditure as a result of the energetic costs of flying to an alternative foraging area. Displacement also has knock-on ecological effects such as increased competition (within and/or between different species) for a common food source. In areas subject to heavy or on-going disturbance, waterbirds may be disturbed so frequently that their displacement is equivalent to habitat loss. When disturbance effects reduce species fitness[19] (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:-

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

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

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

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APPENDIX 1

SITE NAME: CUMMEEN STRAND SPA

SITE CODE: 004035

Cummeen Strand is a large shallow bay stretching from Sligo Town westwards to Coney Island. It is one of three estuarine bays within Sligo Bay and is situated between Drumcliff Bay to the north and Ballysadare Bay to the south. The Garavogue River flows into the bay and forms a permanent channel.

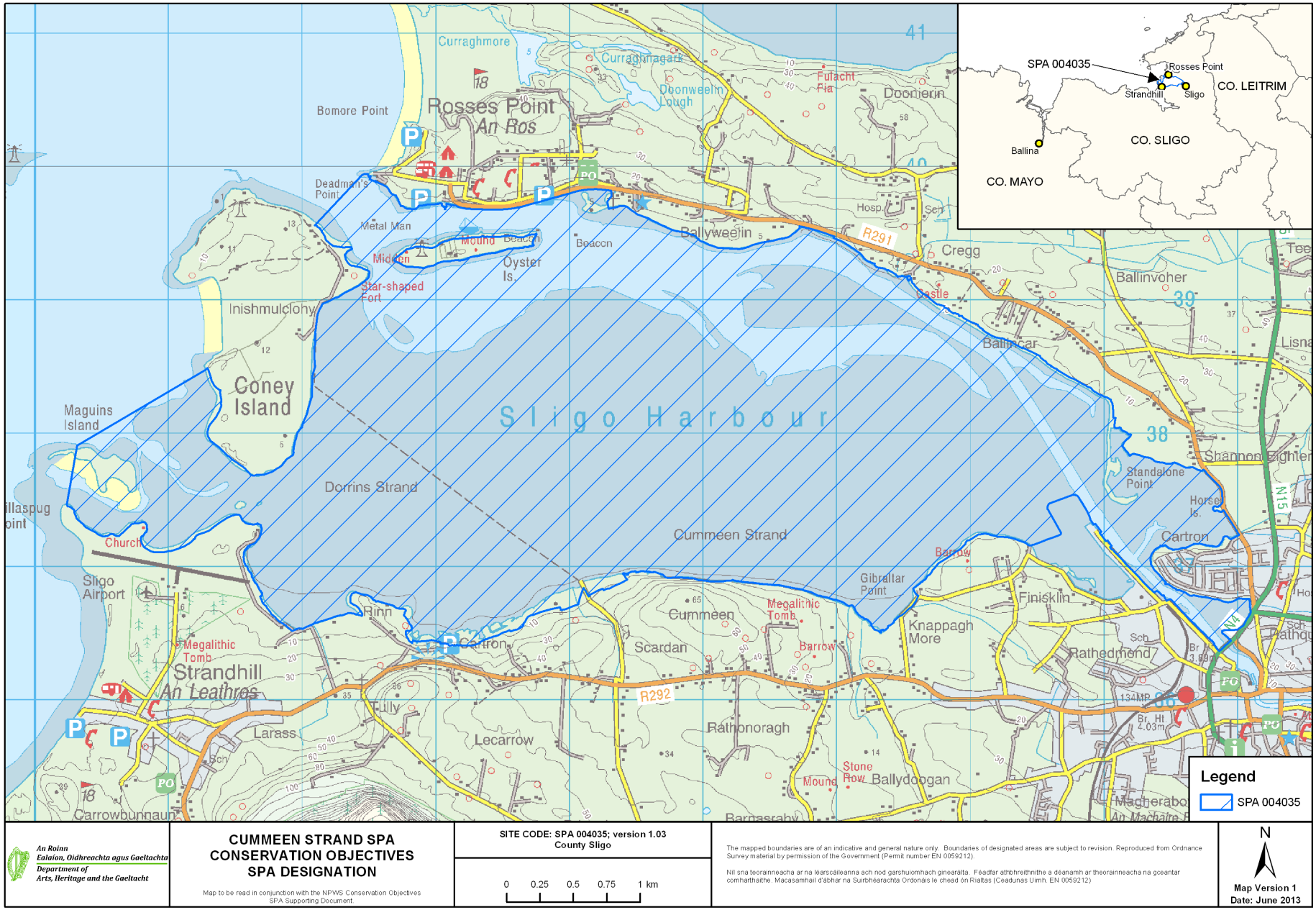
At low tide, extensive sand and mud flats are exposed. These support a diverse macro-invertebrate fauna which provides the main food supply for the wintering waterfowl. Invertebrate species such as Lugworm (*Arenicola marina*), Ragworm (*Hediste diversicolor*), Cockles (*Cerastoderma edul*e), Sand Mason (*Lanice conchilega*), Baltic Tellin (*Macoma balthica*), Spire Shell (*Hydrobia ulvae*) and Mussels (*Mytilus edulis*) are frequent. Of particular note is the presence of eelgrass (*Zostera noltii* and *Z. angustifolia*) beds, which provide a valuable food stock for herbivorous wildfowl. The estuarine and intertidal flat habitats are of conservation significance and are listed on Annex I of the E.U. Habitats Directive. Areas of salt marsh fringe the bay in places and provide roosting sites for birds during the high tide periods. Sand dunes occur at Killaspug Point and Coney Island, with a shingle spit at Standalone Point near Sligo Town.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Light-bellied Brent Goose, Oystercatcher and Redshank. The E.U. Birds Directive pays particular attention to wetlands, and as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Cummeen Strand supports important concentrations of wintering waterfowl, including an internationally important Light-bellied Brent Goose flock (223) and nationally important populations of Oystercatcher (680) and Redshank (408). Other species occurring in significant numbers include Shelduck (86), Wigeon (149), Teal (54), Mallard (145), Red-breasted Merganser (15), Golden Plover (428), Lapwing (695), Knot (165), Sanderling (14), Dunlin (539), Bar-tailed Godwit (85), Curlew (430), Greenshank (13) and Turnstone (62) - all figures are mean peak counts for 4 of the 5 winters between 1995/96 and 1999/2000. Whooper Swan (7) also uses the site, though not regularly.

Cummeen Strand SPA is of high ornithological importance with one species, Light-bellied Brent Goose, occurring in numbers of international importance. In addition, the site supports nationally important populations of a further two species. The regular presence of Golden Plover and Bar-tailed Godwit is of particular note as these species are listed on Annex I of the E.U. Birds Directive. The site is also important as a component of the much larger Sligo Bay complex.

16.4.2010



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

CUMMEEN STRAND SPA
CONSERVATION OBJECTIVES
SPA DESIGNATION

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

SITE CODE: SPA 004035; version 1.03
County Sligo

0 0.25 0.5 0.75 1 km

N

Map Version 1
Date: June 2013

APPENDIX 2

Waterbird data sources

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

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

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

- Swan Surveys

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

- Greenland White-fronted Goose

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

- Greylag Geese

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

- Barnacle Goose (*Branta leucopsis*)

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

- Light-bellied Brent Geese

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

APPENDIX 3

Analysing population trends: a synopsis

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

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

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

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

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

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

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

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

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

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

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

Worked example

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

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

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

Limitations

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

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

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

APPENDIX 4

Waterbird species codes

AE	Arctic Tern	*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

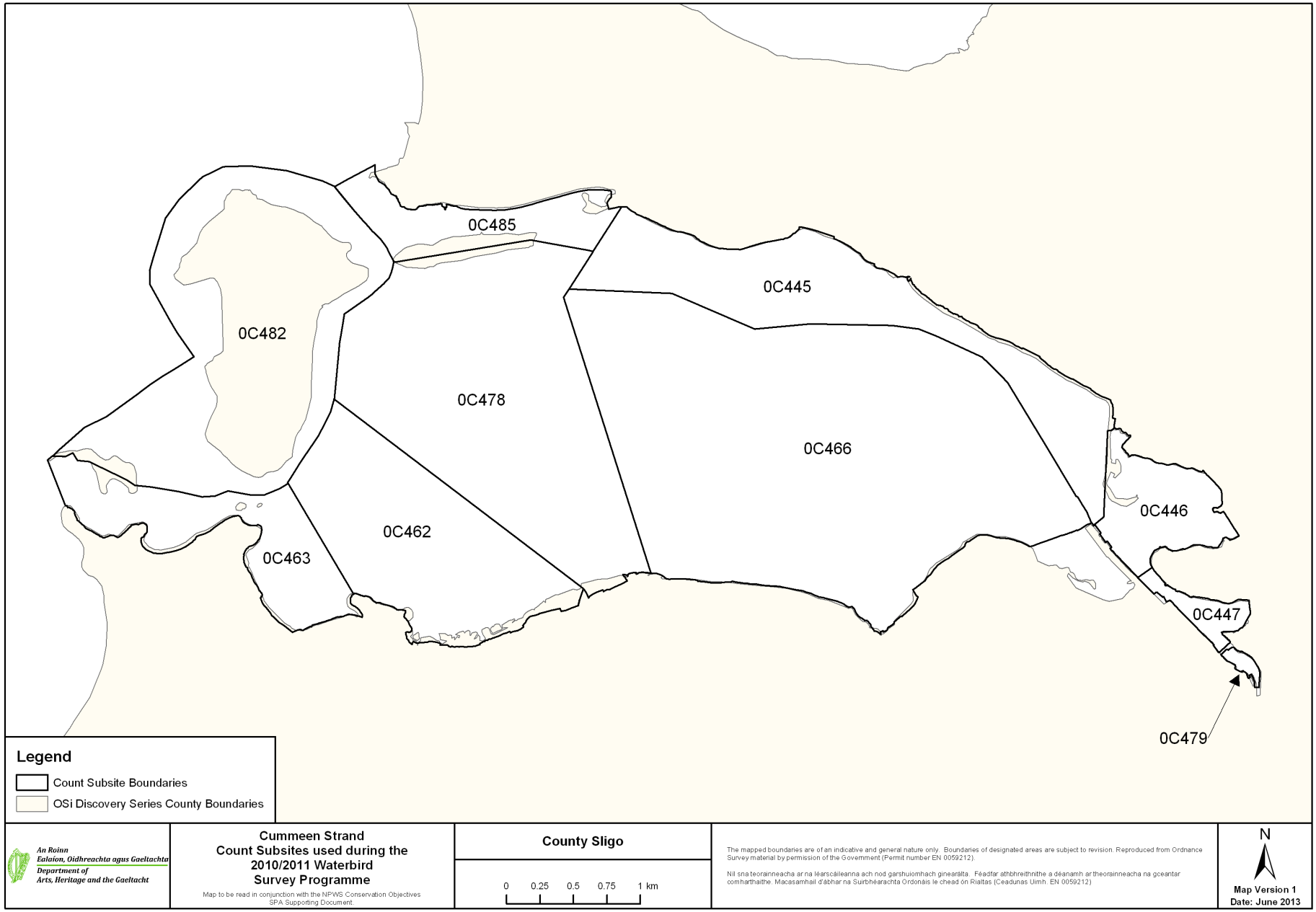
[a] dives <3m.

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

Cummeen Strand – Waterbird Survey Programme 2010/11 – Count Subsites

Subsite Code	Subsite Name	Subsite area (ha)
0C445	Ballincar - Ballyweelin	202.06
0C446	Cartron to Standalone Pt.	63.4
0C447	Inner Port	16.4
0C462	Coney Island Rd. - Dorrins Strand East	196.7
0C463	Killaspug Pt - Dorrins Strand West	109.7
0C466	Cummeen Strand	625.0
0C478	Cummeen west from Coney Island Road	362.4
0C479	Martin's Quay	3.6
0C482	Coney Island	350.9
0C485	Rosses Point Harbour	70.3
	TOTAL	**2001.0**

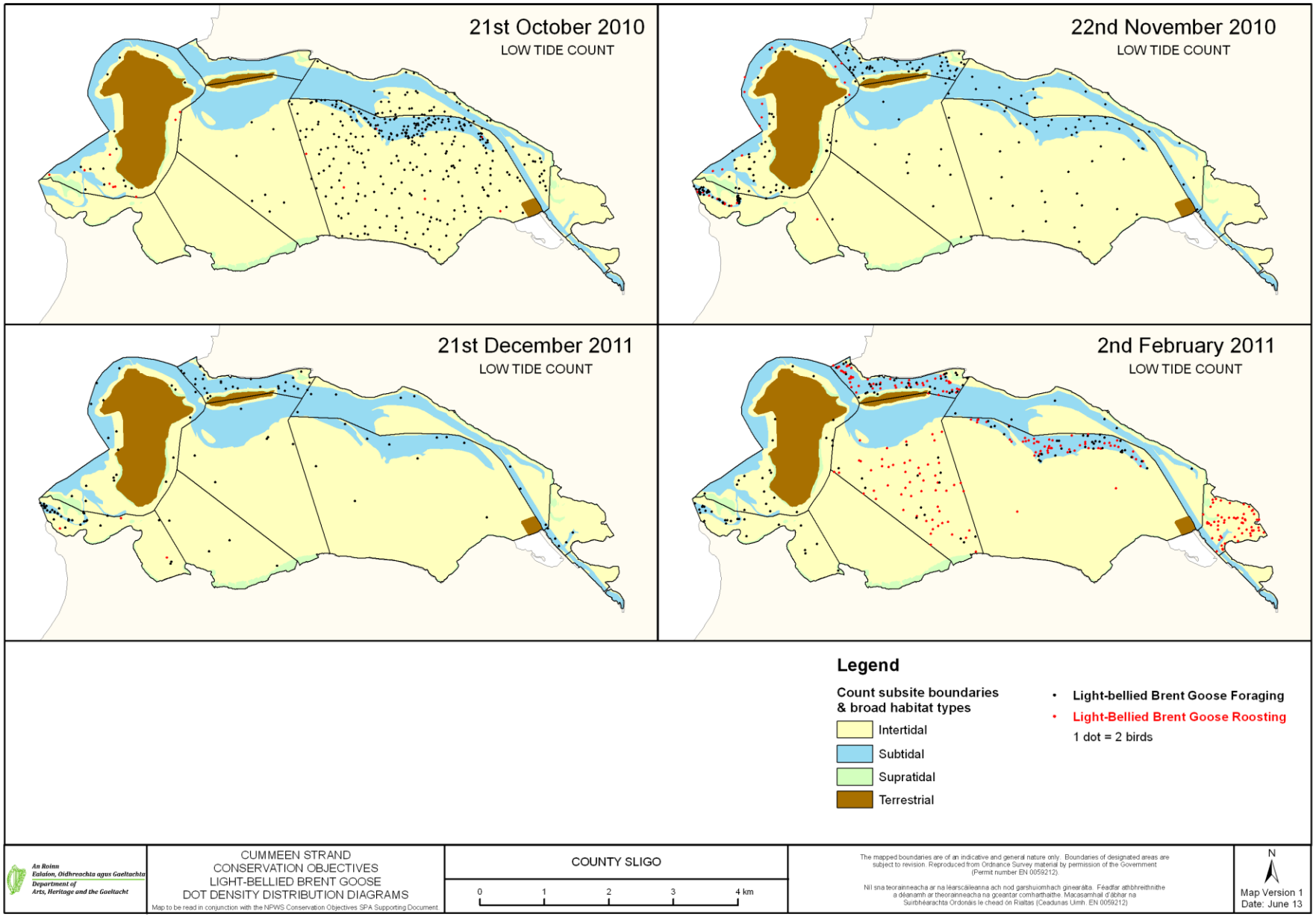

0C485
0C445
0C482
0C478
0C466
0C446
0C462
0C463
0C447
0C479
Legend
Count Subsite Boundaries
OSi Discovery Series County Boundaries
An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht
Cummeen Strand
Count Subsites used during the
2010/2011 Waterbird
Survey Programme
Map to be read in conjunction with the NPWS Conservation Objectives
SPA Supporting Document.
County Sligo
0 0.25 0.5 0.75 1 km
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadunas Uimh. EN 0059212)
N
Map Version 1
Date: June 2013

APPENDIX 7

Cummeen Strand

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

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


21st October 2010
LOW TIDE COUNT
22nd November 2010
LOW TIDE COUNT
21st December 2011
LOW TIDE COUNT
2nd February 2011
LOW TIDE COUNT
Legend
Count subsite boundaries & broad habitat types
Intertidal
Subtidal
Supratidal
Terrestrial
Light-bellied Brent Goose Foraging
Light-Bellied Brent Goose Roosting
1 dot = 2 birds
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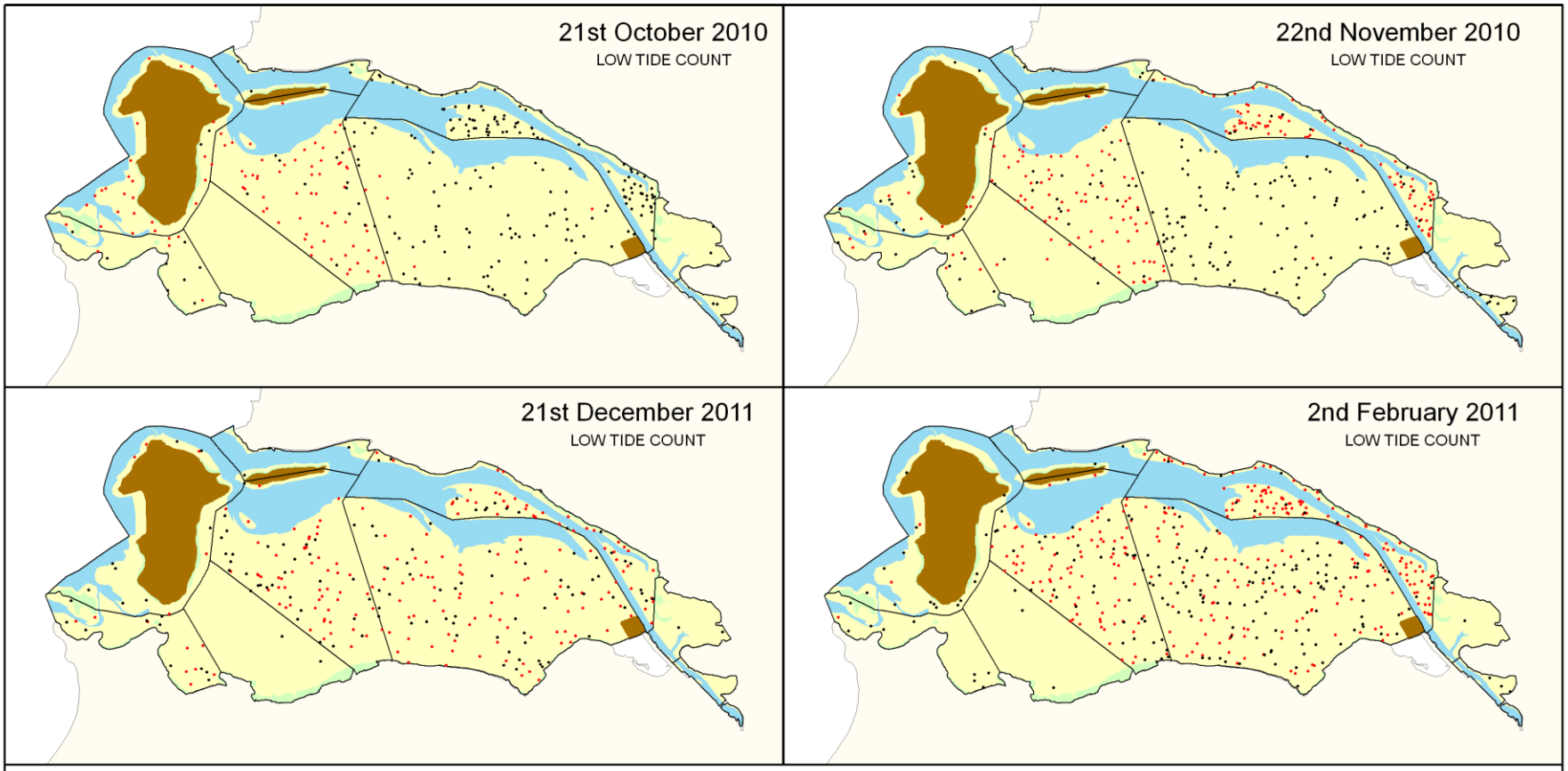
Department of Arts, Heritage and the Gaeltacht
CUMMEEN STRAND
CONSERVATION OBJECTIVES
LIGHT-BELLIED BRENT GOOSE
DOT DENSITY DISTRIBUTION DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document.
COUNTY SLIGO
0 1 2 3 4 km
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead on Rialtas (Ceadúnas Uimh. EN 0059212)
N
Map Version 1
Date: June 13


21st October 2010
LOW TIDE COUNT
22nd November 2010
LOW TIDE COUNT
21st December 2011
LOW TIDE COUNT
2nd February 2011
LOW TIDE COUNT
Legend
Count subsite boundaries & broad habitat types
Intertidal
Subtidal
Supratidal
Terrestrial
Oystercatcher Foraging
Oystercatcher Roosting
1 dot = 2 birds
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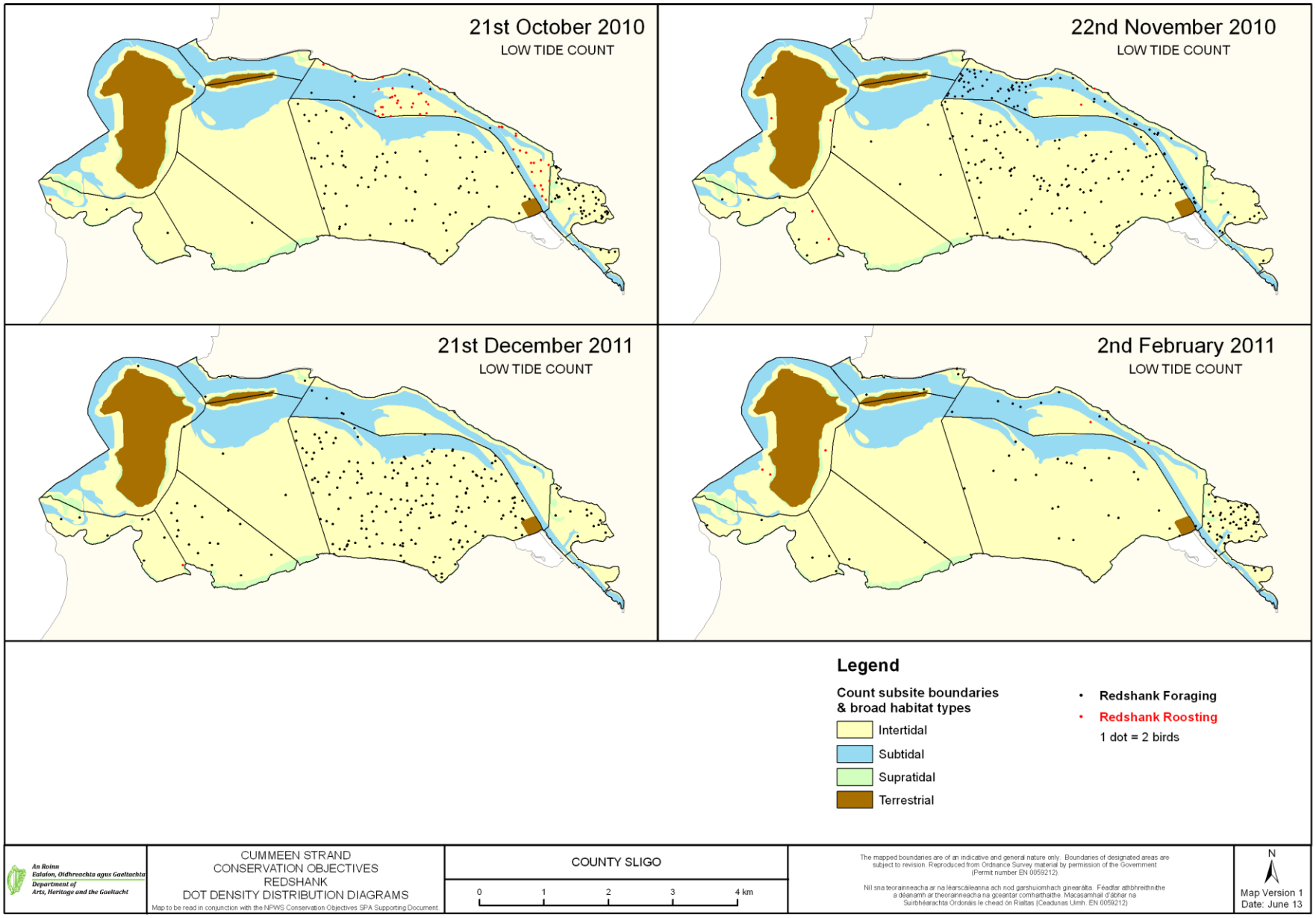
CUMMEEN STRAND
CONSERVATION OBJECTIVES
OYSTERCATCHER
DOT DENSITY DISTRIBUTION DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
COUNTY SLIGO
0 1 2 3 4 km
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059212)
N
Map Version 1
Date: June 13


21st October 2010
LOW TIDE COUNT
22nd November 2010
LOW TIDE COUNT
21st December 2011
LOW TIDE COUNT
2nd February 2011
LOW TIDE COUNT
Legend
Count subsite boundaries & broad habitat types
Intertidal
Subtidal
Supratidal
Terrestrial
Redshank Foraging
Redshank Roosting
1 dot = 2 birds
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Department of Arts, Heritage and the Gaeltacht
CUMMEEN STRAND
CONSERVATION OBJECTIVES
REDSHANK
DOT DENSITY DISTRIBUTION DIAGRAMS
Map to be read in conjunction with the NPWS Conservation Objectives SPA Supporting Document
COUNTY SLIGO
0 1 2 3 4 km
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).
Nil sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a dhéanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadúnas Uimh. EN 0059212)
N
Map Version 1
Date: June 13

APPENDIX 8

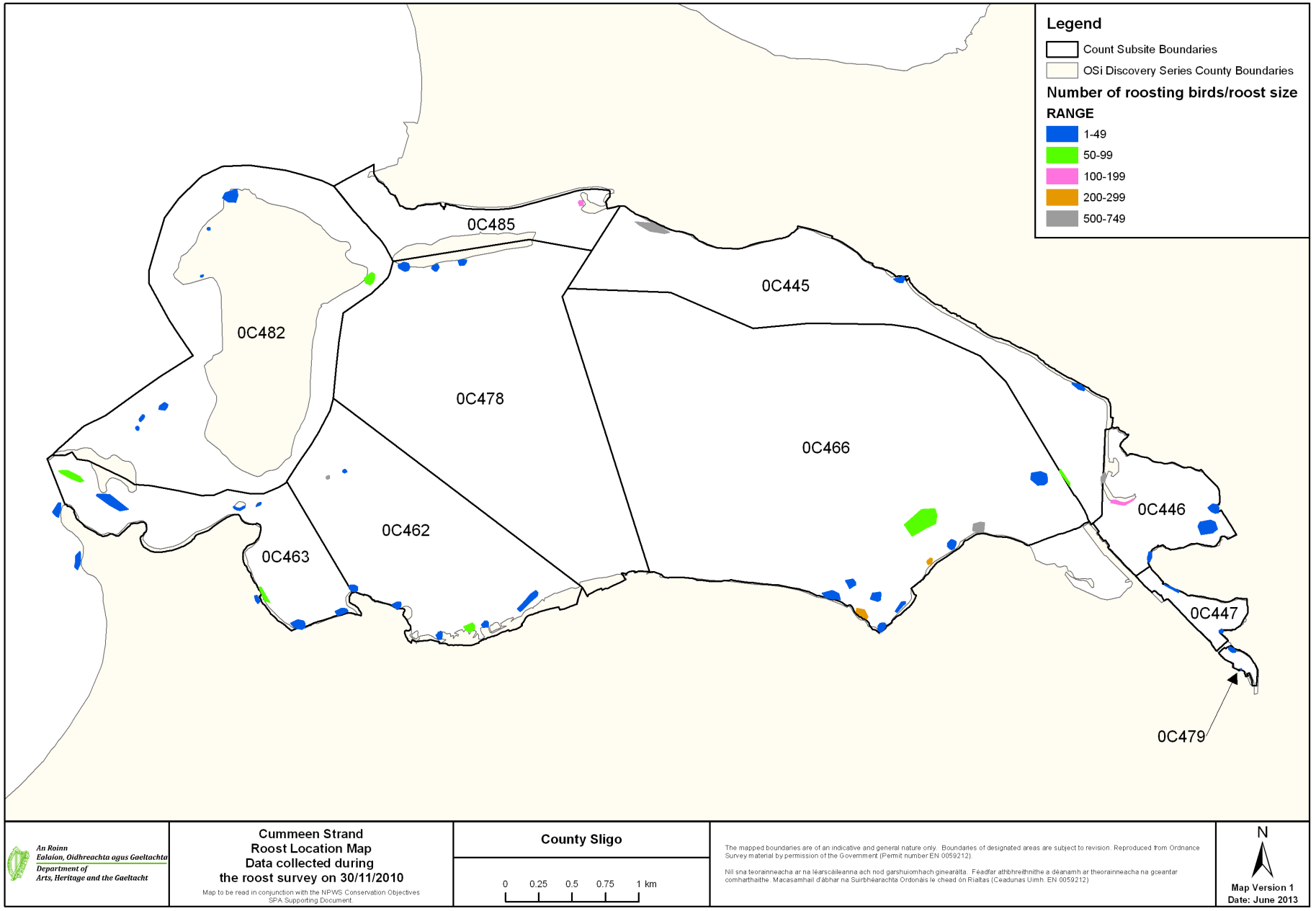
Cummeen Strand

(1a) Summary data and roost location maps from the roost survey 30th November 2010
(Please see Sections 5.3.1 and 5.3.2 for further details on methods/limitations)

Subsite Code	Subsite Name	No. roost locations	No. species	Species
0C445	Ballincar - Ballyweelin	5	9	BA, CU, DN, MA, OC, RK, TT, U., WN
0C446	Cartron to Standalone Pt.	3	10	BH, CM, GB, HG, L., MA, OC, RK, T., WN
0C447	Inner Port	2	2	HG, MA
0C462	Coney Island Rd. - Dorrins Strand East	8	10	CU, DN, GK, MA, OC, PB, RK, SU, SN, TT
0C463	Killaspug Pt - Dorrins Strand West	10	11	BH, CM, CU, DN, H., HG, MA, OC, PB, RM, RK
0C466	Cummeen Strand	11	16	BH, BW, CM, CU, DN, HG, KN, L., MA, OC, PB, RK, RP, SU, TT, WN
0C478	Cummeen west from Coney Island Road	3	3	CA, OC, T.
0C479	Martin's Quay	2	3	BH, MA, MS,
0C482	Coney Island	7	7	CA, CU, OC, PB, RK, SN, TT
0C485	Rosses Point Harbour	1	2	OC, RK

(1b) Cummeen Strand SPA (4035) SCI species and recorded roosts 30/11/10 - shows number of roost locations within subsite, and in brackets, the peak number recorded at a single roost location

Subsite Code	PB	OC	RK
0C445		2 (340)	2 (44)
0C446		2 (26)	1 (62)
0C447			
0C462	2 (54)	1 (3)	1 (16)
0C463	7 (57)	7 (27)	4 (5)
0C466	2 (2)	4 (288)	5 (155)
0C478		1 (10)	
0C479			
0C482	1 (2)	2 (36)	1 (4)
0C485		1 (30)	1 (135)



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Cummeen Strand
Roost Location Map
Data collected during
the roost survey on 30/11/2010

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

County Sligo

0 0.25 0.5 0.75 1 km

N

Map Version 1
Date: June 2013

APPENDIX 9

Cummeen Strand - 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 or around Cummeen Strand.
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.

Activity/event	0C445	0C446	0C447	0C462	0C463	0C466	0C478	0C479	0C482	0C485
1. Coastal protection, sea defences & stabilisation										
1.1 Linear defences						O				O
1.2 Training walls	O					O				
1.6 Other modifications				O			O			
2. Barrage schemes/drainage										
2.3 Other channel modifications						O				
2.4 Tidal barrages								P		
4. Industrial, port & related development										
4.1 Industrial port	O	O	O					H		
4.2 Fishing harbour										O
4.3 Slipway	O				O			O		O
4.4 Pier									O	O
4.5 Manufacturing industries		O								
4.8 Other		O				O				
6. Pollution										
6.1 Domestic & urban waste water	O	O	O			O		O	O	
6.2 Industrial	O	O	O					O		
6.7 Solid waste incl. fly-tipping	O	O	O					O		
7. Sediment extraction (marine & terrestial)										
7.1 Channel dredging (maintenance & navigation)	O	O	O			O				O
8. Transport & communications										
8.1 Airports					O		P			
8.2 Flight path				O	O	O	O		O	
8.3 Bridges & aqueducts		O	O					O		
8.5 Road schemes	P	O	O					O		O
8.6 Car parks		O						O		O

8.7 Shipping channel, shipping lanes	O	O	O							O
8.8 Rail lines		H	H							
9. Urbanisation										
9.1 Urbanised areas, housing		O	O			O		O		O
9.2 Commercial & industrial areas	O	O	O			O		O		
12. Tourism & recreation										
12.1 Marinas			O							
12.2 Non-marina moorings			O							O
12.3 Dinghy & boat parks										O
12.6 Power boating & water-skiing										O
12.8 Sailing										O
12.9 Sailboarding & wind-surfing										O
12.12 Surfing									O	
12.14 Tourist boat trips			O							
12.15 Angling			O					O		
12.17 Bathing & general beach recreation	H				O	H			O	
12.18 Walking, incl. dog walking	O			O	O	O	O		O	
12.19 Birdwatching	O	O	O			O		O	O	O
12.21 4WD, trial & quad bikes							O			
12.22 Motorised vehicles				O		O	O			
12.23 Horse-riding						O				
12.27 Others	O		O		O					
13. Wildfowl & hunting										
13.1 Wildfowling	H									
13.2 Other hunting-related activities										
14. Bait-collecting										
14.1 Digging for lugworms/ragworms						O				
15. Fisheries & Aquaculture										

15.1 Professional passive fishing (e.g. longlining)				U	U	U	U			U
15.4 Fish traps & other fixed devices & nets		H	H							
15.5 Leisure fishing										O
15.6 Molluscs - hand-gathering						O	O			
15.9 Intertidal aquaculture e.g. trestles					O	O	O			
16. Agriculture & forestry										
16.1 Saltmarsh grazing/harvesting				O			O		O	
16.3 Grazing: non-intensive (terrestrial)		O							O	
16.4 Sand dune grazing									O	
16.10 Mowing/grassland cutting									O	
16.13 Agricultural/other land-claim					H					
16.14 In-filling of ditches, pools, marshes and pits				O			O			
16.17 Forest planting on open ground					O					
19. Natural events										
19.1 Storms, floods and storm surges									O	
19.2 Severe cold weather	O	O	O	O	O	O	O	O	O	O

APPENDIX 10

Disturbance Assessment

Scoring system - definitions & rationale

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

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

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

Scoring system – worked example

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

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

Activity/Event	0C445	0C446	0C447	0C462	0C463	0C466	0C478	0C479	0C482	0C485
8.2 Flight path				4	6		5		6	
12.18 Walking, incl. dog walking	5			6	5	5	5		6	
12.22 Motorised vehicles				5						
12.23 Horse-riding				4		4				
15.9 Intertidal aquaculture & assoc. activity						7				